GRAVITY, LIGHT AND CLIMATE

THE NEW AND UNIFIED PHYSICS

P R E F A C E .

Physics are composed of parts joined by physical principles. Matter, light, heat, and gravity are presented to us; and why ask about their nature?

Seen as parts of Nature, a closer knowledge could give an understanding. Our culture has described the world by means of concepts taken from imagination.

Our culture's knowledge of physics is knowledge of appearances. It has not been controllable.

This problem could be solved by referring to one function. Now, the presumed autonomy of phenomena impedes our understanding of their nature.

The procedure will permit the description of physical functions.

It is possible to establish a theory of fundamental properties of the world. There is a reason to believe that the world is continuous

The themes treated here are seen in relation to the descriptive value of phenomena relative to that of physical functions. This distinction is central.

The history of Western science is a chilling tale. From the combined religious and scientific Pythagoras over the religious Plato and his refusal of life's qualities, the collecting Aristotle, to Ptolemy, who, for the sake of his God's shame, concealed the elliptic orbits of the planets behind a veil of 40 epicycles, it is a combination of authoritarian and schizoid culture. Congeniality only could make Europe accept this for nearly 1,500 years.

By letting the prime moving forces of Nature, which are its charges, speak for themselves and disclose their ways of interacting, it has been possible to find the connecting functions between, *e.g.*, nuclear forces, magnetism, water, and light.

Since 1633, when the Catholic Church manifested its standpoint against reality through the judgment of Galileo Galilei, the propounded science has mostly followed Plato and Christian churches, and feigned its principle should be in conformity with God's intention. From this stems the reluctance to admitting the properties of naked Nature as worthy themes of science.

Newton's empirical description of its dimension has shadowed its physical function. The existence of Newton's model has hindered the search for this function, and given us the impression that gravity should be exhaustively described as an autonomous effect.

The relation between reality and description is a central problem of science.

I discovered, around twenty years ago, that it is possible to describe medical symptoms, not as autonomous phenomena only, but as products of bodily dysfunctions, even non-medical. Based on this postulated connection between functions it was possible to describe some illnesses, *e.g.* megrim, *migraine*, as biophysical functions.[29]

Though the themes of physics have mostly been described as phenomena, *cf.* Ptolemy, Newton, Einstein, Schrödinger, and Stephen Hawking, the starting postulate of the present study is that even physics can be described as functions of primary physical substance and its potentials.

This approach has led to the understanding of gravity and the nuclear forces as functions, not as autonomous phenomena; and to seeing the light as a stream of negative magnetic monopoles.

This approach has even led to the understanding of physics not only as contiguous parts of the world, but as one continuous system of substance united in several ways through the functions of its inherent forces.

Physics has been given the role of malignant tool against science, culture, and mind. It is time to do something about it.

Life and climate are two reciprocally dependent resources. Human effort has attacked them both in continuation of the great disaster 65 million years ago. An extended consciousness will be needed in order to give them an existence extended outside the presently lowered capacity of the biosphere's circulation of negative entropy.

The name of this publication in its internet version, www.peptider.no, was taken from *Peptider i blodet* (Peptides in the blood), which I published in 1998 (ISBN 82-994376-0-1). From its Summary (p. 201) it may be seen that the approach to its theme is not unlike that of the present work, though the many aspects of that theme may have blurred the principle of approach.

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C O N T E N T S

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1. INTRODUCTION and SUMMARY.

The problem in relating to the world, or in influencing it, is to know its real properties and functions. This knowledge is the necessary condition of understanding what happens and of obtaining what we want through our intervention.

Our continued existence depends upon our conserving Earth's functions.

Our consciousness depends upon the correct description of the world to which we want to relate. As soon as we want to influence a part of our environment, we have to know the way it works rather than the way we perceive its presence.

Our understanding of physics has been hampered by insufficient or misleading models, partly by their foundation in the empirics of appearances, partly by descriptions based on phenomena instead of functions and their variables. Central parts of this problem are the descriptions made on the basis of Newton's second law. Newton's conscious avoidance of the real functions made him choose inertia, the passive product, or second-hand phenomenon, as the central concept of mechanical force.

This gave it a central place in the units of mechanics and, in the 19th and 20th century, even in the units of dynamics, with the consequence of misleading models.

An instance of this is the joule. This unit of energy is one of those that should have been based on the force producing the mechanical and dynamical energy. This force is the potential between positive and negative charges in the particles of substance constituting matter. They indicate the new unit $C\ m^2\ s^{-2}$.

The cosmological theories are outside the scope of the present work. Here are presented gravity as the fundamental function of mechanics, and light as the fundamental function of dynamics, the second system of energy. It seems difficult, if at all possible, to propose any theory about the central physics of the universe without regarding the physical functions of mechanics or dynamics, or identifying their diverging properties.

The belief in the heating of our climate is a consolatory turning our back to the understanding of climate and of its present and future consequences.

The combination of wrong perception and misleading interpretation seems to be a general human frailty. The perception of our problems and the planning of our actions depend upon our consciousness and its adequate apperception of the world's functions.

The related mental dysfunctions should for a great part be the products of the proteins which were new after the disaster of 65 My B.P., *cf.* ref. 69 and related research. Published research has procured information relevant to the relation between human food and human understanding.

As symptoms are the fundament of medicine, the functional reasons for humans' capacity of understanding their own world are deficient; and their description is only partly reliable.

We could, I believe, approach the problem of man's unreliable perception of his world (and its limits) by reinterpreting social and mental reactions to information about the world in general and, specifically, about the problems stemming from the discrepancy between the modern food after 65 My B.P. and our brains and the themes of our thoughts.

The decisive happening for Earth's recent conditions and defects of energy distribution and retention was the meteorite of 65 M years ago. It was the change from a sustainable climate to a collapse of those functions of life and physics that held the Earth away from the destiny of Mars.

They no longer do. There is already too much desert for avoiding the residual collapse of Earth's capacity of retaining energy and conserving a livable biosphere, if we do nothing about it. Can we?

I think we can, if we start immediately rebuilding the energy retaining capacity of the tropical forests, building a forest in all Sahara, and reforesting most of the other deserts, which, together, now hold the Earth below equilibrium of energy.

The first need of the Earth is a sustainable buffer capacity. One change needed for this is the introduction of plants filling this function.

Now, the grasses contribute to the negative spiral of energy.

The Earth cannot afford this.

If we continue regarding the tropical forests as disposable ornaments to Earth, we shall be lost on a cold globe.

Save the climate !

2. C O N S C I O U S N E S S.

”Det gångna är en dröm; och det närvarande förstår jag icke.”
Dan Andersson (1888-1920).

(The past is a dream; and the present I do not understand.)

Consciousness is our prime resource and perhaps the most important. The object of our awareness is the coming food for our evaluation and understanding.

The adequate perception and understanding of the present is a probable theme of discord. Some autistoid-schizoid persons do not have it, as they misunderstand social signals and situations. The feeling of the world as unreal is a part of this syndrome, as is the sudden loss of memory. It is even possible not to recognize one’s own wife, *cf.* ref. 58.

What can be the cause of a dominant characteristic of thought; and what has been the force conserving it? It is partly due to a mercury-poisoning of the brain, partly to a food-induced lowering of brain functions and to the following insufficient social training, *cf.* ref. 29.

It began as the product of food introduced several hundred million years after the development of our nerve system and brain. These were developed within the post-Cambrian chemistry, while our staple food is grain, which is seed of the grass family, Poaceae. The grasses were developed after the iridium-poisoning of the Earth’s surface 65 million years ago. Most of the meat part of our food is also produced from animals eating grass.

The referred reasons of Plato for thinking the way he did and professed are found throughout his work. They are concentrated in the postulate that the world, as it is, is an apparition only, while the concepts, which he called ideas, should be the constituents of the real world.

Seen from the point of view of epistemology, this is a refusal of the significance of concepts and rational communication. Seen from the point of view of psychiatry, it is staving off the real world. Quite a few people will say: “This is so horrid; I don’t want to think of it”; but few will produce a philosophical system for supporting their vacillating reliance upon their own life.

Ptolemy followed Plato as an ideal and formed his planetary model out of a consideration for his God’s idiosyncrasies. We have Ptolemy’s own words for this: “We believe that the object which the astronomer must strive to achieve is this: to demonstrate that all the phenomena in the sky are produced by uniform and circular motions…” [43] “Having set ourselves the task to prove that the apparent irregularities of the five planets, the sun and moon can all be represented by means of uniform circular motions, because only such motions are appropriate to their divine nature … We are entitled to regard the accomplishment of this task as the ultimate aim of mathematical science based on philosophy.”[23] Ptolemy’s ascription of circular motion to the divine nature of the celestial
bodies is due to Plato, *cf.* ref. 16.

The concept ‘model’ denotes a functional relation between known variables. Its level of pretension to describing reality is higher than that of a theory, which is a postulate of a specific relation between parts of the world. Newton’s second law is a calculation model as well as a theory. Ptolemy’s model of the planetary system was a calculation model, but not a theory. Ptolemy himself disclaimed its correctness as a physical description: Still, he described the planets’ movements precisely enough for the calculation of their positions in the sky and serving navigation for 1,500 years, though the explicit intention of his “uniform and circular motions” was that of concealing the elliptic orbits of the planets,[43] since the circle, according to Plato, should be God’s perfect curve.[16]

Though Copernicus used Ptolemy's calculation model, he felt deceived by Ptolemy, who had described the planetary movements as variable along their ascribed trajectory, thus not uniform.[61]

The spectrum is a phenomenon raising the question of the real physics of light. Its double nature of wave and particle is confirmed by countless experiments and is undoubted within the profession of physics: «The duality of the model is an adequate expression of the nature of light.»[9]

This is a disputable tenet. The pragmatic side of this question is that, as experiments constitute a systematic search for phenomena, it is impossible to know what some unimagined experiment would disclose. This should discourage the belief in a vacillating theory. The fundamental argument is the question of representativeness: what is the criterion for believing that the right question was asked and tested in an adequate way? Can we be sure that the experiments have been adequately interpreted?

On the other hand; imaginable experiments can disclose light as particles.

The epistemological side of the question is that a double model is wrong in principle. If physics should be limited to descriptions of symptoms or phenomena, the duplicity of anything would have been acceptable. In that case, physics would have receded to the stage of Ptolemy, forgetting Pythagoras, Kepler, Lavoisier, and the real world. Seen from the outside of physics and epistemology, science seems to have chosen a pre-accepted description rather than an adequate one. It is not sure that the choosing scientist was aware of any alternative. Plato, Ptolemy, and Newton were aware of them. Concerning the plurality of post-Newtonians, I am in doubt.

Alfred North Whitehead found that "the physical doctrine of the atom has got into a state which is strongly suggestive of the epicycles of astronomy before Copernicus."[54]

It is even impossible to know what some of the performed experiments have disclosed, if anything at all. Letting light through a certain crystal shows a certain effect. Letting light through something else shows another effect. They are referred as instances of empirics. The physical significance of each effect is unknown. If the physical connection between light and prism were known, the empirics would have been more specific; and the experiment might have given further information.

If experiments were a search for functions, they should have been performed under known conditions, having comprised controllable interactions; and their interpretation should have been done within a frame of functions, as it is possible to understand physics from the bottom, even to distinguish between the apparent and the real.

It seems rather strange that prisms are used for finding properties of light, when the possibility of interaction between the slits (*e.g.* those of Newton and Young) and the light has not been considered. If the intention should be to confirm the pre-conceived model of light, any test is sufficient.

'Wave' is ambiguous, hardly defined. If we say that «water is a drop», «the sea is waves», «the electron is a wave», or «planets are epicycles», our attention has been caught by epiphenomena or sum-phenomena, which are the results of interaction. Their classification is imprecise. They are calculable when measurable. Their internal functions do not enter into our understanding of them; and we do not know whether the experiments disclose decisive information. Instances of this are light, gravitation, thermodynamics, and charges on molecules, which are residuals of the atomic forces binding them.

Understanding presumes that the primary and intermediate functions are known. The difficulty is that phenomena will not tell anything about their underlying functions without being asked. In order to ask, we have to know, or guess, what to ask for.

It should also be possible to differentiate according to energy the light from a low-temperature flame. Its different colours represent different energies. The problem is to find a neutral material for the measuring instrument, or to measure directly from the separating instrument.

Newton's second law is a model of phenomena of inertia, not of the physical functions producing mechanics, *cf.* his disowning of theories: *"hypotheses non fingo…"*.[10] ("I do not imagine theories…") He was intentionally avoiding physical functions.

Seen as a whole, a phenomenological description delivers an appearance of science that can be taken to make up for a real functional description. History shows that it is possible to produce accepted science by evading reality; and our culture has more than two thousand years tradition of doing this. Ptolemy was explicit in doing it; and though Newton was not explicit in detail, he was clear in his purpose, *cf.* his letter, ref. 10.

The usefulness of this science has been social, as society takes some utility from avoiding the real functions of the world. Avoiding responsibility is an important purpose, *cf.* "Act of God" in insurance papers.

Since Newton explicitly avoided proposing theories about the constitution or functions of reality,[10] his laws concern phenomena only.

The relations of his second law (N 2) were built into it by Newton, as well because of his avoidance of theories about the real as because of his establishing its three elements as reciprocally defined. It is clear from what Newton wrote that he avoided formulating "hypotheses", or theories (in the vocabulary of our days), about physical functions or reality. His general law of gravitation should therefore be understood as a calculation model for the characteristics of a phenomenon, but not as the model of a physical function.

From his intense religious activities and his letters we understand that he did not want to trespass upon God's domain by having opinions about the Godly order of the world. He probably saw phenomena as so worldly that his God would allow him to approach them. We may presume that he would not intrude into his God's domain by imagining theories about the reality of physics, so he stayed at phenomena.

There is a certain reason to suspect Newton of staying at phenomena because he did not know the functions he avoided. His otherwise manifest paranoia would be enough to explain that his know-all-mentality would leave to his God everything that should not be clear to himself. One of them was gravity.

The first and the third of his laws are without measures; and therefore, from the possible standpoint of a mathematician like Newton, without any religious commitment. The second law is limited to phenomena. Its parts are defined by each other, thus they are without any commitment to Nature, and thereby not trespassing on the domain of Newton's God. Its three parts are measurable; and they are useful as long as the relativity of their phenomena is the object of measuring. The reality of prime moving forces is not reachable through N 2.

The imagined effects of relativity at velocities approaching that of light are projections of the presumed properties of the variables of N 2, *i.e.* an instance of believing the forms and relations of the model to be normative for the world.

Newton was intelligent enough to have known that the three parts of his second law were defined by each other. As he had formulated it himself, the law most probably is a piece of conscious cheating. This is compatible with his avoidance of expressing himself on real functions of the world[10] since that, in his eyes, would have implied an incursion into his God's domain.

Newton avoided any commitment relative to his religion and everything that could be associated with it. From his letter[10] to Bentley it is understood that he avoided expressing himself on the reality of the world. This will let us understand that he could permit himself to saying something about the apparent, but not about the real.

In $F = m \cdot a$, Newton is therefore pretending to say something about the physics of the world, though without committing himself in the affairs of his God by saying anything about the physical reality of God's world. By defining the three parts of $F = m \cdot a$ by each other, he did not commit himself to the real world, thus did not expose himself to the wrath of his God and eternal damnation. Seen in the perspective of a fervent fanatic, he wanted to stay out of trouble relative to his God; and he could even save a good many souls, keeping himself and them from sinning by leaving them a formula of phenomena, apparently useful, but delivering only a seeming calculation of physical functions.

In this way Newton followed up the cheating of Ptolemy in the name of God. Their ways of leading people astray are not very different from each other. Seen in a perspective of social, medical, or general inter-human functions, this leads to an *ad hoc*-definition of the concept 'psychopath': "A psychopath is a person who sees the construction and use of snares for other people as the necessary task of his life, his heavy duty."

As Newton did not include the realms of electrostatic or electro-dynamic functions in N 2, and Einstein adopted it as it was, these functions are not described in relation to the phenomena described by Newton.

Relativity was introduced by Newton in his second law, $F = m \cdot a$; force equals mass times acceleration, by his defining each of its three parts by the two others. As he did not introduce any factor from the external world, he avoided any commitment to his God's domain and thereby did not commit any sin in his own eyes. He even seems to have been afraid of saying anything about his God's world by laying aside phenomena and regarding its real functions.

Einstein projected on reality the undecided relations of Newton's reciprocal definitions. Logically, he called it "relativity". The qualities ascribed to reality are projections of the model's properties.

Einstein said that rather than relying for our orientation in the world on sense impressions, since they can mislead, we rely upon the concepts and their mental relations, which present themselves as stronger and more permanent than the individual experience of the senses.[59]

Einstein was talking for himself. His relation between thought and experience has been taken as an expression of the "sovereignty of thought" as an aspect of the schizoid personality.[60] This personality is a question of degree. Einstein could hardly be taken as deviating significantly from the average of Western society in the question of personality, though in his professional perspective. His way of understanding the relation between observation and thought is representative of the cultures of Western societies.

The *de facto* misleading of Western science has taken place since Plato, with a partial exception for the period from Kepler's planetary laws (1609 and 1619) to Newton's *Principia* (1687).

The strong and lasting concepts and their mental relations of our civilization are condensed in the planetary model of Ptolemy and Europe's accept of it until *c.* thirty years after the publication in 1609 of Kepler's remake of the Copernican system, which was 66 years after its publication and 1450 years after Ptolemy's active period. Compared to that, the lasting accept of Newton's second law (N 2) from 1687 is not impressive, except as an instance of the force of learning being stronger than that of insight.

The history of strong and lasting concepts of our civilization has one main characteristic, which is its origin in fantasy images taken from the qualities ascribed by religion to the world. Science also has another root, which is the Aristotelian compilation of primary data.

The individual sense impressions last for a life. The concepts of a civilization last for millennia. The permanence of the concepts follows from the continuity of society, not from their correspondence to the facts of the world.

The dictum of Einstein is a statement of his loyalty to the ways of society rather than of allegiance to the data of Nature. In this principal standpoint he follows Newton. The loyalty to society is formulated in religion. Describing Nature by means of the models of religion is equivalent to saying: "We do not brook Nature or its ways".

Einstein's $E = m \cdot c^2$ is identically equal to Newton's $F = m \cdot a$. Its parts are defined by their relations to each other.

As long as we rely upon the food produced from the Earth, we accept its disadvantages, which include its negative effects on our brain and nerve system. These effects lie behind some mental, social, and bodily dysfunctions.[29]

Einstein and perhaps most scientists after Plato followed him in their knowing better than Nature how Nature is. Today, we can stand aside and admire the efforts expended in producing models of science which Nature cannot follow.

The opposite was the way of Lavoisier, who let mice and candles tell him how their life and light depend not upon matter containing phlogiston, but upon a part of the air, now called oxygen.

When reality is discussed, or apparently discussed, it seems that the themes of discussion mostly are the existing descriptions according to accepted theory, but not reality, nor the possibility of other descriptions.

It is outside my imagination to rely upon the accepted concepts or their mental relations, since they have led science into a mire of models having slight connections to the real world. How could the Western world continue accepting Ptolemy's model for nearly 1500 years? A part of the answer is that this Platonic-Aristotelian-Ptolemaic model was made a part of the creed. Since the practice of creed is moved from the church to the school, the answer lies in the inertia of religion. The same question and answer apply to the world after A.D. 1687.[7]

It will have been noticed that the progress of technology has taken place without a corresponding consciousness of what took place, relative to physics; or how it took place.

Einstein's version of N 2, $E = m \cdot v^2$ or $E = m \cdot c^2$, has been taken as valid for the region of high velocities, the velocity of light included; and it has been used for making predictions about the behaviour of matter at those velocities. That is not founded.

The energy postulated by Einstein is the secondary effect of movement, *i.e.* the inertial momentum of the moving body, which is the same as the effect considered by Newton. The initiating energy is not a part of Newton's model, thus nor a part of Einstein's.

At the outset, Newton's phenomenological empirics is verifiable by the measuring of phenomena. Einstein introduced the velocity of light in the equation and thus left the low-velocity domain, where inertia has a certain measure of significance, though not as a prime mover.

The extended reliance upon inertia is one reason for the lack of validity of Einstein's version of $F = m \cdot a$, since the forces of high velocities are not of the same category as those of low velocities. The physical functions of high velocities belong to the realm of electrodynamics, or electromagnetism.

At velocities approaching eight *per cent* of that of light, the beginning electro-dynamic effect, described by Maxwell, will wreck the predictions of Einstein concerning the behaviour of bodies approaching the velocity of light.

Kepler was a devout Christian, which did not keep him from finding and publishing the correct function of planetary orbits in spite of Ptolemy's program and of the calculations of Copernicus.

A general problem, which could be representative of our mental relation between reality and description, is the distinction between phenomenon and function. Since Plato, Aristotle and Ptolemy, our culture has worked its mind away from reality and its functions, letting it be drowned in phenomena.

A possible key problem could be the relation between physics and chemistry. Looking back a couple of thousand million years, we see that life was the product of changing physical conditions, not of changing chemical conditions.

We should have an open mind for the possibility that chemistry is a compound of phenomena, while physics comprises the functions producing those phenomena. This specific distinction is probably not alone. It could be a signal holding us alert to the need for seeking the functions behind the phenomena.

If we dream about the invisible and attribute to it a series of physical properties reciprocally compatible, then we should be capable of discerning the possible and the impossible within each group of functions; and we should perhaps attain an understanding of the present.

3. GRAVITY, density, and Young's modulus.

Our present theory of gravity is empirical, as it consists of interpretations of the relations between measurements of phenomena. We are in want of a model of gravity based on physical functions. Such a model should be possible, since we may presume that physical happenings are not mere independent phenomena, but are produced by functions between physical properties.

Related to the physics of gravity are some questions arising from the empirical nature of our models concerning matter.

It is a fair guess that the observed physical phenomena are functions of the primary properties of matter and thus are extensions of the functions of the primary substance of matter.

The primary particles interact by the fields of their charges. Atoms, molecules and their chemical and physical interactions are direct functions of charges as they work through their fields.

Forces of aggregates of matter are indirect functions of the forces of their constituent substance. Direct hits between moving bodies are among the indirect functions of the interaction of charges. A falling stone shows a macrofunction of matter. This macrofunction is a result of the combined forces of a number of fields.

Until recently, the neutrino was thought to be a massless particle without any charge. It is now understood to have a small mass, *i.e.* a small inertia which is based on a corresponding quantity of substance. It has not shown properties indicating any electric charge.

Without any electrical field it cannot enter into any normal physical interaction, thus not be registered like other particles. It does not interact by being deviated or absorbed by the electrons of atoms. Its only registered interaction with other substance is its hit in an atomic nucleus, altering the isotope. For the discovery of neutrinoes is used C_2Cl_4, perchlorine-ethylene, whose ^{37}Cl will be changed into ^{37}Ar (argon-37) as the product of a direct hit in its nucleus. The possibility of a neutrino's collision with an electron is not excluded, though a method for its registration seems to be unknown.

The registration of neutrinoes is lower than expected. This could be caused by neutrinoes being deviated by hitting electrons, thus not being registered in nuclei.

The particles of atoms carrying external charges are electrons and protons. They interact by the repulsion from their like fields, and by the attraction from their opposite fields. It is probable that protons and electrons have fields of approximately the same extension.

Fields work independently of each other, even within the same space. A neutron consists of a proton and an electron. Its combination of negative and positive charge produces an apparently neutral field, since the two opposite charges work within the same space and prevent the separate measuring of each field. Thus a neutron functions as neutral for the fields of its negative and positive charge filling the same space and, by measurements of static fields, having a sum of nought. Their combined fields have an electro-dynamic function, to which we shall return.

The neutrons' dependence upon external forces is shown in their half-life of seventeen minutes as independent particles.

Like charges repel each other. Negative and positive charges attract each other. In atoms, the attraction keeps the electrons in orbits around the nucleus, which consists of a number of protons and, in most elements, a higher number of neutrons. The fields of the electrons are added to each other, and so are the fields of the protons. The positive and negative fields of the atoms do not cancel each other, but are working simultaneously within the same space.

The static forces of the particles of atoms perform one part of the interactive potentials of atoms. The dynamic forces, magnetism, are those produced by moving charged particles. Static and dynamic forces coexist; and their sum from each source is constant.

It is probable that charged particles are equally or nearly equally influenced by attracting and repelling static forces from other charged particles. Between two neighbouring, like atoms, the repelling forces are symmetrical. The negative charges of the electrons of both atoms attract the protons of the other atom; and the positive charges of the protons of each atom attract the electrons of the other atom. Each particle responds to a force with the field of its own charge, whether like or unlike.

It is presumed that matter is a compound of particles having positive and negative charges. The concept 'matter' is used for the combinations of particles into aggregates, thus it denotes the composites of substance. The concept 'mass' concerns matter's function as a part of Newton's second law, in which it is the name of the measure of inertia. The concept 'weight' is used for the gravitational relation between a body and a planet.

It is preferable to use a separate concept in order to designate electrons, protons, neutrons, and their constituting material In order to underline these particles as a theme, the concept 'substance' is used here. This use of the concept 'substance' (s) should not be confused with the use of the same word in the connection 'amount of substance'.

The repelling forces between the particles of like charges in two neighbouring atoms of an element are equal in relation to their substance and inertia.

The attracting forces of protons and electrons in each atom of an element are equal. As they have unequal quantities of substance, they behave differently as attracted particles. By their movement, the electrons' fields of an atom occupy a greater space than those of the protons.

The relation between the attracting force received by the electrons and their smaller substance will be greater than the attracting force received by the protons, relative to their substance.

It will be seen that the net reciprocal attraction between two like atoms is very small compared to the unfettered attraction between opposite charges.

Electric field strength $E = \mathrm{N\ C^{-1}} = \mathrm{kg\ m\ s^{-2}\ C^{-1}}$. (1)

This is the same as $E = \mathrm{N\ C^{-1}} = s\ .\ \mathrm{N\ kg^{-1}\ C^{-1}}$.

The relation between field force and substance is $E\ /\ s = \mathrm{N\ /\ kg\ .C}$

N / kg is the physical function of acceleration, so $E\ /\ s = \mathrm{a\ /\ C}$.

The force is constant for a given field strength. A comparison of two particles of different inertia (or mass) shows that a smaller particle will get a greater acceleration under the same force; or a greater received force relative to its inertia: This implies that, in a given field, the force produced by a certain charge, or the acceleration following the force, is inversely proportional to the quantity of substance of the particle accelerated.

The force produced by a quantity of electric charge is $\mathrm{F_e} = \Psi.E$. (2)

Here Ψ denotes the quantity of charge (coulomb) at work.

The force received by a charged particle is $\mathrm{F}_s = s\ .\ \mathrm{a}$ (3)

The force working on a particle of substance can be denoted as C $\mathrm{kg^{-1}}$. It can be seen as the relation between charge as the initiator of the force and substance as its receptor:

$\mathrm{F}_s = \mathrm{C\ kg^{-1}} = \Psi\ /\ s$. (4)

This illustrates that the dimension of the effect from electrons and protons is equal; but their reaction to the effect will depend upon their quantity of substance.

In a juxtaposition of two like atoms, the positive charges of the nuclei will repel each other and attract the electrons of the other atom, while the negative charges of the electrons will repel each other and attract the nucleus of the other atom.

The combined functions of the equations 1 – 4 give this relation:

$\mathrm{F_e}\ /\ \mathrm{F}_s = \Psi\ .\ E\ \ /\ \Psi\ s^{-1} = \mathrm{N\ /\ C\ kg^{-1}}$ (5)

The four kinds of interaction within the same space produce a combination of field forces. They can be separately represented.

The emitted force from the nucleus, $\mathrm{F_{en}}$, delivers to the nucleus of the other atom a force

$\mathrm{F}_{s\mathrm{n}} = \Psi_{\mathrm{n}}\ /\ s_{\mathrm{n}}$ (6)

and to the electrons of the other atom a force

$\mathrm{F}_{sel} = \Psi_{\mathrm{n}}\ /\ s_{el}$ (7)

The emitted force from one or more electrons, $\mathrm{F}_{\mathrm{e}el}$, delivers to the electrons of the other atom a force

$\mathrm{F}_{sel} = \Psi_{el}\ /\ s_{el}$ (8)

and to the nucleus of the other atom a force

$\mathrm{F}_{s\mathrm{n}} = \Psi_{el}\ /\ s_{\mathrm{n.}}$ (9)

Fr denotes repelling force and Fa denotes attracting force. The subscript e denotes charge; *s* denotes substance; n denotes nucleus; and *el* denotes electron.

Repelling force from the nucleus is Fr_n:

$F_{sn} = \Psi_n / s_n$ (6)

Repelling force from the electrons is Fr_{el}:

$F_{sel} = \Psi_{el} / s_{el}$ (8)

Attracting force from the nucleus is $Fa_{n\text{-}el}$:

$F_{sel} = \Psi_n / s_{el}$ (7)

Attracting force from the electrons is $Fa_{el\text{-}n}$:

$F_{sn} = \Psi_{el} / s_{n.}$ (9)

In two juxtaposed atoms, their sum will be $Fa_{n\text{-}el} + Fa_{el\text{-}n} – (Fr_{n\text{-}n} + Fr_{el\text{-}el}) > 0$ (10)

It is seen that the repelling forces between two equal atoms, a and b, are equal between the two nuclei:

$Fr_{na\text{-}nb} = Fr_{nb\text{-}na}$ (11)

and between the electrons:

$Fr_{ela\text{-}elb} = Fr_{elb\text{-}ela}$ (12)

Here, subscript a denotes atom a; and subscript b denotes atom b.

The attracting forces are equal in the two like atoms:

$Fa_{na\text{-}elb} + Fa_{ela\text{-}nb} = Fa_{nb\text{-}ela} + Fa_{elb\text{-}na}$ (13)

They are greater than the repelling forces:

$2\ Fa_{n\text{-}el} + 2\ Fa_{el\text{-}n} > 2\ Fr_{n\text{-}n} + 2\ Fr_{el\text{-}el}$ (14)

The attracting force from the nucleus to the electrons of the other atom is equal to the charge of the nucleus relative to the substance of those electrons. The electrons' smaller substance is the main reason for gravity, *cf.* eq. 7, $F_{sel} = \Psi_n / s_{el}$.

As the combined fields of the electrons of one atom cover a greater range than that of one electron, they may be somewhat more susceptible to the attracting force of the nuclei than the opposite. In that case, they will have an added effect of the same kind.

There will also be a higher moment relative to its inertia on the electron exerting its force on the nucleus of the other atom.

The outcome is a small surplus of attracting force directed, in the case of two atoms, against the electrons of the other atom, *i.e.*, atoms are, in spite of the repelling forces from their like charges, attracted to each other by the small differential of attracting field force of static electricity mainly from the charges of the protons of one atom directed towards the electrons of another atom.

The resultant sum of these forces is gravity.

This differential of electrostatic forces is small in relation to the sum of potentials involved. The model described here can easily be represented by ^1H. In heavier atoms, a greater number of charges is concentrated in a volume not much greater, so that the sum of their forces will be greater, and probably also the sum volume of their fields. The greater relative forces give them a higher density.

The varying weight of the amount of substance of ^1H is explained below.

An exact calculation will include the radius of the atom and the distance between atoms in a molecule.

The small differential of forces accounts for gravity and for the higher specific weights of the elements of higher relative density.

'Specific weight' is a phenomenological and empirical concept. It should be seen in connection with the phenomenon 'gravitation', whereas 'gravity' is the concept denoting the physical function producing the phenomena associated with gravitation. Seen in a perspective of gravity as a function of substance and its forces, the concept 'relative density' will be more appropriate.

Added to the static forces are the dynamic forces of the moving fields of the electrons. These forces, magnetism, account for some of the structures of molecules; and they are stronger than the static potentials responsible for gravity, *v.i.*

Cohesion and mechanical strength are functions of the sum of the static and dynamic forces in an amount of matter. They are empirically expressed in Young's modulus.

The difference between attracting and repelling forces is very small relative to the level of the forces. Nevertheless, it is decisive for matter as a structure and as combinations of atomic structures.

The difference between attracting and repelling forces, relative to the inertia of the charged particles, is decisive for Nature's possibility of forming interactive matter within a scale of conditions and of letting this matter keep stable forms as well as making possible a large system of exchange of energy and change of forms in innumerable combinations within a limited scale of energy.

All forces have their origin in the potentials between positive and negative charges of the primary particles.[28]

This has an apparent exception in the atomic bomb. As the nuclear potentials are constituted by neutrons, they are, however, a concentrated version of the potential between positive and negative charges. Thus the atomic bomb does not constitute an exception to the principle of potentials between positive and negative charges, but a confirmation of it. *Cf. ch.* 6.

The irregularity of the release of protons from the sun is understood by the presence of electrons and their negative charges in the outer compartments of the sun, since their negative fields will retain protons by their opposite charges, until their concentration surpasses a certain value, at which they are no longer retained. Their outbreaks take place at irregular intervals.

The variations of gravity between planets will be due to the charges of their different metals and minerals, having different temperatures, and most probably by water, *v.i.* Magnetism could have an influence, whose details are not specified, *cf.* its interpretation as gravity influencing light in 1919, *v.i.*

4. LIGHT, the MAGNETIC MONOPOLE.

Energy from the sun.

By its size and composition, the sun has a surplus of energy relative to its surface. This makes it retain hot substance, which in its outer parts is organized according to its charge, so that protons and electrons occupy different compartments. Their separation seems to be caused by the magnetic fields produced by the moving particles.
The two main kinds of particles are of different sizes; and each carries a charge. The electrons are small; and the protons are 1838·6 times their size, and carry a correspondingly lower concentration of positive charge.
The negatively charged electrons acquire a higher velocity and therefore stronger magnetic fields than the protons. The electronic activity is thus correspondingly higher.
Light is produced in the sun as an overflow of energy not useful for the production of matter, seemingly because the energy release is too high for the continuous existence of the matter produced. This is seen in the presence in the sun of multiple ions, *e.g.* iron, Fe^{14+} and heavier elements.[12] The condensation of elements is simultaneous with the breaking down of electrons and emitting their parts as light.
The overflow of energy is carried by a quantity of substance of 5 million tonnes *per* second[12], which makes up 25 g m^{-2} *per* year.
This quantity of substance is emitted as photons, accounting for the sun's luminosity of $3{\cdot}9 \, . \, 10^{26}$ W, conventionally measured. The sun wind consists of another M t s^{-1} of substance released from the sun, not adding to its light.
The sun's density is $1{\cdot}5 \, . \, 10^{5}$ kg m^{-3} in its centre, sinking to 10^{-4} kg m^{-3} at its surface.[12]
Every year, the sun loses as light a quantity of substance corresponding to that contained in its uttermost 250 m. *Per* day, this is 0·7 m.

The separation of electrons from the compound of particles in the sun is a continuous process.
After a time of movement of the particles from the inner part of the sun, they are separated according to charge; and the electrons are alone in their compartments.
Their repulsion and perpetual movement lead to acceleration and breaking down in new collisions, while their rising velocity produces a magnetic field of rising strength. This field will be the main actor in separating the compartments of electrons and protons.
The high temperature consists in the intense movement of particles. In the sun, the energy of this movement divides the negatively charged particles into very small parts, and accelerates them. Their energy is produced by their movement and collisions. It is indicated by the temperature of the uttermost layer of the sun, 5780 K, and by the low density of particles.
The small particles of negative charge acquire new qualities. Particles of the same charge are kept together for years or centuries by the magnetic fields produced by their movement. They are repelled by each other; but through thousands of years they cannot escape. If the particles of each charge did not stay in separate compartments, they would have formed neutrons; and the sun would have collapsed. This happens when the star's energy is nearly spent.
The physical possibilities of protons and electrons depend upon their relative potentials and the release of these potentials as energy.
When they meet at temperatures not too low, they will form neutrons, whose permanent relations will be like atoms of ^{1}H, though having a smaller radius and higher potentials.
In the atom-like relation of the neutron, the potential will be bound in a small volume and by small external forces, hence the collapse of the neutron-star.
In the outer compartments of the sun, the electrons are repelled by each other. Their free course is rather short, a question of millimetres.
After millions of collisions, they have got a high velocity; and they start breaking each other down to smaller particles. They get higher velocities at each collision. After being banged together for, perhaps, thousands of years, they are broken down to photons and accelerated to the velocity of light.

As the apparent sun "disk" has a dark rim, the photons' escape angle is close to the vertical. If light could have escaped from the sun's uppermost layer at a low angle, the sun would have had a lighter rim. Now, most photons are reflected into the sun and make it last longer.
Photons carry potentials. Their negative charge is a small part of the charge of the electron. They repel each other because of their like charges. Before escaping, most photons meet at low angles and are thrown back into the sun.
Protons carry positive charges, which, relative to electrons and light, will release negative energy. Due to the constitution of matter, this is also their function at reaching Earth.
We get light as negative charges only since the sun retains a surplus of protons. Small parts of electrons are emitted as light. A greater amount of positive charges is retained in protons in the sun than negative charges let out by the photons. This is indicated by proton storms, which are their periodic outbursts. They cool down the parts of the Earth hit, though not to a temperature corresponding to a lack of sunshine.
Matter establishes potentials and produces energy as functions of electrons and their parts, the photons.

Is light material ?

From what is seen in the descriptions of light, it is mostly treated as a mathematical phenomenon, as its characteristics are derived from a mathematical treatment of its presumed properties. It is difficult to find a part of the description leading back to physical features.
The description of light after Young has been mathematical, apparently avoiding any invasion of physical functions among the relatively abstract variables considered.
Light's interaction in prisms and other instruments has been taken to explain properties of light itself, as the interaction has not led to systematic analysis.
Its periodicity is, though, produced by the electrons of the atoms of the measuring instruments. Induced wavelength and frequency are the interpretations of measurements by material instruments. Their periodicity reported as measurements has produced the belief in light as consisting of waves.
Since light's periodicity is due to the instruments, its measure should be changed.

Thomas Young apparently believed the slits of his experimental apparatus to be inert relative to the light he let through them. He presumed that the interference fringes seen should be the products of light alone. His presumption had been shared by Newton, who believed he had split the light by means of a prism.
The diffraction experiment of Young as well as the prism experiment of Newton proved that light interacts with the material of the slits. What they did not know was that the atoms are not mere passive lumps of matter, and that the separation according to energy would take place not in the prism, but at the edges of the slits.
Young's experiment was performed in 1807, the year before Dalton published his theory of atoms.[11]
Planck did not seem to distinguish between a ray of light and the single photon. Though delivered as single photons, light has been measured as a light ray.

Light is produced from electrons, which, outside the sun, form parts of matter. Conditions of the production of light are that the electrons should be exposed to energy high enough for breaking them down, and that they should not be close to positive charges which could neutralize them.

Light is made from one of matter's parts, though not as long as it is a part of matter.

What is, then, its character relative to other matter? From the mathematical treatment of its presumed properties, it is difficult to find a part of the description leading back to physical features. The description of light after Young has avoided any invasion of physical matter among the rather abstract variables.
An exception has been the use of light's interaction in prisms and other instruments. They have been taken to explain properties of light itself; as the interaction has not been taken to leave any imprint on the light.

The understanding of light's nature has been made difficult since it does not return to a material form after its display.

Its periodicity is produced by the electrons of the atoms of the measuring instruments. Measured wavelength and frequency are the values delivered by instruments. These measurements of periodicity have produced the belief in light as consisting of waves.

Since light does not, before interaction, have the form of waves, its measure should be changed.

Today, the character of matter will be known well enough for understanding the nature of interaction between light and the matter of the slits. Light will react to matter according to its direction to the electronic solenoids of the atoms, *cf.* ref. 48.

A prism is a part of the edge of a wide magnifying lens; and it magnifies, in one dimension, the differences produced between the potentials in the stream of photons by the edges of the slits. The properties of atoms pose the conditions of interaction; and the properties of light show its limits.

A black streak on a white background, seen through a prism, shows the reverse spectrum. This is another indication that light is a compound of radiation of different energies, and separable in different instruments, whose properties mix with those of light. Since the mixing takes place on the sub-atomic level, it is difficult to determine the relative significance of light and the interacting substance.

Lene Hau lowered the velocity of light to 17 m s^{-1} in a cloud of very cold Na^{+}-ions, a Bose-Einstein condensate. This can be taken as a proof that light consists of negative charges.

The combination of slits, black streak, Lene Hau's experiment, Newton's prism experiment, and the un-analysed effect of light-measuring instruments, makes it difficult to ascertain the relative significance of the influence on the measuring, or the distinguishing interaction with light, from the negative charges of the matter of the slits, the prism, and the measuring instruments.

Since electrons form the uttermost part of matter, they will be its parts meeting the light. Its following interaction with matter should indicate that light is not wholly independent of material forces.

The nature of slits and prisms.

Visible light, ultra-violet (UV), and infra-red (IR) are *c.* thirteen octaves in all, the way light is conventionally measured by frequency or wave length. Can this measure be replaced by a scale congruous with light's potentials?

It seems to be commonly understood that a narrow band of light entering the prism should be the sufficient condition of disclosing the true and complete physics of light, its composition of colours.

The instruments of measuring or producing effects seem to be taken as delivering the proof of the true nature of the matter or substance tested. In the case of light, some instruments have delivered results not easily compatible with the accepted model of light as composed of waves.

The photoelectric effect seems to be a non-wave effect. At the same time, it is an effect of energy, as the displacement of an electron presupposes either the neutralizing of its potential in the atom, or a loosening force greater than that potential.

What is the role of the slit ahead of the prism in producing a spectrum? It seems to be understood that the testing or demonstrating apparatus should disclose some quality of light or other object of test. What does not seem common, is the understanding that the apparatus could dominate the measuring.

The slit is not a necessary part of the colour separation instrument, since the separation of white light into colours also takes place at the edges of the slit or, *e.g.,* of a window frame.

Looking through the prism at one side of the window, we see one half of the spectrum; and the other half is seen at the other side of the window. The middle of the spectrum, the green, is not seen in this way.

Thus, the two edges of the slit are necessary, as the light is transformed in one direction by the electrons orbiting the atoms in one direction; and it is transformed in another direction by the electrons orbiting the atoms in the other direction.

One half of a spectrum is seen in the light coming into the prism from one edge of a window frame. The other half is seen in the light crossing the other edge of the frame.

Relative to the light, the difference between these two halves will have to be one of energy.

The difference between the reactions of the atoms of the two sides of the window or the slits could be a product of the Earth's magnetism, as it will show the electrons of its atoms to be orbiting in parallel. This also shows that light is a magnetic function.

The function of the prism is not the splitting of light into its different colours, as this splitting took place at the edges of the slits.

The function of the prism is seen in its form, which is that of the edge of a magnifying lens of infinite radius. Its role is to enlarge light's separation of energies after this separation took place along the two edges passed by the light before it reached the prism.

The separation of colours shows a scale of energies. The connected problem is to what degree the scale is produced by the scale of potentials of the photons and that of the electrons of the atoms of the edges of the slits.

These electrons have a potential relative to the nucleus of the atom; and this potential is influenced by external fields and forces, those of photons included, *cf.* the photoelectric effect.

The level of power necessary for disturbing the relation between an electron and a nucleus does not depend upon the charge of the electron, but upon the potential of its bond to the nucleus.

The question about the scale of energy of the interaction could have been posed at every experiment concerning the influence of an instrument upon light.

Slits and prisms; energy and frequency.

Thomas Young let light through a series of slits and saw interference lines. He concluded that Newton's postulate of light as particles should be disproved. His experiment, though, did not prove that light consists of waves.

His experiment proved that light interacts with matter. It did not show how the interaction will take place, nor the properties of light or matter, except a discontinuity in at least one of them.

Today, two hundred years after Young's experiment, it is possible to see light as charged particles interfering with the electrons of the atoms. The photons will possibly have their momenta changed by the matter of the slits, and they will partly be reflected from it.

As they enter the atoms with a certain momentum and meet a momentum from each of the electrons of the atoms of the slits, they will be reflected with energies within a certain scale, and with a direction and periodicity reflecting that of the electrons of the atoms of the slits.

The periodicity is a distribution function within a quantity of photons. It reflects the difference of momentum of the photons and the scale of momenta of the electrons of the atoms.

The periodicity is a relation between photons, not a property of each of them. The single photon meets the single electron at an angle. They have like charges of different sizes and velocities; and their vectors are summed in the change of direction and velocity of the photon and of the electron.

For a quantity of photons meeting a specific material, their absorption and reflection will be within a certain scale of energy; and, because of the interaction, this scale is higher than that of electrons alone.

The properties of atoms are partly known from the absorption spectra of the elements. Their physics can be understood from the vector resultant of the photon leading into the atom.

Will the periodicity of atoms be better understood if it is described as waves? One question is whether the description in a mathematical model is valid or useful.

It probably is, provided it contains those measurable aspects of reality which are both defined and significant. These criteria should be filled:

1. The aspects should be defined precisely enough for distinguishing between functions and phenomena.

On the background of more than two thousand years of registration and mental treatment of phenomena, we should reflect upon the nature of our object. Is it a real physical product, or is it an appearance only?

2. The aspects should be measurable.

3. The aspects should be significant.

This may not be easily determined. The theory of light describes a number of experiments in different instruments. Their significance is not undisputable.

If a family is seen as an economic system, a mathematical description should be possible. Seen as a system of distribution of energy, it is more complicated, though still a possible theme of a mathematical description. Seen as a social system, its mathematical description will reach a level of abstraction excluding important functions, and evading all problems and decisive functions.

Light and atoms have fewer interactive aspects than families. It is still not easily decided what aspects should be regarded as important, to the exclusion of others.

The periodicity of atoms is the product of a system of particles, potentials, and movements not easily moulded into an abstract form which could represent geometry, interaction between moving particles, and the potentials within the geometry.

A problem is that the moving matter implies cooperation between several atoms of different kinds. They share certain conditions of principle.
Parts of a description are the interpreting of the interaction between photons and electrons, and the forms of potentials in X-rays and light.
The properties of the reflected light are measured indirectly by the atoms of a measuring instrument, whose electrons report their own periodicity, which they share with the photons.

Light enters matter without any vibrations. It is taken up or reflected by the atoms, whose negatively charged electrons have strict periods of orbiting. They cannot stand still; and they have to move in orbits which do not offer the possibility of change of momentum, except at the introduction of a higher momentum from the outside.

A disturbance from a photon will change the momentum of an electron, thus its orbit. This accounts for the heating of matter in the sunshine. The actual effect is variable. Most electrons will be parts of solenoids and will interact with photons.

Not any disturbance will be strong enough for detaching an electron, thus producing the photoelectrical effect. It is used for producing electricity from silicon exposed to sunlight.
The energy needed for the detaching is known as the ionization energy. For Si, it is 8·15 eV (or $2{\cdot}1 \,.\, 10^{-18}$ J) *per* atom for the first electron, and progressive for more electrons.

The absorption spectrum is a measure of the energy taken up by the atoms. It should be possible to keep an energy account of a reflecting body: emission from a light source, reflection from the body, its absorption spectrum, and its energy uptake.

This is not a straightforward calculation. Every photon reaching the nucleus will lower the potential of the atom, or augment its potential on a somewhat lower scale by changing the relative charges of nucleus and electrons.

The light entering the measuring instrument will consist of discrete particles. They will partly be absorbed into the atoms of the surface of a body, partly be reflected from it.

At reflection, the periodicity is given as a frequency or interpreted as a wavelength relative to the velocity of light.

The periods ascribed to light are on the same scale as those of the electrons of the atoms of the measuring instrument.

This fact alone is enough for dismissing the wave theory of light.
Thus the properties ascribed to light are, on decisive points, those of the instruments used for measuring the light.
It seems difficult to find the correct functions in the relations between light, magnetism, and movement in bodies or particles characterized by their inertia. The starting point is misleading, as the moment carried is not that of inertia.
The changing fields seem to be important, *e.g.* at earthquakes, magnetic storms and tropical storms. Domestic animals are known to react to earthquakes before they break out. The animals are mostly grazing along the longitude of Earth’s magnetic field, their heads facing the North. This indicates that the earthquakes could have a relation to magnetism.
The “cow effect” could be related to the change of forces, perhaps in magma flows. The changing magnetic fields related to earthquakes seem to be active before the quakes are noticed at the surface.
Bodies and particles move at velocities below that of light. The gravity fields of the sun and planets extend at least over the radius of the solar system. When fields are permanent, they cannot be quantized.
The radiation or fields of potential energy between bodies will have to take place by some physical means. The radiation felt between living creatures is measurable and of the same physical kind as that from a star, a lamp, or a candle.
When interaction between atoms or bodies at a distance leads to a change of their relative potential, this takes place by a transmission of photons or by physical bonds, consisting in the relative potentials of their fields.
The potentials between atoms will find an equilibrium, which will be sustained by a continuous exchange of photons. An instance of this is the equalizing of temperature in a body or in a fluid at rest. The energy of the photons is expressed in the bodies’ temperature. At 0 K, the exchange will be ended.
It seems that the simplest explanation of the spreading of heat in bodies should be their exchange of photons. This gives the mechanism of gravity a possibly extended physical explanation; and it likewise gives a probability based upon a physical function to Einstein’s postulate of propagation of fields with the velocity of light.
When an electron of an atom receives a photon, which arrives without any frequency of its own, it is often reflected, either out of the atom, or into it.

This interaction is possible because of the magnetism of the solenoid of the electrons of most atoms, making them visible.
The heating of matter takes place when the photon is absorbed as an added charge to an electron, giving it a higher potential relative to the nucleus, a higher velocity, and an orbit closer to the nucleus of its atom. The electron cannot stand still; and its velocity is proportional to the negative of the square root of its distance from the nucleus.
When an electron absorbs a photon, it gets a higher potential relative to the nucleus. This happens when the sun is shining on a surface and heats it. The added potential is seen as energy in the higher temperature of the body and in its thermal expansion, which is a product of a greater exchange of photons between the atoms.
Each atom is contracting by its higher potential between electrons and nucleus; but the distance between the atoms is augmenting as a product of higher photonic activity. This leads to thermal expansion, melting, and boiling.
The photon becomes a part of the atom's absorption spectrum. It will hardly be possible to deduct the photonic momentum from the change in the atom's sum of potential levels. The reflected photon into the nucleus will lower its positive charge, leading to a rise of the potential of the atom.
On the macro level, the charge added to the electrons is seen as a thermal expansion. The distance between the atoms becomes somewhat greater by their more intense exchange of photons, as this exchange will produce a higher pressure between the atoms.
The exchange of photons will be the mechanism of heat conduction, thermal expansion, and thermal dissolution of matter.
It should be deducible from what is known that light is material and a physical product of the negatively charged part of the substance of which matter is composed.
It should be possible to determine momenta of photons, not only their relative energies.
Associating high levels of energy with short wave lengths does not seem reasonable when the energy has been used for producing an unknown number of photons of a kind unknown to the 19^{th} or 20^{th} century.
The potential transmitted by one photon is the smallest differential that can be transmitted between atoms. Fields are stable accessories or parts of protons and electrons. Light is quantized as a photon and its very small field. Photons carry different momenta. On their way, they last for a moment or for milliards of years; and their end is short in a star, a planet, or my eye.

Magnetism and potentials.

Bodies are not accelerated to the velocity of light. Particles the size of electrons are not accelerated to the velocity of light.
Bodies are held together as bodies by the potentials between their constituent atoms and molecules. When energy is added to a body, its internal potentials are weakened relative to the potentials necessary for holding its atoms together, *cf.* melting. The added energy can be electricity or an accelerating force, or it can be seen as a phenomenon, like heat or pressure.

The effect is seen already at small differences of structure or temperature. Our tendons in the limbs are stronger than the internal ligatures of the body. On a larger scale, hot iron is malleable; and cold iron is used for constructions. Hot water dissolves; and cool water is a part of organic bonds.
These apparently different kinds of energy are all released potentials between positively and negatively charged primary particles of substance.
The world does not consist of mathematics. Mathematics delivers calculation models saying nothing about the essence of the world, but giving a picture of dimensions between parts of it in their presumed relation.
Mathematics describes functions between the dimensions of the parts described. Its clear and unambiguous form makes the mathematical picture convincing and removes the thought of alternative descriptions. Mathematics does not prove the reality of its theme.
In the case of movement and forces, celestial or terrestrial, an accepted convention is used by custom and without question.

This is seen as well from the Ptolemaic model as from the Newtonian model of inertial mechanics. Both models are correct as mathematics describing phenomena; and both of them are misleading as images of real physical functions.
Breaking down electrons in the sun is not a precise procedure. The number of photons produced could be between one thousand and one million *per* electron. The elementary charge, that of the electron, is $1{\cdot}6 \,.\, 10^{-19}$ C.

When the electron is divided in the production of light, this charge is divided between the photons According to Maxwell, a photon should have a potential of $4\ \pi\ \rho\ .\ v/c$,

e.g. $4\pi\ .\ 8\ .\ 10^{-25}\ C = 10^{-23}\ C$

at the velocity of light. $8\ .\ 10^{-25}$ C is probably among the smaller charges on photons. The greater photons could have one thousand times this charge.
The corresponding amount for all photons from one electron will be

$1{\cdot}6\ .\ 10^{-19}\ C\ .\ 4\pi = 2\ .\ 10^{-18}\ C$

When v = c, the potential is 4π, or *c.* 12·5, times the charge. Hence the transition to electro-dynamic function begins when the velocity of the charge surpasses 7·96 *per cent* of the velocity of light.

Here is a connection to the transforming of an alternating current, in which each change of direction of the current implies a high velocity. A new field is induced in the iron core at each turning of the current. The dynamic potential of the current will increase as the number of its reversals *per* second; $\Sigma\ \Delta\ v\ s^{-1}$. There are technical losses dependent upon the material in the iron core and the resistance of the coils.
The technical similarity between the current in a solenoid and the changes of direction at the collisions between the electrons in the sun will indicate their common physical function, that of exchanging dynamic electricity for static charges, making possible high-volt currents, magnetism, and light.
The magnetic phenomenon of a permanent direct current producing a current in a parallel conductor is a function on an energy level below dynamic magnetism and light.

Light could be the product clearest showing the physical character of the versions of dynamic electricity. Its charges are divided and given a common direction; and each of them is small, directional, and indivisible.
Its fields are no longer believed to be spherical, like those of static charges, but directional, or polar. They are impervious to static or low-velocity charges, thus react to magnetism only.
The inertia of a body is secondarily influenced by the movement, even when the body is thrown like a stone. Influenced in a field, like it is indirectly influenced by gravity, the body's fields receive a potential and a force; and the body is moved.
A phenomenological measure of the force is the difference of inertial momentum of the body, times its velocity, *cf.* Newton's second law. This disregards the force producing the movement, thus the forces of matter and substance.
Energy according to Newton's second law (N 2) is mv^2, which is kg $m^2\ s^{-2}$. Since this is a *post hoc*-calculation of a presumed effect of a potential or a moment on a quantity of matter, it is not a measure of the energy added.
As it was seen above, the moving forces of gravity are those of the charges of substance.
Material forces are produced by potentials or momenta, which result from the charges of substance only. The energy transmitted from one photon can be described by $4\pi\ C\ m^2\ s^{-2}$. This indicates the magnetic effect.
The photon cannot deliver a momentum produced by inertia. Its effect can neither be an influence on the inertia of the body hit by the light.
Its effect will have to be an electro-dynamic function consisting in the light's potential having consequences for the structure and dimension of the potentials of the atom hit. Heating is well known. An instance is the photoelectric effect, where an electron's bond in an atom is loosed by the electro-dynamic force of the photon.
The electrons of the sun keep the velocity of light high and stable by repelling photons. The velocity limit of photons could be set by the amount of energy used by the sun for the initial acceleration of electrons.
The sun's escape angle, close to the vertical, sets a limit to the emission of potential-carrying particles, *cf.* the sun's loss of substance as light of 25 g m^{-2} *per* year.

It is possible that the velocity of light could be a product of the electromagnetic force of the photons surpassing the force of the remaining parts of electrons.
In the sun, there is no energy loss by neutralizing of charges, as electrons and protons occupy different compartments of the outer part of the sun.

The forces used for keeping the particles apart also break down the electrons. The time used for accelerating electrons and breaking them down to photons is unknown.

The mean free distances have been calculated to nanometres for electrons and millimetres for photons at half the radius of the sun.[12]

The parts of electrons collide many times *per* second. They are accelerated by each collision and are broken down to attometre size.
The electrons are kept in their compartments by the magnetic fields they produce by their fast changes of direction, *cf.* the first coil of the transformer. The parts of electrons are stepwise accelerated to the velocity of light.
One constraint on this is the energy of the escaping light. Another is the energy needed for holding the sun hot in order to making the process possible.

Other methods of producing light are working in one step. From a candle to the atomic bomb, light is produced by acceleration to the velocity of light.
The collisions in the sun are a necessary process, conditions given. The same does not seem to be the case in the candle. The collisions keep the sun hot and are the necessary condition of the high temperature of the sun's outer parts.
The sun's luminosity is $3{\cdot}9 \,.\, 10^{26}$ W. Its loss of substance is $5.\ 10^{9}$ kg s^{-1}. This quantity multiplied with the square of the velocity of light gives a total energy of $4{\cdot}5.\ 10^{26}$ W. Of this, 87 *per cent* is emitted as light.
The rest is emitted at other frequencies and as sun "activity" (which does not cover the sun's main activity, the emission of light). This conventional calculation is not correct, as it is based on inertia and Newton's second law.
The energy shown in the sunlight is the last of a series of nuclear processes.
A problem seems to be the velocities relevant to moving away from the sun. Its Newtonian escape velocity is 618 km s^{-1}, though not practicable for high temperature and the lack of a suitable surface.

Protons' normal velocity away from the sun is 100-500 km s^{-1}; apparently not enough for escaping. They probably escape because they are pushed out by their magnetic fields.

Light escapes at $2{\cdot}99792488.10^{8}$ km s^{-1}, maybe because the magnetic fields of the sun will retain it until a break-through at that velocity.
The separation of electrons and protons in the outer part of the sun could be due to their setting up opposite magnetic fields by their incessant movement.
The higher velocity of the electrons will produce the stronger magnetic fields.
The escape angle of the photons is close to the vertical, which is seen from the sun's dark rim.

The arrival of a photon will change the momentum of an electron, thus its orbit. This accounts for the heating of matter in the sunshine. The actual effect is variable. Most electrons will be parts of solenoids, thus will interact with photons.
Not any disturbance will be strong enough for detaching an electron, thus producing the photoelectric effect. It is used for producing electricity from silicon exposed to sunlight.

The energy needed for the detaching is known as the ionization energy. For silicon, it is 8·15 eV *per* atom for the first electron detached; and the energy cost is progressive for more electrons.
The absorption spectrum is a measure of the energy taken up by the atoms. It should be possible to keep an energy account of a reflecting body: emission from a light source, reflection from the body, its absorption spectrum, and its energy uptake.
This is not a straightforward calculation. Every photon reaching the nucleus will lower the potential of the atom, or augment its potential on a somewhat lower scale by changing the relative charges of nucleus and electrons.
The light entering the measuring instrument will consist of discrete particles. They will partly be absorbed into the atoms of the surface of a body, partly be reflected from it.
Is light still light after interaction? Do we see its properties after interaction? Can we see them before interaction or without interaction? What are we after? Do we ever meet light as it is? The colours of paintings, clothes and flowers are shining against us. Are they light?
They are. Reflected light from a surface has left a part of its energy with the atoms of the reflecting surface. The levels of energy retained are those of the colours not reflected. This is probably not quite correct, since the range of energy of a group of photons is not necessarily that of the range of all photons.
The small atoms of light gases are too weak for reflecting light. This makes the air invisible.
Reflected light from a mirror is not sorted according to energy level. That is why glass and a few metals are used for mirrors. Still, we cannot know what light is when we see it after reflection or other interaction. Its capacity of interaction is varied and rich. This is a good reason for not always believing what we see.
But when can we believe it? When we know the functions behind what happens.

The seen light is no longer light.

Conclusions about light after interaction depend upon our understanding its energy exchange with matter and its effect on the photons we receive. This understanding has not been developed, as it is still dominated by belief.

Antoine Laurent Lavoisier (1743-94) relied more on reality than on belief or learning. His experiments went against the confirmed knowledge of the accepted scientists of his time; and they became the foundation of physics of matter, thus of chemistry. He proved the role of oxygen in combustion and metabolism.

A tradition exists for interpreting everything happening to light as a property of light itself. The forces, frequencies, and energies of light after interaction seem to be taken as properties of light, not as products of interaction.

There are no reasons for those conclusions, since the mechanisms of interaction between light and the instruments are not fully known. It would have been difficult to distinguish the parts of the interaction, even if this had been tried; as no existing model of light permits an interpretation.

We should not feel above learning from Lavoisier to establish a concord between our model, the questions we ask Nature, the experiments we perform, and the interpretations we permit ourselves.

The interacting qualities, properties, or forces are unknown in the light as well as in the instruments. It should, though, be possible to establish some insight in the properties of light and of the instruments used for experiments, and thereby make possible an analysis based on functions.

The static forces of the particles of atoms are one part of the interactive potentials of atoms. These forces are those of the atomic nuclei and of the moving electrons.

The dynamic forces, magnetism, are those produced by the movement of charged particles at high velocities.

The moving particles of matter are the electrons, which carry negative charges. Their electro-dynamic forces are not great, as the velocities of electrons are well below that of light.

In some molecules, the coordination and velocities of electronic orbits is so great that they have electro-dynamic properties, *e.g.* water.

Static and dynamic forces coexist; and their sum from each source is constant at each velocity. At particle velocities well below that of light, the static part of their potentials is still active. This part is diminished at higher velocities and disappears before approaching the velocity of light.

At velocities above eight *per cent* of that of light, the moving charge starts producing a dynamic force. This implies that the energy absorbed for the acceleration will not be linear.

In space travel, Newton's second law describes the situation, since the space ships' velocity still is below the limit, *c.* eight *per cent* of the velocity of light, to the realm where the equation is no longer valid.

The dynamical part of the energy is communicated not only by the direct hit of the photon, but also by the magnetic field of the photon at its close passing a charged body or particle. This is a part of the photoelectric effect.

This vector function of light is a stronger version of the function of moving charges.

A further consequence is that the atomic and molecular potentials of matter, which are the forces holding matter together, will be overridden by the greater forces the body receives at acceleration to velocities approaching that of light.

Since matter is not broken down by being exposed to ordinary light, the energy levels of matter are seen as higher than those of light. From their interaction, we may, though, see the character of light in its relation to that of matter. It is possible to weigh information from the different interactions and to deduce properties from them.

The consistency of matter seems to be conserved up to an energy level of light. This can be understood only if light's energy is distributed in small units relative to the forces holding matter together; and if the energy of its particles is low compared to the size of the body upon which light falls.

A strong radiation of photons will heat, ignite, and destroy any compound of matter, *cf.* the atomic bomb.

The properties of light as it comes out of the sun or a lamp are of interest; but the energies and products of interaction are those performing its physical functions and therefore demanding attention.

So does the mechanism of the production of light. Identification of the interacting parts is necessary in order to keep a consistent interpretation within the range of the physically possible.

One limit to the physically possible is the energy level of the potentials holding matter together.

From substance to light.

If a quantity of matter cannot conserve its consistency above a certain velocity, it will be impossible to define velocity as a physical condition of bodies above that velocity.
The concept 'velocity of light' is a concept outside mechanics. This is a problem if light should be defined as a wave or in any other way related to mechanics.
The concept 'wave', taken from mechanics, has been seen in physical representation on the sea and has been interpreted as longitudinal waves into the periodicity of sound propagation by pressure differentials in fluids, *e.g.*, in air and in the magma of the Earth.

Outside these realms the concept 'wave' does not seem to describe anything concrete enough for demanding a place in physics. A ray of light seems to be beyond the physical parts of the world, the way these are commonly understood. It has passed the limit of matter understood as a compound of atoms or of particles of substance.
Protons move at a few hundred km s^{-1}, electrons perhaps at 1000 km s^{-1}, and photons at *c.*300 000 km s^{-1}. This partial extra-materiality of light does not indicate its specific nature.
The interaction of potentials of matter will transmit its periodicity to the light falling on it. This is seen in the absorption spectra of the elements relative to their reflection spectra.
The magnetic interaction with photons is possible for those electrons which in their orbits have an angular velocity (rad s^{-1}, radians *per* second; or θ s^{-1}) high enough for letting them surpass their static forces and enter the realm of electrodynamics.
The invisibility of most gases and many fluids is a product of their electrons' too low level of electro-dynamic potential for reflecting photons.

If we presume that a physical continuity exists between macro-matter and sub-Ångstrøm substance, it will be possible to build a continuous and consistent model of matter, light, and energy.
A photon, *e.g.* an electron times 10^{-6}, should have the charge of its part of the electron.
Its properties are charge and velocity; and its effect is electro-dynamic, or magnetic. Its charge would be: e. 10^{-6} = 1·6. 10^{-25} C. The greatest photon could be one thousand times greater than the smallest, and it would carry a corresponding charge of 1·6. 10^{-22} C.

At approaching the velocity of light, the inertial momentum is overtaken by the charge of the photon, producing $4 \pi \rho c^2$.
The photon has no inertia. The momentum of a charged particle moving near the velocity of
light is no longer a part of mechanics, as it is magnetic, or electro-dynamic. It can be described as charge times the velocity, Ψ . c. Its moment or potential will have the dimension C . m^2 . s^{-2}.
This would be a more adequate measure of magnetic flux, or pole strength. The inertia of a charged particle is not a part of the potential of charges moving at velocities near c.
At the velocity of light, no particle as great as an electron is kept intact. This is seen in the way light is produced in the sun.

At the outset, electrons have a specific charge of 1·76 .10^{11} C kg^{-1}. Their charge is conserved as the electrons are broken down to photons. This conservation of charge is the condition of the sun's use of energy for splitting the electrons and emitting light.
Within each of the sun's compartment of electrons, forming its outer layer, or apparent surface, they are repelled from each other by their like charges. After a short free way, they collide, are repelled and gain some velocity from the magnetic fields of the moving neighbouring charges.
If they have more than a few millimetres free way, they will also be accelerated by the repulsion from their fellow electrons. At a certain velocity, they are broken into smaller parts at each encounter; and these parts are further accelerated.
Their velocity produces a system of magnetic fields holding the photons within the sun. These fields define the apparent surface of the sun, which is not a surface in the ordinary meaning, but the limit of the region of photons not yet emitted.

When they have reached a very small size, probably <1/1000 of an electron, and the velocity of light, they are ready for leaving the sun. This depends upon finding the right exit, which is at an angle near the vertical; and its finding should coincide with a strong push from the magnetic field.
The constraints are heavy, since the rate of loss of light substance is 25 g *per* square metre *per* year. This quantity corresponds to that contained in the uttermost 250 metres of the sun.

The parts of the sun seen from its outside are limited to the photons let out. This means that nothing of the sun's interior is seen. The light from the sun does not communicate any picture, as it is an aggregate of photons whose history in the sun is a long process of disorganization. There is no possibility of "looking into the sun"[12], as all the photons released from it are ready for use, though not yet used for visual representation.
This has a bearing on the interpretation of astronomical information, as emitted particles do not impart anything but themselves. Among them are found traces of elements showing parts of the history of the universe. The element helium (named after Helios, the sun) was discovered in the radiation from the sun, before it was found on Earth.
It seems probable that each photon carries a part of the elementary charge corresponding to its part of the electron. A photon of $4 \cdot 10^{-36}$ kg could then carry a charge of $7 \cdot 10^{-24}$ C. It seems reasonable that photons could have sizes from 10^{-3} to 10^{-6} of an electron.
The sun emits as photons the energy used for breaking down the electrons. They carry the energy received at being broken down and then accelerated through their reciprocal repelling and their multidirectional magnetic field.
This mechanism of repelling and breaking down produces the magnetic shield of the sun, preventing its dissolution. This is due to the electrons' lack of capacity for influencing magnetic matter or its fields, *v.i.*
The sun appears to be boiling at 5780 K. The relative roles of the factors are not obvious. A phenomenological model of possible relations between temperature, quantity of substance, particle charges and emitted energy would probably not be very clarifying as to the dynamics of this layer of the sun. The phenomenological exposition is insufficient as an explanation of the sun's electrodynamics.
The velocity of light removes the forces of static charges, thus also gravity. Gravity is a differential force between positively and negatively charged particles, relative to their inertia. It works between the static charges of particles at low velocities.
Gravity does not belong to the system of energy to which light belongs. It can therefore not hold photons within the sun until they reach the escape direction and the velocity of light.

The gravity of the sun is not produced in its uttermost layer. Gravity is a static force. The photons' velocity and dynamic charge exclude them from gravity.
Light is produced in the outer layer of the sun. This layer is probably not deep, relative to the sun's radius of 696 000 km.
The low rate of loss of substance from the sun can be seen as the sun's mechanism of conservation of energy.
The moving electrons and parts of electrons produce a magnetic field directed at 90 degrees to the movement of the particles. As they are banged back and forth at velocities close to that of light, the field is discontinuous, though strong.

This field seems to be the mechanism holding the photons within their domain. The nature of outbreaks confirms this conjecture, since they are sunspots and other magnetic fields produced by protons.
This could explain the photons' apparent difficulty at hitting the exit angle. The magnetic field could hold the photons back until they reach a wave of magnetic field shoving them out of the sun at the right angle.
A consequence of this is a possible effect of sunspots and their outbreaks of protons. The solar extra-luminous activities are northern lights and magnetic storms affecting communication. They counteract photons and electrons, producing flares and cold weather on Earth.
A part of the produced power is not used for emitting light, but for emitting protons and for maintaining the magnetic fields holding electrons and protons in their respective compartments. The relation between the two energy amounts is that 13 *per cent* of the sun's energy is used for the emission of protons.
Sunlight and magnetic forces in solar eruptions are great energy flows. Their dynamics is not related to the inertial force of movement described in Newton's second law.
A more adequate description is found in Maxwell's third equation. The dynamic energy of

a charged particle is produced at a velocity of eight *per cent* of that of the light, and upwards.

The electro-dynamic momentum of the charge ρ will be 4 π ρ . v/c, thus 4 π ρ at the velocity of light. At this velocity, the static part of the charge is reduced to nought.

When this happens, electromagnetism is the only function of charge and velocity.

The transition to magnetism takes place during the acceleration; thus its force is augmenting in the process.

The energy emitted from the sun is not delivered by an imagined inertial momentum of the photons. The inertia of the electrons and their broken-down parts is used up through the collisions; and its charges are converted to magnetism.

This indicates that the charges of the electrons are parts of a convertible system of electricity whose qualities are partly dependent upon its movement and its relation to external fields and forces.

This is also seen in the transformer. It further indicates that static charges are the carriers of inertia.

The accelerated negative charges are transmitted as such at a direct hit, or they transmit an electro-dynamic, or magnetic, force *en passant* through their moving fields.

This energetic potential of the moving charge of the light was put into it during its acceleration, as it cannot emerge from a lower energy input.

The charges of 5 M t s^{-1} of electrons are emitted at the velocity of light:

$$5 \cdot 10^{9}\ \mathrm{kg\ s^{-1}} \cdot 1{\cdot}76 \cdot 10^{11}\ \mathrm{C\ kg^{-1}} \cdot c^{2}$$

$$= 7{\cdot}9 \cdot 10^{37}\ \mathrm{C\ m^{2}\ s^{-3}}.$$

This dynamic power is divided between photons, at least $5{\cdot}5.\ 10^{42}$ *per* second, since they can be estimated to between one thousand and one million *per* electron divided.

This estimate is based on the division between photonic energies.

By the conventional measure of wavelength or frequency, there are several octaves of infrared, nearly one octave of visible light, and a few octaves of ultraviolet.

The potentials of moving photons are now measured as the energy level of the reaction of the measuring instrument, and currently given either as wavelength or as frequency, which are then ascribed to light. In this procedure, the range of IR, light, and UV covers around one dozen octaves.

This hides the physical properties of light and matter, and the kind of their interaction.

The electro-dynamic function of charges can be seen in the perspective of magnetism. The transition from potentials between static charges and charges moving at low velocities to fast moving charges on the other begins at velocities above *c.* eight *per cent* of the velocity of light.

Mathematics does not prove the reality of its theme, that its parts should be of the same kind, or are parts of the same function.

Its clear and unambiguous form makes the mathematical picture convincing and removes the thought of alternative descriptions.

The technical condition of transforming an electrical current to a higher or lower potential is that it should be an alternating current. The physical condition will then be the change of direction of the current.

An electrical current is a stream of negatively charged particles. Their change of direction can take place abruptly, or by rotation in the orbit of an atom or a solenoid.

In the sun, the course of electrons and their parts is unstructured. Their direction is abruptly changed by the collisions.

The added energy of this process through the years is shown in the breaking down of the electrons and the high exit velocity of their parts.

The added energy is also shown in the transition from the static to the dynamic charge of each minuscule particle resulting from this breaking down of electrons.

At their high velocity, their negative potential is transferred to the other system of energy.

This is the product of negative charges at high velocities. The transition will take place at velocities above those of protons.

The forces are unique and are not object to interference from the static potentials of low-velocity charges.

Light has its origin in negative charges and the removal of static charges. Light is therefore an electro-dynamic radiation whose properties are charge and velocity; and whose effect is that of magnetic monopoles.

The measure of the transition is the velocity of change of direction relative to the velocity of movement. This is seen in the neutron compared to the atom of hydrogen.

Neutrons.

The neutron's function in physics is to hold atomic nuclei together in spite of the protons' like charges and their following repelling. It fills this task by its magnetism. Liberated neutrons have a half-life of seventeen minutes. They are spontaneously dissolved into an electron, a proton, and an antineutrino.

The neutron is Nature's prototype of the magnetic solenoid.

Magnetism is also produced by technical solenoids. When the electrons move in the direction of your fingers, and to the left, in the spool you hold in your hand with its backside up, the north pole of the solenoid is to the right.

At a high velocity of electrons, the rate of change of direction surpasses a value at which the static potentials of the electrons are converted to electro-dynamic potentials, *cf.* the breaking down of electrons in the sun.

The direction of the current is conventionally taken to be from plus to minus, though electrons carry their negative charges in the opposite direction.

Electrons of most atoms function as solenoids and produce magnetic fields, *cf.* the orientation of the window frame and its effect on light, *v.s*.

The smallest atoms produce no magnetic field, thus they do not interact with light. Uncontaminated air is invisible for this reason.

Neutrons are small magnets. They appear neutral for their equal positive and negative charges. Their function in atomic nuclei stems from the strong magnetic field produced by the solenoid of their fast moving electron.

Neutrons differ from ^{1}H-atoms by not being permanent. They have a singleton half-life of seventeen minutes. When a neutron is taken out of its magnetic bond in an atomic nucleus, the fast-moving electron will lose hold of its proton partner. The reciprocity between the protons and the neutrons in the atomic nucleus is lost; and the neutron's solenoid is dissolved.

In the atomic nucleus, except ^{1}H, its protons accept their closeness, as their like charges are overpowered by the neutrons' magnetic function. The protons are neutralized by the neutrons, whose fields are empirically seen as producing two nuclear forces, one weak and one strong.

The nuclear forces and general magnetism.

The weak nuclear force is not a force, but the absence of a repelling force between the protons of the nucleus. This is a product of the position of the protons between the neutrons, and of the neutrons' magnetic fields' imperviousness to the forces of the static fields of the protons.

In nearly all atomic nuclei there are greater numbers of neutrons than of protons. The protons are kept out of contact with each other, as the neutrons occupy the spaces between them.

The strong nuclear force is produced by the magnetic fields of the neutrons. They hold the protons together in the nucleus. They could have played the important role of holding together the nuclei of the greater, trans-uranian atoms once existing. Their new production does not seem impossible, though their conservation will depend upon strong magnetic fields.

This could be seen in connection with the weakening of the Earth's magnetic field.

This field will probably no longer make possible stronger local fields than now.

Together with the dissolution of the neutron when its magnetic field is not engaged, this indicates that the solenoid function of any atom is dependent upon the atom's relation to the other atoms of the molecule which they constitute, and to the magnetic surroundings.

This is indicated in a partly specific way by the two magnetic bonds of the water monomer. The passage of light through water is limited to a few dozen metres.

It is also indicated by the bond of the chlorine molecule, which interferes with the visible spectrum, producing the green colour of the gas.

A possible low pressure associated with low potentials in the atomic nucleus should indicate the absence of heavier elements in the outer parts of stars, and of the impossibility of forming them there, *cf.* the trans-uranian elements.

The neutron, which has a small radius and a strong magnetic field, has surpassed the limit of possible interaction with the static or low-velocity potentials of substance.

A measurement of the magnetism of the neutron should then indicate the limits of the static force and structure of matter.

The weakening of the Earth's magnetic field could lead to a general weakening of life and matter in addition to the disappearance of rain.

Redshift.

The transition from electrons to photons is a long process of cleaving the particles by their collisions in the magnetic field of repelling forces, produced by those moving particles.
The magnetic field is the sun's long-term transmitter of energy. Its effect is the acceleration of the particles which become light.
The energy is released and distributed by the breaking down and accelerating the electrons by collisions and reflection into a new direction.

This magnetic field of the sun also keeps its inner parts, belonging to energy system 1, from dissolving, *v.i.*
The fast movements within the repelling magnetic field remove the static potentials of the particles and produce magnetism.
For the single photon, the end of the process is its expulsion into space, where this negatively charged monopole of magnetic potential will race forever, or until it is suddenly stopped by a body or, more probably, crushed by a stronger photon from some other star.

Redshift is the necessary product of this process; and the discovery of the 2·7 K background radiation should rather be taken as its confirmation than as a proof of Big Bang.
The number of collisions in the sun will be considerable, probably above one hundred million *per* year for each particle. Each collision will produce a change of direction, a rise in velocity, and a removal of a part of static charge.
Eventually, each electron is broken down to photons, which could be between one thousandth and one millionth part of the size of the electron.

The transformer works in a similar way. As the alternating current changes direction 50 or 60 times *per* second, it is broken 700 million times *per* year. The electrons of the current are renewed as the current is tapped. They are not broken down in the conductor, nor accelerated above the normal velocity of the current, *c.* 2/3 of the velocity of light.
The conditions of the conductors and the field effect in the soft iron core of the transformer are different from those of the sun. The transformer has an inner loss of efficiency and needs cooling. The force of the change of direction in the sun will be stronger than in the transformer.
The sun's surface holds 5780 K, at the equilibrium between production and release of energy.
It should be possible to indicate the intensity of the process by the relation between the change of velocity and the actual velocity, with regard to the charge involved:

$$(\partial^2 v / \partial t^2) \, 4 \pi \rho$$

The prime moving forces of matter are the potentials of its constituting substance. The forces are easily seen in fluids. In cooling technology, a circular stream of air is used for producing low temperatures, as the potentials of its charges are used in circulation.
A stream of water keeps its potential as long as it is not moving in narrow circles, *cf.* the sinking level of a whirl-pool.
Static potentials are heavily loaded in a non-linear acceleration. This is exploited in transforming into electro-dynamic potentials. In the sun, the radii of the changes of direction are nil. The relation between force and inertia is greater than in solenoids.

The time and number of collisions needed for the transforming to electro-dynamic potentials could be caused by the energy needed for the transformation, relative to the velocity reached in the process. The factor $4 \pi \rho$ implies that the energy used and absorbed is over-proportional relative to the change of velocity.
There is an alternative way of describing the transition to dynamic charges. Charge could be a limited property of matter. Its static part could be removable by the movement and change of direction of the charged particles.
In that case, the process is a shaking away the static charges from the particles, a series of shocks draining them of their static charges.

Magnetism and life.

The electro-dynamic function could be seen as a residuum attainable at a high energy only, *cf.* light.
Light, as an electro-dynamic radiation, returns (after a long detour in the sun) energy to matter in a life-compatible form and thereby produces negative entropy through plant growth, which is a necessary condition of other life.
It will be seen that plant life and the life depending upon it are both dependent upon light's electrodynamics as the primary condition of their growth and metabolism.

It seems that all forms of life depend upon magnetism, which is necessary as well for the growth of cells as for their internal functions and their communication with other cells.

Water is seen to be the carrier of a world-wide magnetism upon which life depends.
The two sides of the spectrum at the sides of the window frame is a view into this uniting function.
Together, these open a new perspective upon structures of life.
This function could even be the physical reason for life. Light's magnetism could be the energetic frame of life's physics, organic chemistry and neural functions.
This will explain magnetism's pervading function in life's conditions. It seems that magnetism should be the communication system of Earth and life.
Deduced from the properties of water, magnetism should be the link between the parts of life.

The present sinking strength of the magnetic field of the Earth is probably not a product of equal distribution.

Through its connection to water it should be understood as an unequal distribution of water in the outer parts of the Earth.
If magnetism is a system of connections and communication, which it seems to be, the lack of water in the dry parts of the Earth will hold clouds and rain away from those parts.
In the case of Sahara, the high pressure produced by the heat radiation and the cool, sinking air, is a sufficient explanation of the high pressure and the lacking clouds.
This function also has a spreading effect, seen in the rising inequality of precipitation over the world.

Charges and forces

.

Bernoulli's model, Δ p = - ½ ρ v^2, concerns the empirical pressure part of the differential of energy. This part of the use of the potentials of substance is not in conflict with the orbital movement of electrons.
The stream along a periphery takes up a part of its potential, *cf.* the cooling effect of the circulating stream of air.

The rectilinear movement of elementary particles is, though, in conflict with the primary material property of matter.

There will be an inertial resistance to the rectilinear movement of particles when these are characterized by a gyroscope-like inertia of their parts. This will be part of the reason for the impossibility of accelerating bodies and atoms to the velocity of light, maybe its main part.

At high velocities, the inertia of the charges of substance is added to the mechanical (or Newtonian) inertia. This is a probable reason for the higher need of energy in the acceleration of particles to the velocity of light.
The dynamic potential of light could be the reason for its finite velocity. At the velocity of light, there will be equilibrium between the energy added to each photon and its electro-dynamic inertia.
This could indicate that the energetic limit does not reside in the photons, but in the physical conditions of their external world, especially in the force between the field of the photon and those of its surroundings.

There is an alternative explanation. The transition from static to dynamic regime seems to imply a removal of one kind of potentials.
The transition will then be a removal of a way of transmitting forces, and the forces themselves, which implies that a certain input of energy gives a stronger reaction, *e.g.* a higher velocity; and at the same time the possible interactions are fewer.
The acceleration and series of collisions in the sun point to a possible technical procedure. One part of it is the removal of the static part of charges. In liquids, it introduces the dynamic part of the fluid pressure.
The moving charges are functional parts of the atoms. In the orbital movement, their momentum will change its character. Their inertial momentum is taken over by their charges.
The change will be the production of the electro-dynamic field from the static potential.
The similarity between the movement of electrons in the atom and in the solenoid is not occasional, but systematic, showing the functional connection between their charges.
Fluid pressure is exerted by the sum-fields of the positive and negative charges, which produce the innermost potentials of matter, *cf.* gravity. We could equate pressure and potential.
The ρ denotes the fluid's density in

$$\Delta p = ½ \rho v^2 = \Delta Pa = \Delta kg\ m^{-1} s^{-2}.$$

This is the empirical and phenomenological unit of pressure within the scope of N 2.
The differential of charge can be given a measure and a functional physical dimension:

$$\ln (\partial^2 v / \partial t^2) . 4 \pi \rho = C\ m^2 s^{-3},$$

ρ denotes potential or charge. This could describe the energy function of solenoids.

A stream round a corner produces a Δp in the form of a lowered pressure or a loss of potential because of the energetic implication of its fast change of direction relative to its velocity, the $\partial^2 \theta / \partial t^2$, the change of direction in the course of a short time.

The change of direction is remarkably faster in the sun than in any solenoid.

The functions related to magnetism show that the forces of moving fluids are products of the potentials of their charges.

The relation between static and dynamic bonds and radiation is shown by light's passage through the air. The atoms of oxygen and nitrogen have electrons of limited potentials, which cannot initiate any interaction with light.

Among gases heavier than these two, chlorine is the first to show a colour, since its electrons' momenta are strong enough for the magnetic reflection.

Water's property of absorbing light will be a product of the two magnetic bonds of its monomer, which will interact with light. Its hydrogen-bonds between the monomers are among the weaker bonds and will not be able to retain or reflect light, *v.i.*

The physics of currents casts light over the nature of the charge of light relative to the charge of electrons.

An extension of the interpretation of the forces of fluid turbulence should indicate that the transition from the negative charges of electrons to the negative electro-dynamic force of photons should be a question of removing a part of the potential of the electrons, stripping them of their property of static interaction and leaving the magnetic potential capable of interacting with the innermost qualities of substance only.

This can be seen in relation to gravity, whose sum-fields reach the whole of the solar system. The distance to Pluto is nearly forty times the distance between Earth and the sun, or nearly 6.10^9 km. Since Pluto is held in a sun-centred orbit, the static sum-field of gravity is active at this distance.

The magnetic field of the sun seems not to reach the planets. Sunshine, its moving magnetic monopole, will reach Pluto in five hours and a half.

Magnetism can be seen as a residual force of substance, the dynamical force left after the static potential has been beaten out of matter.

The magneto-dynamic monopole of light should be brought to its focus, while the static fields produce gravitation at great distances.

The fields of magnetism have shorter ranges than the sum-fields of gravity. In the solar system, they are local; and the magnetic field of Earth has not been able to keep up the force of that of Mars.

The solenoid is the most numerous mechanism of Nature, as there is one in each atom. The field produced by a current at its change of direction will produce magnetic effects when it is strong enough.

Light is impervious to the smallest of molecules, thus H_2 and O_2 are invisible. Greater molecules produce magnetic fields by the higher velocity of their electronic solenoids, thus are visible.

The energy level is higher after the transition to electro-dynamic potential, as much energy is needed for cleaving electrons. Their potential is raised to 4 π times their charge. Part of their potential concentrates its own field to a minimum in the magnetism of light.

Photons and electrodynamics.

Light is not carried by a medium, but by itself, the charges of photons. The inertia of its source is displaced by dynamical charges, though probably not much.

Like other fields of charged particles, the photonic fields should have a somewhat greater extension than the photons themselves.

Light as we perceive it is produced by the small charges of the photons moving at the high velocity of light.

Each photonic charge is therefore outside the domain of static electricity, its greater charges and low velocities.

It is as well outside the domain of mechanics, where inertia can be moved and deliver a force not related to the dynamics of light.

Light is a specific case of high-energetic radiation. In it is left magnetism as the form of the potential transmitted.

The relatively low surface temperature of the sun could be understood from the low concentration of matter in its outer parts and the electrons' breaking down over a long time.

The combination of properties makes the sun's outer part a specimen of cosmic energy saving.

Light's physics.

Light's role in physics has led to the understanding of the division between domains of energy, *v.i.*

The photonic charges are transmitted as electro-dynamic potentials, which produce several effects in the receiving atom:

1. reflection outwards from one or more electrons;

2. absorption and added potential to one or more electrons;

3. reflection inwards, into the atom, and absorption of the photon in its nucleus;

4. removal of an electron from the atom, and

5. coordination of the polarity of the electronic orbits of the atoms hit by the light.

The first effect is the mechanism making visible the world outside the stars.

The second effect makes the world warmer, or keeps it from freezing. It consists in the photons' adding a negative charge to electrons, augmenting the potentials between them and the protons of the nucleus as the electrons get a higher velocity and a smaller radius of orbit, thus heating matter.

This quantum effect is not an exact measure, as it depends upon the charge of the hitting photon. A following heat radiation from the atom will consist in low-energetic photons.

This effect is the mechanism of negative entropy. Part of the function is the transmission of energy for chemical transformations, like photosynthesis. It is the main part of the conditions of life and thus of the sun's role in maintaining the climate.

The third effect is known as the producer of absorption spectra.

The fourth is known as the photoelectric effect.

The fifth effect is that of the electro-dynamic radiation of photons coordinating the electronic orbits of several atoms. These will then be more strongly bonded; and the forces of their fields will be coordinated like those of a naturally magnetic material.

Magnetism is the visible effect of this coordination of atoms. It confers a greater possibility of exploiting their potentials. It will also take up a higher energy and coordinate the atoms of the Earth. This is seen in the two parts of the spectrum. The moving photons produce a magnetic field of one polarity.

Thus light, by its electro-dynamic property and movement, is the magnetic monopole.

Gauss' law of magnetism, rendered by Maxwell, is thus not generally valid. This is partly a result of the condition posed by Gauss, that the net flux over a closed surface will be zero. Light has no closed surface.

There is no corresponding positive pole, since the protons are neither cleft nor accelerated to the velocity of light.

The preliminary exclusion of a possible monopole is an instance of the model being taken as overruling reality.

In this case, the actual physics includes the moving photon, not any bipolarity.

The magnetic qualities show light to be an electro-dynamic function. As a myriad of unipolar femto- or atto-magnets, the photons promote their poles, which have nothing behind them.

An instance of interaction initiated by the magnetic field is the Faraday effect. It consists in the rotation of the plane of polarized light in the presence of a magnetic field.

This is an instance of interaction between two electro-dynamic functions.

Another instance is the apparent displacement of a star during the solar eclipse in 1919. As the static fields of matter produce gravity, but cannot interfere with light, this will pass gravitational sum-fields without interference, *cf.* the systems of energy.

The displacement of the star was therefore not due to the sun's gravity, but to the magnetism of its outer, light-producing compartments.

We find a coordination of dynamic fields in the presumedly covalent bond between atoms in a molecule. When the electrons of two neighbouring atoms are orbiting in the same direction, they will form two solenoids polarized in the same direction; and their unlike poles meeting will attract each other and bind the two atoms together.

This should be the way of forming of the three-atomic molecules, whose magnetic properties are understood if this structure is presumed, *cf.* water, N_2O, O_3, *etc.*

The electro-dynamic function of photons gives a better explanation of the photoelectric effect than the simpler one that a photon should push an electron out of the atom by its inertial force.

The reason for this is that the electro-dynamic momentum of a photon has removed its inertial momentum.

The high momentum of the electron in its orbit demands a direct hit or a high field potential for producing a break of the orbit. The dynamic potential will perform this by a direct hit of a photon or by its magnetic field at a very close passage.

The magnetism of protons is associated with sunspots and magnetic loops above the surface of the sun. Compared to photons, the protons move slowly, at a velocity of a few hundred kilometres *per* second.[12]

Compared to photons, the protons' dimension would be in the range of 10^7-10^{10}. Their size will not permit them to be accelerated to electro-dynamic velocities. Their effect on Earth is not communicated by magnetic fields, as the current terminology indicates, but by the protons themselves, *cf.* ref. 12.

Unlike protons, the photons have integrated their magnetic force in the small fields of their particles. This is a result of their being broken down and accelerated to the velocity of light.

Photons no longer carry any potential of static electricity, since this is transformed to a magnetic potential during the process, *v.s.* Their fields are probably not much greater than the particles. They are not extensible; and each of them will probably not be distinguishable from its particle.

When the velocity of light has been reached, the potentials communicated by the photons no longer have any electrostatic part, but are exclusively electro-dynamic. The dimension of their dynamic potential was described by Maxwell as 4π times their charge.

The electro-dynamic force of negative charge is unique to photons of greater and smaller potentials, as is their distributed magneto-dynamic effect.

Its level of energy is produced by its velocity; and its energy is transmitted as it is absorbed or reflected by the receiving atom.

The energy of light is the sum of electro-dynamic momenta of negative charges, since the movement at the velocity of light excludes the static effect of the charges.

The effects of the fields of photons are not perceptible except in the presence of the photons. The light is seen where the light falls.

This is different from the effects of the fields of static charges. Gravity is an interaction between the different charges of protons and electrons, relative to their inertia.

The static fields of the sun are active at the distances of planets, though their originating particles stay in the sun and in the planets.

The transition from static to dynamic potential takes place during the breaking down of electrons and through the acceleration of their parts.

It seems possible that there should be a transition stage where static and dynamic field potentials are effective from the same particle. At the velocity of light, there is no static interaction between the particles.

The photons' negative charges should be expected to repel each other in a ray of light.

Since the ray is kept concentrated in spite of its photons' like charges, we see that their static potentials have been removed.

The lateral magnetic effect of photons is probably active only at a very short distance, perhaps among the electrons of a receiving atom. It seems probable that an electron receiving a magnetic force from a photon should have its field changed so as to influence its closest electrons within the atom.

At the velocity of light, the function of the photonic field is electro-dynamic only. The fields moving at the velocity of light are incapable of static interaction.

The stars glitter because the air contains small parts of solenoidally bonded molecules, like CO_2, N_2O, and H_2O. The mechanism of the disturbance of light is the magnetic field effect of the small solenoids. This effect produces the impreciseness of astronomical observations at sea level.

The electro-dynamic function of photons also explains that the magnetic field of the sun draws photons into curved paths when they pass close to the sun.

The deviation of a star position at the solar eclipse in 1919[26] was predicted by Albert Einstein (1879-1955) as a product of gravity. Since gravity is a function of matter's static potentials, that was impossible.

As was seen above, light is impervious to gravity or other forces of static charges. The apparent displacement of the star was therefore not caused by the gravity of the sun, but by its magnetism.

Gravity is a sum of static or low-velocity differentials between positive and negative charges in bodies. These are dominant in the region of lower velocities of charges.

Photons have no static potentials, as their dynamic fields carry the whole of their potential. They move independently of gravity, as is seen in the distribution and reflection of light. Photons belong

to the system of dynamic forces, thus light is influenced by the magnetic fields of fast moving charges.
Photons are brought to rest in atoms, in the process of negative entropy, of which they are the executors. Then they are no more photons, but parts of the potentials of atoms.
Space has no form, nor forces. If it had, space travel would have been more difficult. The photons of 1919 described a curve in space not because of the imagined curved space or the postulated inertia of the photons, but because of their dynamical interaction with the magnetic field of the sun, its outer part.

Magnetism is seen in matter in a macro-function on Earth. The electronic solenoids of its matter are oriented together and in parallel. This is seen in the production of the spectrum. Each half of it is seen at one of the edges of the slit and magnified by the prism.

This visible distribution is produced by the orientation of the matter of the slit, or of the window frame, in the magnetic field of Earth.

This shows that magnetism is a macro-product of the elementary properties of matter; and that it produces a general structure of the matter of the Earth, as well as it poses limits to its functions.

Light measured ?

Redshift indicates the survival of the most energetic part of the photons from a stellar source. Red is the most energetic colour, thus the one surviving.

Redshift proves that the part of the spectrum, currently interpreted as its most energetic, blue to UV, is its least energetic part. High energies used in the production of light will divide electrons into a greater number of smaller photons. As the velocity of light is the limit to the movement of photons of all sizes, the smallest of them will carry the smaller moments.
The photons having the least momentum and producing the shortest wavelengths at detection are those penetrating deepest into matter, *e.g.* living tissue.
Neutrinoes go through the body not because of their high energy, but because they are without any charge and thus do not interact with matter except by a direct hit in an atomic nucleus.
Without interacting, they cannot produce any force, nor release any energy. Their hitting an electron cannot be registered; but atomic nuclei are scanned for their sporadic interaction.
UV-radiation is low-energetic. It penetrates human skin to a depth where it can harm normal bio-molecules by its specific potentials. It hurts by penetrating the skin and by its electro-dynamic potential relative to the functional variables of the lower skin cells.
Its hurtfulness does not lie in its force, but in its low potential and its following deep penetration and high specificity relative to the functional parameters of the bio-molecules.

Photons outside the visible range of potentials are invisible; and these photons are emitted and absorbed by all bodies at all temperatures above 0 K. They are the mechanism of the phenomena “heat conduction”, “heat radiation”, and ultra-violet radiation.
Depending upon the surroundings, the net flow of photons goes to or from a body. At equilibrium of temperature between bodies, there is still an exchange of photons.

The physical functions of the world are not adapted to our senses; but our senses are, to a certain degree, adapted to physical functions. Some insects see the UV-radiation; and we feel the heat from the stove.
A scale of energies of radiation could be found by its measuring. This would not tell us anything about its physics. Our vision fathoms 390-760 nm as it is measured now. This is nearly one octave of electro-dynamic radiation.
When light is described by wavelength or frequency, this is not because these should be inherent in light, but because these are what we can measure by means of the properties of the instruments used.
They are inadequate to light’s properties, though render a scale. They are what we have, until we can measure light’s own properties.
Added to the difficulty of description comes the problem of representativeness. How is the level of energy defined in relation to the known qualities of the radiation? Is there a defined connection between the qualities?
The physics of radiation will start with its physical properties. We ascribe two qualities to radiation; wavelength and frequency.
Colour and potential are taken to be its secondary qualities. The last of these is measured as delivered energy. It has not been possible to refer this unambiguously to the measured qualities, which are wavelength and frequency.

These phenomena are induced by the measuring instruments. Light's primary qualities are ascribed to it because of an inadequate measuring method and a wave theory of light which is physically impossible. It has no connection to the way light is produced as a continuous radiation.

The wave theory of light is a re-use of a part of the mechanical model of matter. It is inappropriate to electro-dynamic functions.

Light is a part of electromagnetic radiation. Kilometre waves, radio, TV-waves, X-rays and lamp light are all technically produced.

Their measuring by the instruments of today renders the qualities of frequency and wavelength, which are then ascribed to the radiation.

This is an argument against taking the instruments' properties as more important than those of the object of measuring.

There seems to be no reason for presuming that an electromagnetic radiation should not consist of photons. The conditions and measurements indicate that the radiation consists of particles of different charges.

Light goes through empty space. It needs no transporting medium; and its charged particles convey an electro-dynamic force. As this force is not a product of inertia, it is not correctly described as $m \cdot v^2$ or $m \cdot c^2$, *cf.* above.

Energy is the product of the momenta of photons when they release their potentials. The energy of light is electro-dynamic.

Its link to the functions of electricity is not the current, but the amount of charge.

Ampere, the unit of electric current intensity, is one of the seven base units of the *Système International d'Unités*.

The more fundamental and applicable unit will be the quantum of charge, coulomb, as $A = C\ s^{-1}$. Thus, its rational measure will be the coulomb. The derived units of electricity and magnetism are also rational when based on the coulomb.

According to Maxwell, $4\ \pi$ is the factor of electrodynamics at the velocity of light, relative to static charges. The effective charge will then be $4\ \pi\ \rho$ at the velocity of light.

Leaving the phenomenological units of inertia and starting from the functions of the physical properties, the electro-dynamic, or electromagnetic, potential of light could be described by the unit "4 π times charge times velocity squared". This quantity,

$$4\ \pi\ \rho\ c^2 = 4\ \pi\ \text{coulomb.}\ c^2$$

has the dimension $C\ m^2\ s^{-2}$.

The great quantity of potentials entered into the production of light is carried with the light. Its energetic form is different from that of mechanical forces, which are produced at lower velocities.

This is shown in the great energy of the electromagnetic potentials transmitted by the photonic radiation compared to that delivered by an inertial momentum.

Relevant dimensions for the description of light and some pertaining effects are

magnetic field strength, $\boldsymbol{H} = C\ m^{-1}\ s^{-1}$

magnetic moment, $\boldsymbol{m} = C\ m^2\ s^{-1}$

energy, $W = C\ m^2\ s^{-2}$

power, $P = C\ m^2\ s^{-3}$.

These are examples. Other new units are needed. They should not be built upon the kilogramme, because of its derivation from inertia, thus from matter's passive reaction to a force.

Most of today's units are based on the kilogramme, which is derived from inertia.

Other phenomena should also be excluded from the use in definitions.

Light's magneto-dynamic nature will demand units of magnetism for its measuring. Main units of forces will be those above.

It will also be important to define the units not by the ampere, which is secondary relative to the amount of charge involved; but by the coulomb, the fundamental amount and unit of charge, which is the one relevant for the functions.

Colours are produced by light's interaction with matter. Their span of energy is greater than that of light alone, since they are separated by an added or subtracted amount of energy taken from the solenoids of the matter met by the light.

The possibility of this mechanism should be a warning against interpreting qualities of light or other physical functions as proper to one of the interacting parts, since they are products of interaction.

Magnetic relations.

No model, calculation, or measurement should be taken as a proof of physical properties.

In Planck's law[51] the energy of light is not seen as the product of a physical function, but as a separate postulate, hν. The constant h, whose dimension is joule second, was introduced into the formula of empirical phenomena.

A double presupposition is a part of that theory. It is that the energy of the light should be an independent factor; and that the energetic product should be proportional to the frequency. Neither seems tenable.

A possible measure, and more adequate, would be the electro-dynamic, or magnetic, effect of the single photon. As the electronic technology is advanced, it should be possible to measure light by the magnetic interaction between single photons and an instrument.

It should also be possible to measure the specific influence of the slits on the separation of colours seen through the prism.

It will be possible to calculate light's potential and energetic consequences on the basis of a consistent theory of light. This will show the energy delivered at light's interaction with matter to be proportional to the apparent wavelength now measured.

A strong light can be produced by technical means, regardless of wavelength. Thus, light should be measured as the energy of one photon. This leads the problem of extrapolating the measures back to light's origin in the sun.

Photons will transport different charges as a scale of electro-dynamic potentials. These potentials will be strengthened or weakened according to the potentials of the electrons met and to the geometry of photons' encounter with matter, so that the scale of energies of reflected photons will be greater or smaller than that of the photons before meeting matter, *cf.* the spectrum from the two sides of the window frame.

A probable size of the smallest photon could be one millionth of an electron, with a charge of $1{\cdot}6 \,.\, 10^{-19} \,.\, 10^{-6}$ C = $1{\cdot}6 \,.\, 10^{-25}$ C. This is the corresponding part of an elementary charge. The static charge is removed from light.

The inertial model of Newton's second law, also in its Einsteinian form $E = m \,.\, c^2$, is inadequate for the description of light, since the mass *m* is not relevant to movement or forces of particles of light.

The essential parts of the properties of photons are their charges and their electromagnetic momenta.

Magnetic fields will equalize the direction of atoms through the dynamic solenoids of their electrons. They are technically used in transformers. The electrical conduction needs less energy when all the atoms of the conducting metal have the same polarity. The current consists of electrons moving through the metal. This is possible because the outer electrons of metals do not hold fixed places in the molecules.

A magnetic field lowers the Ohmian resistance. A condition of transforming could be a low internal turbulence from atoms' solenoids, as this will lower the resistance.

The condition of transforming is the alternating current's fast shift of direction. The high Δv is found also in the outer part of the sun. The fast changes of the electrons' direction produce the transition to magnetism. This is a technical proof of light's magnetic properties.

The electrons of most atoms function as magnetic spools, reflecting light, which will interact with the magnetic fields of matter. It interacts with the electronic solenoids of most atoms, making matter visible. This is partly seen in media penetrable to light. The light blue colour of the atmosphere is a mixture of potentials of light.

Water reflects the sunlight's highest energies from its surface, but lets the blue and UV through to a certain depth.

Light interacts with the electrons of the surface of most matter. The atomic solenoids will reflect or absorb light, *v.s.*

To a variable degree, photons are absorbed by the electrons, thus augmenting their potential relative to the nucleus. This absorption is the mechanism of heating of surfaces in the sunshine.

Another possibility is the reflection of photons into the inner parts of the atom. These photons account for the absorption spectra of the elements. At reaching the nucleus, photons will lower the potential between it and the electrons. The effect is produced by the angle and energy of the meeting.

Photons' effects are produced by their high velocity and negative polarity, which together make them cross the limit to electromagnetism.

At meeting matter, they function in relation to the electrons of its surface. In a measuring instrument, a bundle of light will be measured by its effect upon atoms according to their dimensions and their electrons' orbiting frequencies, which establish a level of magnetism.

The instrument will use its own material properties for interpreting the potential of the light from the energy measured at meeting the material. The potential will therefore be described from the properties of the material's atoms, which are frequency and its reciprocal quality, wavelength.

These qualities are, though, the properties of the material of the instruments, since their electrons cannot stop their movement in atoms.

Frequency and wavelength ascribed to light are interaction phenomena measured because we do not use instruments capable of measuring the properties of light itself, nor the movement of its particles. The measured is light's relation to the energy of the atoms of the measuring instrument.

Describing light's energy level in terms of frequency or wavelength is not very useful. They belong to the current model and the interaction as it is understood; but they are not properties of light.

These are its potential *per* photon and its momentum as a released electro-dynamic potential. The photon's electro-dynamic momentum should be measured, as well as the potential released at its meeting matter.

Daniel Bernoulli in 1738[2] probably did not have any idea about the role of electrical charges in hard or fluid matter. His model of a dynamical force from a stream of water had the same geometry as that of vectors formed more than one hundred years later.

The electrical current has a direction ninety degrees relative to its field; and the resulting force has its direction at ninety degrees relative to those two. The same is the case for the resultant force in Bernoulli's model.

He could not have known that the magnetism of the water molecules carries its dynamical force when those are parts of a laminar stream.

The resistance of an electrical conductor could consist in a magnetic turbulence produced as a necessary consequence of the structure of the atoms and their internal movements.

This could be the mechanism of the Ohmian resistance. Curl H could impede ΔE, or produce a ΔE as a secondary whirl current, giving the current a greater resistance. This should be measurable as a temperature difference and as a local magnetic field.

Atoms outside a magnetic field, or in a weak field, could be in a certain disorder, produced by its inter-atomic forces, which are products of intra-atomic potentials.

A higher degree of order makes possible a greater transmission of potentials by and through the molecules. Sunlight and water will produce a higher circulation of energy in the long-lasting structures of life; and they are the conditions of life's lasting, though transient, negative entropy.

A magnetic turbulence could be seen as the loss of structure produced by the removal of a magnetic field from a quantity of matter, or by the lack of an external magnetic field of a certain potential, not too high.

A function concerning life is that the atoms of non-metallic matter will be oriented in a magnetic field, like the atoms of metals. This orientation is performed by the water monomer's two magnetic bonds.

This is an important function, as it is the link between life and the majority of non-life molecules. It is probably the function that made possible the first condensation of atoms, forming molecules which could bind physically connected molecules, creating the hot mist of the solar system previous to the first planets.

The interaction between light and the edges of a slit or a window indicates that even the relatively dry, even non-metallic matter is oriented. If this is a general function, which it seems to be, it should be the orientation of the solenoids of the electrons of atoms in the Earth's magnetic field.

In water-containing, living matter, all atoms should have the same orientation. The structure of water indicates that it is susceptible to magnetism as well as a producer of magnetism.

This implies that water cannot avoid the influence from external or internal magnetic fields. It even indicates that the field is a necessary and forming condition of life's functions, *cf.* the nerves, whose water-magnetic ion function is empirically known.

It seems possible that the strength of the magnetic field of the Earth will support a certain density of magnetic fields in molecules, thus a number of water ions *per* cm^3.

A deviation by the bonding of ions will initiate the production of new ions. This could be seen as a local function, though it will probably be a function of the Earth's magnetic field, *v.i.*

Electro-sensitivity

is believed by many to be the cause of their discomfort or disease when they are close to certain types of electric or electronic equipment.

Others believe this to be superstition.

Our neurons' function is based upon Na or K, which both have low ionization energies, 119 and 100 kcal *per* gram-mole, respectively. Both of them have a low Pauling's electronegativity, 0·9 and 0·8, respectively; and both of them are lighter than water.

These properties make them more reactive to electric and magnetic fields than most metals.

The fast reactions of the neural system also depend upon the low inertia of its participating elements.

Our neural function is a transport through the nanometre passages of the neuron membranes. In each of the passages one water polymer carries an atom of Na or K out through the neuron membrane and back. The progression of the metal transport is the nerve signal.

Our neural communication is performed by ions consisting of one metal atom magnetically bonded to a water tri- or tetramer.

The neural function is made possible by the water molecule's magnetic susceptibility, which lets the two molecules together constitute an ion.

The neural function takes place by its own local magnetic fields, in the brain as well as in the nerves of the body.
Our brain and neural system are susceptible to electrodynamics because their functions are performed by magnetism. They are easily disturbed by technical fields.
A constraint on their function is the charge and capacity of the water polymer which carries the metal atom.
Dimers of water are used by bacteria, which belong to the archaic hot-water fauna. Bacteria are descendants, or parts, of a monocellular high-temperature life which should have to exploit a high proportion of water dimers for its high consumption and energy.
Our neurons demand the electrostatic capacity of greater water polymers. These are trimers or tetramers and have lower external potentials, since, in the greater water molecules a greater part of the monomers' potential is used for its bond within the polymer.
The trimers and tetramers can transport the metal atom at the temperatures of the mammals. The human body temperature will be among the higher.
A decisive factor for our survival is that the water polymers of our nerves should release the metal atom after its transport through the neuron membrane. Dimers do not seem to release the atom after the passage.
For mammals, the critical temperature of neural function is below 42 ºC. Some birds have a somewhat higher body temperature. They could even have a higher temperature tolerance, taken over from their ectothermal, reptile forerunners.
This also casts light over our prehistory. Our walking barefoot gave us a permanent contact with the neutral conductor, and with the main field of Earth's magnetism, which we have lost in well-built houses and solid shoes.
We should see the cow effect ("Keep your head towards the North!") as a reminder of our own neural function of magnetism. Probably we ought to arrange our houses in relation to the magnetic field of the Earth.

Energy from the sun.

It seems difficult to find the correct functions in the relations between light, magnetism, and movement in bodies or particles characterized by their inertia. The starting point is misleading; as the moment of light is not one of inertia.

The changing fields seem to be important, *e.g.* at earthquakes, magnetic storms and tropical storms. Domestic animals are known to react to earthquakes before they break out.

The animals are mostly grazing along the longitude of Earth's magnetic field, their heads facing the North. This indicates that the earthquakes could have a relation to magnetism.

The "cow effect" could be related to the change of forces, perhaps in magma flows. The changing magnetic fields related to earthquakes seem to be active before the quakes are noticed at the surface.

Bodies and particles move at velocities below that of light. The fields of the sun and planets extend at least over the radius of the solar system. When fields are permanent, they cannot be quantized. The radiation or fields of energy will have to take place by some physical means.

The radiation felt between living creatures is measurable and should consist of photons of the same physical kind as those from a star, a lamp, or a candle.

When interaction between atoms or bodies at a distance leads to a change of their relative potential, this takes place by a transmission of photons or by physical bonds, consisting in the relative potentials of their fields.

The potentials between atoms will find an equilibrium, which will be sustained by a continuous exchange of photons. An instance of this is the equalizing of temperature in a body or in a fluid at rest. The energy of the photons will be expressed as the temperature of the bodies. At 0 K the exchange will be ended.

It seems that the simplest explanation of the spreading of heat in bodies should be their exchange of photons. This gives the mechanism of gravity a possibly extended physical explanation; and it likewise gives a probability based upon a physical function to Einstein's postulate of propagation of fields with the velocity of light.

When an electron of an atom receives a photon, which arrives without any frequency of its own, it is often reflected, either out of the atom, or into it. This interaction is possible because of the magnetism of the solenoid of the electrons of most atoms.

The heating of matter takes place when the photon is absorbed as an added charge to an electron, giving it a higher potential relative to the nucleus, a higher velocity, and an orbit closer to the nucleus of its atom. The electron cannot stand still; and its velocity is proportional to the negative of the square root of its distance from the nucleus.

When an electron absorbs a photon, it gets a higher potential relative to the nucleus. This takes place when the sun is shining on a surface and heats it. The added potential is seen as energy in the higher temperature of the body and in its following thermal expansion.

Each atom is contracting by its higher potential between electrons and nucleus; but the distance between the atoms is augmenting as a product of higher photonic activity. This leads to thermal expansion, melting, and boiling.

The photon becomes a part of the atom's absorption spectrum. It will hardly be possible to deduct the photonic momentum from the change in the atom's sum of potential levels. As the absorption of a photon into the nucleus will lower its positive charge, the reflection of a photon into the nucleus of the atom leads to a rise of the potential of the atom.

On the macro level, the added charge to electrons is seen as a thermal expansion. The distance between the atoms becomes somewhat greater by their more intense exchange of photons, as this exchange will produce a higher pressure between the atoms.

The exchange of photons will be the mechanism of heat conduction, thermal expansion, and thermal dissolution of matter.

Velocity seems to be a possibility for physical bodies and particles in general.

It will be seen from what is known that light has a material origin as a physical product of the negatively charged part of the substance of which matter is composed.

Light's form and physics are, though, rather different from those of matter, as will be understood from its present description.

Associating high levels of energy with short wave lengths does not seem reasonable when the energy has been used for producing a number of photons of a kind unknown to the 19^{th} or 20^{th} century.

The potential transmitted by one photon is the smallest differential that can be transmitted between atoms. Fields are stable accessories or parts of protons and electrons.

Light is quantized as photons. Photons carry different momenta. On their way, they last for a moment or for milliards of years; and their end is short in a star, a planet, or my eye.

Is light still light after interaction?

Do we see its properties after interaction? Can we see them before interaction or without interaction? Do we ever meet light as it is? The colours of paintings, clothes and flowers are shining against us. Are they light?

They are. Reflected light from a surface has left a part of its energy with the atoms of the reflecting surface. The levels of energy retained are those of the colours not reflected. This is not quite correct, since the range of energy of a group of photons is not necessarily that of the range of all photons.

The small atoms of light gases are too weak for reflecting light. This makes the air invisible.

Reflected light from a mirror is not sorted according to energy level. That is why glass and a few metals are used for mirrors. Still, we cannot know what light is when we see it after reflection or other interaction. Its capacity of interaction is varied and rich. This is a good reason for not always believing what we see. But when can we believe it? When we know the functions behind what happens.

The seen light is no longer light.

Conclusions about light after interaction depend upon our understanding its energy exchange with matter and its effect on the photons received. This understanding has not been developed, as it is still dominated by belief.

Antoine Laurent Lavoisier (1743-94) relied more on reality than on belief or learning. His experiments went against the confirmed knowledge of the accepted scientists of his time; and they became the foundation of physics of matter, thus of chemistry. He proved the role of oxygen in combustion and metabolism.

A tradition exists for interpreting everything happening to light as a property of light itself. The forces, frequencies, and energies of light after interaction seem to be taken as properties of light, not as products of interaction.

Those conclusions are not permissible, as the interaction between light and the instruments are not fully known. No existing model of light permits an understanding.

We should not feel above learning from Lavoisier to establish a concord between our model, the questions we ask Nature, the experiments we perform, and our interpretation.

The interacting qualities, properties, or forces are unknown in the light as well as in the instruments. It should, though, be possible to establish some insight in the properties of light and of the instruments used for experiments, and thereby make possible an analysis based on functions.

The static forces of the particles of atoms are one part of the interactive potentials of atoms. These forces are those of the atomic nuclei and of the moving electrons.

The dynamic forces, magnetism, are those produced by the movement of charged particles at high velocities.

The moving particles of matter are the electrons, which carry negative charges. Their electro-dynamic forces are not great, as their velocities are well below that of light.

In some molecules, the coordination and velocities of electronic orbits is so great that they have electro-dynamic properties, *e.g.* water.

Static and dynamic forces coexist; and their sum from each source is constant at each velocity. At particle velocities well below that of light, the static part of their potentials is still active. This part is diminished at higher velocities and disappears before approaching the velocity of light.

At velocities above eight *per cent* of that of light, the moving charge starts producing a dynamic force. This implies that the energy absorbed for the acceleration will not be linear.

The dynamical part of the energy is communicated not only by the direct hit of the photon, but also by its magnetic field at its very close passing a charged body or particle. This is a part of the photoelectric effect.

This vector function of light is a stronger version of the general function of moving charges.

A further consequence is that the atomic and molecular potentials of matter, which are the forces holding matter together, will be overridden by the greater forces received by a body exceeding normal planetary velocities by being accelerated to velocities approaching that of light.

Since matter is not broken down by being exposed to ordinary light, the energy levels of matter are seen as higher than those of light.

From their interaction, we may, though, see the character of light in its relation to that of matter. It is possible to weigh information from the different interactions and to deduce properties from them.

The consistency of matter seems to be conserved up to an energy level of light. This can be understood only if light's energy is distributed in small units relative to the forces holding matter together; and that the potentials of its particles are low compared to the size of the body upon which the light falls.

A strong radiation of photons will heat, ignite, and destroy any compound of matter, *cf.* the atomic bomb.

The properties of light as it comes out of the sun or a lamp are of interest; but the energies and products of interaction are those performing its physical functions and therefore demanding attention.

So does the mechanism of the production of light. Identification of the interacting parts is necessary, in order to keep a consistent interpretation within the range of the physically possible.

One limit to the physically possible is the energy level of the potentials holding matter together.

From substance to light.

If a quantity of matter cannot conserve its consistency above a certain velocity, it will be impossible to define velocity as a physical condition of bodies above that velocity.

The concept ‘velocity of light’ is a concept outside mechanics. This is a problem if light should be defined as a wave or in any other way related to mechanics.

The concept ‘wave’ is taken from mechanics. It is seen in physical representation on the sea and has been interpreted as longitudinal waves into the periodicity of sound propagation by pressure differentials in fluids, *e.g.*, in air and in the magma of the Earth.

Outside these realms it does not seem to describe anything concrete enough for demanding a place in physics. A ray of light seems to be beyond the physical parts of the world, the way these are commonly understood.

It has passed the limit of matter understood as a compound of atoms or of particles of substance.

Protons move at a few hundred km s^{-1}, electrons perhaps at 1000 km s^{-1}, and photons near 300 000 km s^{-1}. This partially extra-materiality of light does not indicate its specific nature.

It is easily seen that the interaction of potentials of matter will transmit its periodicity to the light falling on it. This is seen in the absorption spectra of the elements relative to their reflection spectra.

The magnetic interaction with photons is possible for those electrons whose orbits have an angular velocity (rad s^{-1}, radians *per* second; or $\theta\ s^{-1}$) high enough for letting them surpass their static forces and enter the realm of electrodynamics.

The invisibility of most gases and many fluids is a product of their electrons’ too low level of electro-dynamic potential for reflecting photons.

If we presume that a physical continuity exists between macro-matter and sub-Ångstrøm substance, it will be possible to imagine a consistent model of matter, light, and energy.

A small photon, perhaps one electron times 10^{-6}, should have a charge corresponding to its part of the electron.

Its properties are charge and velocity; and its effect is electro-dynamic, or magnetic. Its charge would be: e. 10^{-6} = 1·6. 10^{-25} C. The greatest photon could be one thousand times greater than the smallest, and it would carry a corresponding charge of 1·6. 10^{-22} C.

At the velocity of light, the inertial momentum is overtaken by the charge of the photon, producing $4\ \pi\ \rho\ c^2$.

Photons have no inertia. The momentum of a charged particle moving near the velocity of light is no longer a part of mechanics, as it is magnetic, or electro-dynamic. It can be described as charge times its velocity, Ψ . c. Its moment or potential will have the dimension C . m^2 . s^{-2}.

This would be a more adequate measure of magnetic flux, or pole strength. The inertia of a charged particle is not a part of the potential of charges moving at velocities near c.

At the velocity of light, no particle as great as an electron is kept intact. This is seen in the way light is produced in the sun.

At the outset, electrons have a specific charge of 1·76 .10^{11} C kg^{-1}. Their charge is conserved as the electrons are broken down to photons. This conservation of charge is the condition of the sun’s use of energy for splitting the electrons and emitting light.

Within each of the sun’s compartment of electrons, forming its apparent surface, they are repelled from each other by their like charges. After a short free way, they collide, are repelled and gain some velocity from the magnetic fields of the moving neighbouring charges.

If they have more than a few millimetres free way, they will also be accelerated by the repulsion from their fellow electrons. At a certain velocity, they are broken into smaller parts at each encounter; and these parts are further accelerated.

Their velocity produces a system of magnetic fields holding the photons within the sun. These fields define the apparent surface of the sun, which is not a surface in the ordinary meaning, but the limit of the region of photons not yet emitted.

When they have reached a very small size, probably <1/1000 of an electron, and the velocity of light, they are ready for leaving the sun. This depends upon finding the right exit, which is at an angle near the vertical; and its finding should coincide with a strong push from the magnetic field.

The constraints are heavy, since the loss of light substance is 25 g *per* square metre *per* year. This quantity of substance corresponds to the matter of the uttermost 250 metres of the sun.

The parts of the sun seen from its outside are limited to the photons let out. This means that nothing of the sun's interior is seen. The light from the sun does not communicate any picture, as it is an aggregate of photons whose history in the sun is a long process of disorganization. The photons released are ready for use, but not yet used for visual representation.

This has a bearing on the interpretation of astronomical information, as emitted particles do not impart anything but themselves. Among them are found traces of elements showing parts of the history of the universe. The element helium (named after Helios, the sun) was discovered in the radiation from the sun, before it was found on Earth.

It seems probable that each photon carries the part of the elementary charge which was its part of the electron. A photon of $4 \cdot 10^{-36}$ kg could then carry a charge of $7 \cdot 10^{-24}$ C. It seems reasonable that photons could have sizes from 10^{-3} to 10^{-6} of an electron.

The sun emits as photons the energy used for breaking down the electrons. They carry the energy received at being broken down and then accelerated through their reciprocal repelling and their multidirectional magnetic field.

This mechanism of repelling and breaking down constitutes the magnetic shield of the sun. This shield prevents the sun's dissolution. This is due to the intact particles' lack of capacity for influencing magnetic matter or its fields.

The sun appears to be boiling at 5780 K. The relative roles of the factors are not obvious. A phenomenological exposition is insufficient as an explanation of the sun's electrodynamics.

A phenomenological model of possible relations between temperature, quantity of substance, particle charges and emitted energy would not be very clarifying as to the dynamics of this layer of the sun.

The velocity of light removes the forces of static charges, thus also gravity. Gravity is a differential force between positively and negatively charged particles, relative to their inertia. It is effective between the static charges of particles at low velocities.

Gravity does not belong to the system of energy to which light belongs. It can therefore not hold photons within the sun until they reach the escape direction and the velocity of light.

The gravity of the sun is not produced in its uttermost layer. Gravity is a static force. The photons' velocity and dynamic charge exclude them from influencing gravity, and *vice versa*.

Light is produced in the outer layer of the sun. This layer is probably not deep, relative to the sun's radius of 696 000 km.

The low rate of loss of substance from the sun is a part of the sun's mechanism of conservation of energy. The moving electrons and their parts produce a magnetic field directed at 90 degrees to the movement of the particles.

As they are banged back and forth at velocities close to that of light, the field is discontinuous, though strong. This field will be the mechanism holding the photons within their domain.

The outbreaks of positive charges are sunspots and magnetic fields. They could explain part of the photons' apparent difficulty at hitting the exit angle. The magnetic field could hold the photons back until they are reached by a wave of magnetism shoving them out of the sun at the right angle.

A consequence of this is a possible effect of sunspots and their outbreaks of protons. At solar extra-luminous activity, disturbances on Earth are northern lights and magnetic storms, *i.e.* protons, affecting communication. They counteract photons and electrons, producing flares and cold weather on Earth.

A part of the produced power is not used for emitting light, but for emitting protons and for maintaining the magnetic fields holding electrons and protons in their respective compartments.

The relation between the two energy amounts is that 13 *per cent* of the sun's energy is used for the emission of protons.

Sunlight and magnetic forces in solar eruptions are great energy flows. Their dynamics is not related to the inertial force of movement described in Newton's second law.

A more adequate description is found in Maxwell's third equation. The dynamic energy of a charged particle is produced at a velocity of eight *per cent* of that of light, and upwards.

The electro-dynamic momentum of the charge ρ will be $4 \pi \rho \cdot v/c$, thus $4 \pi \rho$ at the velocity of light, when the static part of the charge is reduced to nought; and electromagnetism is the only function of charge and velocity.

The energy emitted from the sun is not delivered by an imagined inertial momentum of the photons.

The inertia of the electrons and their broken-down parts is expended through the collisions; and its charges are converted to magnetism.

This indicates that the charges of the electrons are parts of a convertible system of electricity whose qualities are partly dependent upon its movement and its relation to external fields and forces. This is also seen in the transformer.

It further indicates that static charges are the carriers of inertia.

The accelerated negative charges are transmitted as such at a direct hit, or they transmit an electro-dynamic, or magnetic, force *en passant* through their moving fields.

This energy potential of the moving charge of the light was put into it during its acceleration, as it cannot emerge from a lower energy input.

The charges of 5 M t s^{-1} of electrons are emitted at the velocity of light:

$$5 \cdot 10^{9}\ \mathrm{kg\ s^{-1}} \cdot 1{\cdot}76 \cdot 10^{11}\ \mathrm{C\ kg^{-1}} \cdot c^{2}$$

$$= 7{\cdot}9 \cdot 10^{37}\ \mathrm{C\ m^{2}\ s^{-3}}.$$

This dynamic power is divided between photons, at least $5{\cdot}5.\ 10^{42}$ *per* second, since they can be estimated to between one thousand and one million *per* electron divided. This estimate is based on the division between photonic energies.

By the conventional measure of wavelength or frequency, there are several octaves of infrared, nearly one octave of visible light, and a few octaves of ultraviolet.

The potentials of moving photons are now measured as the energy level of the reaction of the measuring instrument, and currently given either as wavelength or as frequency, which are then ascribed to light. In this procedure, the range of infra-red, light, and UV covers around one dozen octaves.

This model hides the physical properties of light and matter, and the kind of their interaction.

Magnetism.

The electro-dynamic function of charges can be seen in the empirical perspective of magnetism. The transition from potentials between static charges and charges moving at low velocities on the one hand and fast moving charges on the other takes place at velocities above *c.* eight *per cent* of the velocity of light.

The technical condition of transforming an electrical current to a higher or lower potential is that it should be an alternating current. The physical condition will then be the change of direction of the current.

An electrical current is a stream of negatively charged particles. Their change of direction can take place abruptly, or by rotation in the orbit of an atom or in a solenoid.

In the sun, the course of electrons and their parts is disorganized. Their direction is abruptly changed by the collisions. The added energy of this process through years and millennia is shown in the breaking down of the electrons and the high exit velocity of their parts.

The added energy is also shown in the transition from the static to the dynamic charge of each minuscule particle resulting from this breaking down of electrons.

At the high velocity, their negative potential is transferred to the other regimen or system of energy. This is produced by negative charges at high velocities. The transition will take place at velocities above those of protons.

The forces are then not object to interference from the static potentials of low-velocity charges.

Light has its origin in negative charges and the removal of static charges. Light is thus an electro-dynamic radiation whose properties are charge and velocity; and whose effect is that of magnetic monopoles.

The measure of the transition is the velocity of change of direction relative to the velocity of movement. This is seen in the neutron compared to the atom of hydrogen. Neutron's function in physics is that of holding atomic nuclei together in spite of the protons' like charges and their repelling. It fills this task by its magnetism.

Liberated neutrons have a half-life of seventeen minutes. They are spontaneously dissolved into an electron, a proton, and an antineutrino. The neutron is Nature's prototype of the magnetic solenoid.

Magnetism is also produced by artificial solenoids. When the electrons move in the direction of your fingers in the spool you hold in your hand with its backside up, the north pole of the solenoid is to the right. At a high velocity of electrons, the rate of change of direction surpasses a value at which the static potentials of the electrons are converted to electro-dynamic potentials, *cf.* the breaking down of electrons in the sun.

Electrons of most atoms function as solenoids and produce magnetic fields, *cf.* the window frame and its effect on light, *v.s*.

The smallest atoms have no magnetic field, thus they do not interact with light. Uncontaminated air is invisible for this reason.

Neutrons are small magnets. They appear neutral for their like positive and negative charges. Their function in atomic nuclei stems from the strong magnetic field produced by the solenoid of the fast moving electron.

Neutrons differ from ^{1}H-atoms by not being permanent, though lasting from the beginning of matter. Their high potentials make them smaller than the ^{1}H-atoms, thus the electron will orbit the proton at a higher velocity than in the atom.
This further indicates that they were condensed at higher pressures and temperatures than are hydrogen atoms. This probably makes them older than all elements.

When a neutron is taken out of its magnetic bond in an atomic nucleus, the fast-moving electron will lose hold of its proton partner. The reciprocity between the protons and the neutrons in the nucleus is lost; and the neutron's solenoid is dissolved.

In the atomic nuclei, except ^{1}H, protons are held together by the neutrons' magnetic function, which is empirically seen as two nuclear forces, one weak and one strong.

The weak nuclear force is not a force, but the absence of a repelling force between the protons of the nucleus. This condition is produced by the protons' positions between the neutrons, in combination with neutrons' neutralizing the forces between the protons.

In nearly all nuclei there are greater numbers of neutrons than of protons. The protons are kept out of contact with each other, as the neutrons occupy the spaces between them.

The strong nuclear force is produced by the magnetic fields of the neutrons. They hold the protons together in the nucleus. They would have held together the nuclei of the greater, trans-uranian elements once existing. Their new production does not seem impossible, though their conservation is made impossible by the weakening of the magnetic field of Earth.

Together with the dissolution of the neutron when its magnetic field is not engaged, this indicates that the solenoid function of any atom is, to some degree, dependent upon the atom's relation to the other atoms of the molecule which they constitute, and to the magnetic surroundings.

This is indicated in a partly specific way by the two magnetic bonds of the water monomer. The passage of light through water is limited to a few dozen metres. It is also indicated by the bond of the chlorine molecule, which interferes with the middle of the visible spectrum and produces the green colour of the gas.

A possible low pressure associated with low potentials in the atomic nucleus should indicate the absence of heavier elements in the outer parts of stars, and of the impossibility of forming them there, *cf.* the trans-uranian elements.

The neutron, which has a small radius and a strong magnetic field, has surpassed the limit of possible interaction with the static or low-velocity potentials of substance.

A measurement of the magnetism of the neutron should then indicate the limits of the static force and structure of matter, *cf. ch.* 7.

The transition from electrons to photons is a long process of cleaving the particles by their collisions in the magnetic field of repelling forces, produced by those moving particles.

The magnetic field is the sun's long-term transmitter of energy. Its effect is the acceleration of the particles which become light. The energy is distributed by the breaking down and accelerating the electrons by collision and reflection into a new direction.

This magnetic field of the sun also keeps its inner parts, belonging to energy system 1, from dissolving, *v.i.*

The fast movements within the repelling magnetic field remove the static potentials of the particles and produce magnetism. In a short, exaggerating, and imprecise way, the process can be indicated by $\Sigma\, \Delta\, v / t \rightarrow \infty$.

For the single photon, the end of the process is its expulsion into space, where this negatively charged monopole of magnetic potential will race forever, or until it is suddenly stopped by a body, or probably by a stronger photon from some other star.

Redshift is the necessary product of this process; and the 2·7 K background radiation should be taken as its confirmation rather than a proof of Big Bang.

The number of collisions in the sun will be considerable, probably above one hundred million *per* year for each particle. Each collision will produce a change of direction, a rise in velocity, and a removal of a part of static charge. Eventually, each electron is broken down to photons, which could be between one thousandth and one millionth part of the size of the electron.

The transformer works in a similar way. As the alternating current changes direction 50 or 60 times *per* second, a corresponding wave of current is broken seven hundred million times *per* year. The electrons of the current are renewed as the current is tapped and used. They are not broken down in the conductor, nor accelerated above the normal velocity of the current, *c.* 2/3 of the velocity of light.

The conditions of the conductors and the field effect in the soft iron core of the transformer are different from those of the sun. The transformer is exposed to an inner loss of efficiency, which leads to a need for cooling. The force of the change of direction in the sun will be stronger than in the transformer.

The sun's uttermost part glows at 5780 K, where the equilibrium between production and release of energy is reached.

It should be possible to indicate the intensity of the process by the relation between the change of velocity and the actual velocity, with regard to the charge involved:

$$(\partial^2 v / \partial t^2)\ 4\ \pi\ \rho$$

The prime moving forces of matter are the potentials of its constituting substance. The forces are easily seen in fluids. In cooling technology, a circular stream of air is used for producing low temperatures, as the potentials of its charges are used in circulation. A stream of water keeps its potential as long as it is not moving in narrow circles, *cf.* the sinking level of a whirl-pool.

Static potentials are heavily loaded in a non-linear acceleration. This is exploited in transforming into electro-dynamic potentials. In the sun, the electrons' radii of change of direction are nil. The relation between force and inertia is greater than in solenoids.

The time and number of collisions needed for the transforming to electro-dynamic potentials could be a product of the energy needed for the transformation, relative to the velocity reached in the process, *cf.* the proportionality factor 4 π ρ, which implies that the energy used and absorbed is over-proportional relative to the change of velocity.

There is a possible, half-way alternative way of describing the transition to dynamic charges. Charge could be a limited property of matter. Its static part could be removable by the movement and change of direction of the charged particles. In that case, the process is a shaking away the static charges from the particles, a series of shocks draining them of their static charges.

Water is seen to be the carrier of a world-wide magnetism upon which life depends. Together with the spectrum seen at the edges of the window frame this opens a new perspective upon structures of life.

This will explain magnetism's pervading function in life's conditions. It seems that magnetism should be the communication system of Earth and life.

Deduced from the properties of water, magnetism should be the link between the parts of life.

The change of direction is remarkably faster in the sun than in any solenoid.

The functions related to magnetism show that the forces of moving fluids are products of the potentials of their charges.

The relation between static and dynamic bonds and radiation is shown by light's passage through the air. The atoms of oxygen and nitrogen contain electrons of limited potentials; thus they cannot initiate any interaction with light.

Among gases heavier than these two, chlorine is the first to show a colour, since its electrons' momenta are strong enough for the magnetic reflection.

Water's property of absorbing light should be a product of the two magnetic bonds of its monomer, which will interact with light. Its hydrogen-bonds between the monomers are among the weaker bonds and will not be able to retain or reflect light, *v.i.*

The physics of currents casts light over the nature of the charge of light relative to the charge of electrons. An extension of the interpretation of the forces of fluid turbulence should indicate that the transition from the negative charges of electrons to the negative electro-dynamic force of photons should be a question of removing a part of the potential of the electrons, stripping them of their property of static interaction and leaving the magnetic potential capable of interacting with the innermost qualities of substance only.

This can be seen in relation to gravity, whose sum-fields reach the whole of the solar system. The distance to Pluto is nearly 40 times the distance between Earth and the sun, or nearly 6.10^9 km. Since Pluto is held in a sun-centred orbit, the static sum-field of gravity is active at this distance.

It is not known whether the magnetic field of the sun extends to Pluto. Sunshine, its moving magnetic monopole, will reach it within five hours and a half.

Magnetism can be seen as a residual force of substance, the dynamical force left after the static potential has been beaten out of matter.

The magneto-dynamic monopole of light should be brought to its focus, while the static fields produce gravitation at great distances. The fields of magnetism should have shorter ranges than those of gravity. The solenoid is the most numerous mechanism of Nature, as there is one in each atom.

Light is impervious to the smallest of molecules, thus H_2 and O_2 are invisible. Greater molecules produce magnetic fields by the higher velocity of their electronic solenoids, thus are visible.

The energy level is higher after the transition to electro-dynamic potential, as much energy is loaded into the cleaving of electrons. Their potential is raised to 4π times their charge. Part of their potential concentrates its own field to a minimum in the magnetism of light.

The heat felt in the bodies hit by the light from the sun is secondary, produced by the reactions of the atoms of matter hit.

A short description of it can be that the atoms of matter produce the heat by their reaction to the magneto-dynamic sunlight.

Photons no longer carry any potential of static electricity, since this is transformed to a magnetic potential during the process of production of photons, *v.s.*

The photonic fields are probably not much greater than the particles. They are not extensible; and each of them will probably not be distinguishable from its particle.

When the velocity of light has been reached, the potentials communicated by the photons no longer have any electrostatic part, but are exclusively electro-dynamic. The dimension of their dynamic potential was described by Maxwell as 4π times their charge.

The electro-dynamic force of negative charge is unique to photons of greater and smaller potentials, as is their distributed magneto-dynamic effect.

Its level of energy is produced by its velocity; and its energy is transmitted as it is absorbed or reflected by the receiving atom.

The energy of light is the sum of electro-dynamic momenta of negative charges, since the movement at the velocity of light excludes the static effect of the charges.

The effects of the fields of photons are not perceptible except in the presence of the photons. The light is seen where the light falls. This is different from the effects of the fields of static charges. Gravity is an interaction between the different charges of protons and electrons, relative to their inertia. The static fields of the sun are active at the distances of planets, though their originating particles stay in the sun and in the planets.

The transition from static to dynamic potential takes place during the breaking down of electrons and through the acceleration of their parts. It seems possible that there should be a transition stage where static and dynamic field potentials are effective from the same particle. At the velocity of light, there is no static interaction between the particles.

As the photons have like, negative charges, they should be expected to repel each other in a ray of light. The ray is, though, kept concentrated in spite of its photons' like charges. This shows that their static potentials have been removed.

There is no lateral effect within the light ray or from it towards the outside. It is not visible from the side, except when it is passing through a spreading medium, like water. This accounts for Olbers' paradox, the darkness of the night sky.

The lateral magnetic effect of photons will be active at a very short distance only, *e.g.* among the electrons of a receiving atom. It seems probable that an electron receiving a magnetic force from a photon should have its field potential augmented so as to influence its closest electrons.

At the velocity of light, the function of the photonic field is electro-dynamic only. The fields moving at the velocity of light are incapable of static interaction.

The stars glitter because the atmosphere contains small parts of solenoidally bonded molecules, like CO_2, N_2O, and H_2O.

The mechanism of the disturbance of light is the magnetic field effect of the small solenoids. This effect produces the imprecision in star observations at sea level.

The electro-dynamic function of photons also explains that the magnetic field of the sun will draw photons into curved paths when they pass close to the sun.

The deviation of a star's light at the solar eclipse in 1919[26] was predicted by Albert Einstein as a product of gravity. Gravity is a static function, thus his prediction was incorrect.

As was seen above, light is impervious to gravity or other forces of static charges. The apparent displacement of the star was therefore not caused by the gravity of the sun, but by its magnetism.
Gravity is a sum of static or low-velocity differentials between positive and negative charges in bodies. These are dominant in the region of lower velocities of charges.

Photons have no static potentials, as their dynamic fields carry the whole potential. Therefore they move independently of gravity, as is seen in the distribution and reflection of light. Photons belong to the system of dynamic forces, thus light is influenced only by the magnetic fields of fast moving charges.

Photons are brought to rest in atoms, in the process of negative entropy, of which they are the executors. Then they are no more photons, but parts of the potentials of atoms.

Space has no form, nor forces. If it had, space travel would have been more difficult. The photons of 1919 described a curve in space not because of the imagined curved space or the postulated inertia of the photons, but because of their dynamical interaction with the magnetic field of the sun, its outer part, where its light is produced.

Magnetism is seen in matter in a macro-function on Earth. The electronic solenoids of its matter are oriented together and in parallel. This is seen in the production of the spectrum.

Each half of the spectrum is seen at one of the edges of the slit and magnified by the prism.

This visible distribution is produced by the orientation of the matter of the slit, or of the window frame, in the magnetic field of Earth.

This shows that magnetism is a macro-product of the elementary properties of matter, and that it produces a general structure of the matter of the Earth, as well as it poses limits to its functions.

Magnetic relations.

No model, calculation, or measurement should be taken as a proof of physical properties.

In Planck's law[51] the energy of light is not seen as the product of a physical function, but as a separate postulate, h ν. The constant h, whose dimension is joule second, was introduced into the formula of empirical phenomena.

A double presupposition is a part of that theory. It is that the energy of light should be an independent factor; and that the energetic product should be proportional to the frequency.
Neither seems tenable.
A possible and more adequate measure would be the electro-dynamic, or magnetic, effect of the single photon. As the electronic technology is advanced, it should be possible to measure light by the magnetic interaction of single photons with an instrument.

It should also be possible to measure the specific influence of the slits on the separation of colours seen through the prism.
It will be possible to calculate light's potential and energetic consequences on the basis of a consistent theory of light. This will show the energy delivered at light's interaction with matter to be partly proportional to the apparent wavelength now measured.

A strong light can be produced by technical means, regardless of wavelength. Thus, light should be measured as the energy of one photon. This leads the problem of extrapolating the measures back to light's origin in the sun.

Photons will transport different charges as a scale of electro-dynamic potentials. These potentials will be strengthened or weakened according to the potentials of the electrons met and to the geometry of photons' encounter with matter, so that the scale of energies of reflected photons is greater or smaller than that of the photons before their interaction with matter, *cf.* the spectrum from the two sides of the window frame.

A probable size of the smallest photon could be one millionth of an electron, with a charge of $1{\cdot}6 \,.\, 10^{-19} \,.\, 10^{-6}$ C = $1{\cdot}6 \,.\, 10^{-25}$ C. This is the corresponding part of an elementary charge. The static charge is removed from light.
The inertia of Newton's second law, also in its Einsteinian form $E = m \,.\, c^2$, is inadequate for the description of light, since the mass m is not relevant to properties, movement or forces of particles of light.

The parts of the properties of photons are their charges and their electromagnetic momenta.

Magnetic fields will equalize the direction of atoms through the dynamic solenoids of their electrons. They are technically used in transformers. The electrical conduction needs less energy when all the atoms of the conducting metal have the same polarity. The current consists of electrons moving through the metal.

This is possible because the outer electrons of metals do not hold fixed places in the molecules. A magnetic field lowers the Ohmian resistance.

A condition of transforming could be a degree of parallelity of the current obtained by the lowering of internal turbulence from atoms' solenoids, lowering the resistance.

The condition of transforming is provided by the alternating current's rapid shift of direction. The high Δv at each shift of direction of the charges is found also in the outer part of the sun. The fast changes of direction produce the transition to magnetism. This is a technical proof of light's magnetic properties.

The electrons of many atoms function as magnetic spools, reflecting light, which will interact with the magnetic fields of matter according to their potentials. It interacts with the electronic solenoids of atoms, making most matter visible.

This is partly seen in media penetrable to light. The light blue colour of the atmosphere is a mixture of potentials of light.

Water reflects the sunlight's highest energies from its surface, but lets the blue and UV through to a certain depth.

Light interacts with the electrons of the surface of most matter. The atomic solenoids will reflect or absorb light, *v.s.*

To a variable degree, photons are absorbed by the electrons, thus augmenting their potential relative to the nucleus. This absorption is the mechanism of heating of surfaces in the sunshine.

Another possibility is the reflection of photons into the inner parts of the atom. These photons account for the absorption spectra of the elements.

Reaching the nucleus, they lower the potential between it and the electrons. The effect is produced by the angle and energy of the meeting.

Photons' effects are produced by their high velocity and negative polarity, which together make them cross the limit to electromagnetism. At meeting matter, they function in relation to the electrons of its surface.

In a measuring instrument, a bundle of light will be measured by its effect upon atoms according to their dimensions and their electrons' orbiting frequencies, which establish a level of magnetism.

The instrument will use its own material properties for interpreting the potential of the light from the energy measured at meeting the material. The potential will therefore be described from the properties of the material's atoms, which are frequency and its reciprocal quality, wavelength.

These qualities are, though, the properties of the material of the instruments, since their electrons cannot stop their movement in their atoms. Frequency and wavelength ascribed to light are interaction phenomena measured because we do not use instruments capable of measuring the energy of light itself, nor the movement of its particles. The measured is light's relation to the form and level of energy of the atoms of the measuring instrument.

Describing light's energy level in terms of frequency or wavelength is not very useful. They belong to the model and the interaction; but they are not properties of light.

These are its potential *per* photon and its momentum as a released electro-dynamic potential. The photon's electro-dynamic momentum should be measured, as well as the potential released at its meeting matter.

Daniel Bernoulli in 1738[2] probably did not have any idea about the role of electrical charges in hard or fluid matter. His model of a dynamical force from a stream of water had the same geometry as that of vectors formed more than one hundred years later.

The electrical current has a direction ninety degrees relative to its field; and the resulting force has its direction at ninety degrees relative to those two. The same is the case for the resultant force in Bernoulli's model.

He could not have known that the magnetism of the water molecules carries its dynamical forces when they are parts of a laminar stream.

The normal resistance of an electrical conductor could consist in a magnetic turbulence produced as a necessary consequence of the structure of the atoms and their internal movements.

This could be the mechanism of the Ohmian resistance. Curl H could impede ΔE, or produce a ΔE as a secondary whirl current, giving the current a greater resistance. This should be measurable as a temperature difference and as a local magnetic field.

Atoms outside a magnetic field, or in a weak field, could be in a certain disorder, produced by its inter-atomic forces, which are products of intra-atomic potentials.

A higher degree of order makes possible a greater transmission of potentials by and through the molecules. Sunlight and water will produce a higher circulation of energy in the long-lasting structures of life; and they are the conditions of life's lasting, though transient, negative entropy.

A magnetic turbulence could be seen as the loss of structure produced by the removal of a magnetic field from a quantity of matter, or by the absence of an external magnetic field of a certain potential, not too high.

A function concerning life is that the atoms of non-metallic matter will be orientated in a magnetic field, like the atoms of metals. This orientation is performed by the water monomer's two magnetic bonds.

This is an important function, as it is the link between life and the majority of non-life molecules. It is probably the function that made possible the first condensation of atoms, later forming molecules which could bind physically connected molecules into the hot mist of the solar system previous to the first planets.

The interaction between light and the edges of a slit or a window indicates that even the relatively dry, non-metallic matter is oriented.

If this is a general function, which it seems to be, it should be the orientation of the solenoids of the electrons of atoms in the Earth's magnetic field.

In the water-containing, living matter, all atoms should have the same orientation. The structure of water and the necessary structure of the bonds of its monomers indicate that water is susceptible to magnetism as well as a producer of magnetism.

This implies that water cannot avoid the influence from external or internal magnetic fields. It even indicates that the magnetic field is a necessary and forming condition of life's functions, *cf.* the nerves, whose function is empirically known.

It seems possible that the strength of the magnetic field of the Earth will support a certain density of magnetic fields in molecules, thus a number of water ions *per* cm^3.

A deviation by the bonding of ions will initiate the production of new ions. This could be interpreted as a local function, though it is probably a function of the Earth's magnetic field.

5. ENERGY and NEUTRINOES.

Negative energy.

The solar activities are light, solar wind, and emission of protons.

A remarkable difference is seen and felt between the main activity, which is light, produced by photons, and the secondary activity of emitting the substance not useful for the production of light. This substance consists of protons, which produce what we perceive as magnetic storms. The beginning of an emission is seen as sunspots.

Seen from the point of view of humanity, our interest is in a livable climate on Earth and a nice distribution of sunshine. The systemic difference between sunshine, the bringer of energy and negative entropy, and the influx of protons, is that protons counteract energy by neutralizing electrons and photons.

A difficulty of understanding is that the proton showers are interpreted as magnetic fields or "magnetic storms".

Protons are the residue of substance after the production of light in the sun. Due to their equivalence of positive charge compared to the electrons, combined with their relatively large size and low velocity, their potential is low compared to that of light. They are retained in the sun until they break out in sunspots.

This retention is greater than their production. Their outbursts are irregular and incomplete. The final period of a star is characterized by its high concentration of protons and sinking production of light.

The weight of the proton, $1{\cdot}67265.10^{-27}$ kg, is not compatible to the photon, since this does not belong to the mechanical system of matter and gravity. It has, thus, no weight.

The positive charge of the proton has the same size as the negative charge of the electron.

The magnetic fields produced by the protons' eternal movement at low velocity in the sun are different from those of the photons. The weaker fields of the heavier protons will push a part of them out of the sun at intervals, at velocities below 1,000 km *per* second.

Relative to that of photons, the character of protons is seen as heaviness alternating with absence. In the meeting between one of each kind, the potential is released as energy, *e.g.* northern lights.

In our bodies, the potential of protons is on a low level compared to that of our metabolism, and it is felt as negative energy, a penetrating cold.

Around sunspot maximum, electronic communication is suffering. The periodicity of proton outbreaks is not strict. Sunspots are the warning given.

The negative potentials of the protons are partly displayed as the interaction producing northern light. The distribution of protons is so uneven that we have periods without "magnetic storms", or rather, showers of protons, chilling us to the bones. The distinction between protons and magnetic storms is artificial, as magnetic fields follow the protons.

When outbursts of protons reach the Earth, they will neutralize electrons and photons; thus their effect is that of negative energy. This is noticeable when the temperature is lowered by protonic activity, when also electronic systems and radio communication are harmed.

Radiation of non-photonic particles is an energy cost, detracting from the energy released in breaking down and accelerating electrons and their nano parts. Protons are the most important of them. They chill us from the inside.

The magnetic loops following the pairs of sunspots are not described as accompanied by particle streams.[12] Protons are emitted in irregular bursts and at irregular intervals obstruct electronic communication by neutralizing its electrons and photons.

There is probably a lower emission of protons than that corresponding to the emission of light. In the long run, the Earth will receive more energy than protonic anti-energy, or negative energy. A lower emission of photons is seen in old stars, which have a surplus of protons.

In the case of the opposite of protons, which is light, its magnetic component is mostly disregarded. This leads to a lack of understanding of the connections between functions of Earth and life.

Our energy.

Maybe we get as much as possible out of the energy we receive from the light, or maybe we could have fetched more of it. This is perceived as a technical problem. It is primarily a problem of understanding. It does not seem that we know the climate functions of energy distribution, as the atmospheric phenomena of temperature and concentration of carbon dioxide have caught the attention.

The principal problem is whether we have managed the Earth so as to make it lose the marginal capacity necessary for retaining enough energy for maintaining an average surface temperature above 273 K.

The sum of solar activities, which are light, solar wind, and radiation of protons, is their power input, calculated or measured as C m^2 s^{-3}.

The main activity, light, is produced by the electro-dynamic effect of the fields of the photons. It is therefore followed by magnetic effects, like the photoelectric effect.

As the velocity of protons is below one *per mille* of that of light, they have a low energy effect. Their intervention in our metabolism and in our system of electronic, or photonic communication, makes their negative energy a societal problem.

The sequels of movement of bodies are described in units containing the kilogram, which is the SI-unit of mass, the measure of inertia, *cf.* ref. 15. This is relevant for passive movement, when the charges of matter are not considered, *cf.* Newton's second law.

The potentials producing the forces of Nature are those between the positively and negatively charged particles of substance. The proposed units of these forces are based on the coulomb, the unit of electrical charge.

Light delivers energy, as it is a product of negative charges, which augment the potentials of atoms.

Protons have positive charges and lower the potentials of atoms when applied from the outside. Protons therefore bring negative energy. A fire will have a lower temperature and deliver less energy if stoked by air or fuel holding protons in a too great proportion.

The solar wind is emitted at 1 M t s^{-1}. It is permanent and consists of positive as well as negative particles.[12] The solar wind is probably a loss of substance only, not an important emission of energy.

The charge of the sun's substance emitted carries the potential of the radiation from the sun, as well as its other activities. The energetic sum of these charges, *c.* $7{\cdot}9 \,.\, 10^{37}$ C m^2 s^{-3}, is the dimension of the sun's emitted power, or its potential produced and used for all its activities, *i.e.* light, proton emission, and the sun wind.

The negative charge of the sun's main loss of substance will be

$$5 \,.\, 10^{9} \text{ kg s}^{-1} \,.\, 1{\cdot}76 \,.\, 10^{11} \text{ C kg}^{-1}$$

$$= 8{\cdot}8 \,.\, 10^{20} \text{ Cs}^{-1}$$

The potential of this flux is Ψ s^{-1}. c^2, which amounts to the power of the sunshine:

$$8{\cdot}8 \,.\, 10^{20} \text{ C s}^{-1}.\, c^2 = 7{\cdot}9 \,.\, 10^{37} \text{ C m}^2 \text{ s}^{-3}.$$

This is the functional dimension of the power produced by the sun. The main part of it is used for the production of light.

Common calculations use the units based on inertia, which do not include the potential of charge. Among these phenomenological units is that of received inertial power, W = kg m^2 s^{-3}.

The units derived from inertia were defined from Newton's second law and propagated by its use.

The negatively charged electrons give atoms extrovert potentials and make matter strong.

We also use potentials by moving them, *e.g.* by purifying metals, to places where we need permanent potentials. Each move will cost energy in addition to the potential moved.

The solar power can be estimated at $7{\cdot}9.\ 10^{37}$ C m^2 s^{-3}. This unit is a physical function, while watt is a unit of phenomenological, inertia-based interpretation.

In light or other electro-dynamic connections, inertia is irrelevant, as it is not a property of light. Forces and potentials are communicated by matter's fields. In light, its only property, which is its magnetic potential, is communicated by its magnetic monopole.

The communication of inertial force is a special case, which is not a possibility for light. A non-inertial force is needed for its initiation. Its production or dimension is not described by inertial units. The force will be the product of potentials between unlike charges.

The measured luminosity of the sun is $3{\cdot}9.\ 10^{26}$ W, or kg m^2 s^{-3}. The unit watt is derived from inertial energy as it is described in N 2, though it is used also as a measure of the indirect, dynamic effect, *per* second, of a quantity of charge moving at the velocity of light. The dimension of power would be better rendered as C m^2 s^{-3}. This unit will be a more correct description of light and other charge-products seen as physical functions.

The sun's power output is $7{\cdot}9\ .\ 10^{37}$ C m^2 s^{-3}. 13 *per cent* of it is not emitted as light, but used for the sun wind and the emission of protons.

In spite of protons' greater quantity of substance, they are emitted at a lower energy cost, *cf.* their low velocity. They are not cleft, while electrons are cleft and accelerated; and so carry the invested energy in the forms of multiplicity and high velocity. Their total energy is many times that of the protons.

When protons reach matter on Earth, electrons are neutralized; and matter is cooled. This is felt as a penetrating cold. Precipitation and icing on aeroplanes are hastened, not because protons are cold, but because they remove energy by neutralizing negative charges and producing cold molecules, or condensation nuclei.

Particles and velocity.

Will it be possible to accelerate bodies or particles to the velocity of light?

This depends upon the definition of 'particle'. The particles of substance are protons and electrons. Protons are emitted from the sun at below 500 kilometres *per* second.

Electrons have been technically accelerated to velocities near that of light. There is no indication that bodies or particles could be accelerated to the velocity of light, regardless of the applied energy. The latest news (2011) is that neutrinoes have been accelerated to the velocity of light. This indicates the inertia of a charge.

Light is produced in the sun by the electrons' continuous repelling each other. Electrons are accelerated through collisions, broken to small pieces and accelerated to the velocity of light. Each augmentation of velocity is the product of a number of collisions between femto- and atto-particles.

This process of breaking down electrons and accelerating their parts to the velocity of light could take thousands of years. It may be possible because of the division of the outer parts of the sun into separate compartments for protons and electrons. These compartments are sustained by the magnetic fields of the moving particles.

This could be a part of the reason for the unsuccessful acceleration of particles. One of the conditions of the sun is not fulfilled. This is the absence of positive charges within the possible reach of the fields of the matter tested.

Relative to neutral particles, this constraint does not apply.

Particles accelerated in a tube of metal or ceramics will not be impervious to their opposite fields. Contrarily, the electrons in their compartments in the sun will be many kilometres away from any positive charge.

The mechanism of the sun could be a necessary condition of breaking down and accelerating parts of electrons. It will have to take place where there is no disturbing positive charge or other energy sink. The absence of positive charges will probably not secure the desired acceleration of entire electrons.

The broken-down particles are photons; and they reach the velocity of light. Bodies or charged particles will not reach it.

Force, inertia, and mass.

The attracting force of a planet is related to the charges of the particles attracted and to external forces of pressure and gravity, *cf.* the loss of hydrogen and water from the atmosphere of small planets. The gas planets in our planetary system have great quantities of matter, giving them a great gravity. They can therefore retain hydrogen and helium in their atmospheres, while the Earth has lost most of the parts of the light gases not bound in chemical composites.

Mars has, with less than eleven *per cent* matter relative to that of the Earth, lost most of its water, atmosphere, and magnetism. The gas planets probably have smaller proportions of oxygen, thus of oxides, like SiO_2 and water.

We live on a planet of a lucky middle size and in a middle position. Its equilibrium of climate probably lasted as long as most of its tropical surface was kept wooded.

It will be seen that a world of positively and negatively charged particles having the same inertia would not have been able to form matter, as the attracting forces of its substance would not have been strong enough, relative to inertia and repelling forces, for matter's permanence. Quasi-permanent atoms could not have existed, except as nano-binary neutral systems, perhaps not unlike neutrons, which are not permanent.

Atoms are kept together, forming molecules, by the forces of their moving electrons. The forces are part static, *i.e.* they are potentials between charges of particles without relative movement, or moving at low relative velocities;
and part electro-dynamic, *i.e.* moving at high relative velocities.

Their ranges are great, from light H_2 and apparently weak water to heavy iridium and strong crystals of SiC. The electro-dynamic, or magnetic, forces from the electrons' orbits hold the atoms together in molecules.

In two atoms, the electronic orbits of each will form a region of more or less parallel orbits or, in small atoms, nearly a plane. The circular orbit of a small atom will have its magnetic north pole to the right when the electron goes away from you; and the pole will have an affinity to the south pole of another atom.

Two atoms will adjust their electronic orbits in parallel and in the same direction of orbiting if this is a possible consequence of the structure of the atoms.

Water's composition of H:O:H induces two strong electro-dynamic bonds, making the water monomer a strong molecule. By consequence, the outward force of the polymer water molecule is weak and, through its ionic form, adaptable to an infinite number of cases of need for a soft or transient connection.

Magnetism and gravity are dynamic and static forces, respectively.
Gravity shows that the sums of the fields of atoms have an enormous extension relative to that of the single fields of particles.

The great extension of sum-fields could be a product of the reciprocal repulsion of like, static fields. In the case of stars and planets, the combined positive and negative, static fields of the stars reach to their farthest planets.

The sum of attracting forces between bodies is somewhat greater than the sum of repelling forces partly because of the attracted negatively charged fields filling, or moving in, a greater space than that of the positively charged particles.

Beside this, the negatively charged particles receive a greater attraction relative to their amount of substance; and this is the decisive factor of gravity, *cf. ch*. 4.

A body receiving a continuous gravitational force from a greater body is subjected to this body and will, if it is not directly falling into it, move in an orbit relative to it.

The potential of a smaller body in an orbit around a bigger one is kept stable by this movement. A potential does not use energy for its maintenance. It was established by the binding of a potential of charges and their movement into the permanence of an orbit.

For its release, an amount of energy is needed, unless the situation includes a mechanism for tapping the potential. The moon recedes nearly four centimetres *per* year because a part of its potential is used for raising the tides on Earth.

'Mass' as a concept used in Newton's second law, is the name of the measure of inertia. Inertia is not a function of those properties of matter, or substance, whose interaction produces the forces coming into play, *e.g.*, in gravity.

The difference between the calculation of inertia and the calculation of forces is probably not great at low velocities. Still, it will be misleading, since inertia is not the physical function producing the moving force. At high velocities, the forces are of another dimension as well as of another kind, as they are electro-dynamic. This implies that the calculations based on inertia are even more misleading.

If I throw a stone, I move it by my force relative to its inertia.

When a stone falls to Earth, it is moved by the potentials between its atomic charges and those of the Earth. In this case, the charges of the stone and the Earth are its prime movers; and its inertia is its moved, passive property.

One use of scientific models seems to be common. This consists in drawing conclusions about reality from the model, which is a set of imagined properties of its object, since reality has not been asked about its properties, *cf.* gravity, light, and climate. Problems can be defined out of the model, *cf.* Planck's constant.

Newton's second law is based on phenomena of inertia, not on the physical functions producing mechanics, *cf.* his disowning of theories: *"hypotheses non fingo…"*.[10] ("I do not imagine theories…")

Einstein's version of N 2, $E = m.\ v^2$, has been taken as valid for the region of dynamics, the velocity of light included; *cf.* $E = m\ .\ c^2$. It has been used for making predictions about the behaviour of matter at those velocities. That is not founded.

The primary forces of matter are the potentials of its substance. They are not seen in or through the inertial phenomena described in N 2. The forces are the products of the charges of matter.

At high velocities, the forces produced are no longer those between positive and negative charges as such, but between these charges at extreme velocities. In these cases, they are electro-dynamic forces.

These forces are of a different kind; and they are stronger than the forces operating in the region of mechanics. There does not seem to exist a definition of the concept 'mass' which could make $E = m \cdot c^2$ correspond to the actual physical conditions. This problem arises from the origin of 'mass' as the name of inertia, which is the passive function of matter in mechanics, not its active force in dynamics.

From the necessary conclusions about light's origin and properties, it is understood that any cohesion between material particles is surpassed long before the velocity of light is reached. This is shown by light itself, whose photons do not mingle within a ray; and whose origin is the dissolution of matter.

Mass, as a conceptual part of inertia, describes a part of mechanics. It is not part of the description of dynamic relations, thus not of matter's behaviour at the velocity of light.

The physical side of the question is that no inertial body can reach that velocity. $E = m \cdot c^2$ does not describe any physically possible situation, thus not any real situation.

The forces of matter are the potentials between the positive and negative charges of its substance.

The negative charges of substance are accelerated to the velocity of light when electrons are broken down to photons.

Positive charges are carried by the protons, which are 1838·6 times heavier than electrons. They are accelerated in the sun. They are not broken down; and they are not met under natural conditions accelerated to above a few hundred kilometres *per* second.

This leads to segregation between the positive and negative charges. Life was developed on the basis of the negative charges of light. Light is not a product of inertia, like $m \cdot v^2$, but is an electro-dynamic potential. At the velocity of light, this is $4 \pi \rho c^2$, where ρ indicates the charge of the particle.

This dynamic potential is greater than the static potential; and a greater energy is needed for its production. This over-proportional consumption of energy at rising velocity lets the energetic product of acceleration change from the static to the electro-dynamic system of energy.

Maxwell's description is abstract rather than instrumental. Its physical conditions are those of substance and matter as they are shifted under the influence of the forces of movement at high velocities. Since the potentials of the moving substance are relations between positive and negative charges, the relations between the parts of substance are those changed by the transition to the system of energy of high velocities.

The constitution of matter is not compatible with the velocities approaching that of light, or with their producing forces. The internal movements of substance are of high repeatability and permanence as long as they are not overrun by external forces. The internal movements are the conditions of keeping the potentials of substance intact and thus maintaining the structure of matter.

Problems arise when external energy surpasses the potentials of substance. Hot water is no longer a substrate of most life, though life was developed as less complex protein molecules in hot water perhaps three thousand million years ago.

A specific development is followed by the need for its conditions. Our body temperature is an equilibrium; and 42 °C is a deadly extreme.

The force of light is stronger than the forces of matter. Matter and its constituting substance are dissolved by high energy, *e.g.* by acceleration to a high velocity. The production of light presupposes a concentrated energy breaking down the structure of matter and dividing its electrons into a number of photons.

Matter's internal forces are superseded by the energy needed for accelerating parts of substance to the velocity of light. Protons are left behind.

In the relations between the static forces of substance, the positive and negative charges are engaged on a like footing. In every relation, their potentials are engaged. The primary interactions of matter take place as functions of charged particles. These particles have four properties: substance, extension, charge, and field.

This is different from light, which has two properties: charge and velocity.

A measured effect of gravitation on matter used for presuming properties of substance will be valid only if the measured matter is representative of those properties relative to the forces of gravity. It should then contain an approximately equal number of positive and negative charges, *cf.* above.

In the ordinary hydrogen atom, ^1H, the electron is presumed to have a lower mass than electrons in other atoms. This 'mass defect' is ascribed to a conversion of mass to binding energy in the atom.

This does not seem to conform to the physics of atoms. The apparent bond between the electron and the proton of the atom is not a fast bond, but a dynamical relation conserved on the enduring condition of those two particles, which is their relative movement.

The difference from other atoms is not the kind of the bond, but the lack of neutrons in the nucleus. This makes the hydrogen's electron's attraction to the Earth's protons smaller relative to the repulsion between the Earth's electrons and the electron of the hydrogen. This implies a lower force in the nucleus, thus a lower attraction of the electron to the Earth's protons.

A body of matter is composed of positively and negatively charged particles in certain permanent proportions and in structures of movement. It cannot be interpreted as representing a theory of energy.

In a permanent relation, there is no release of energy, as the maintenance of the potential of the relation is the condition of the relation.

The opposite is also known, though on other conditions. One neutron is heavier than the sum of the weights of one electron and one proton, as it is equal to the weight of the proton plus the weight of 2·5 electrons. The proton is supposed to have a weight 1836·1 times that of the electron. Its actual weight is 1838·6 times that of the electron.

The explanation of this paradox is that singly-charged particles are not exposed to the same force as that produced by gravity in most bodies.

The single particles cannot respond to gravity like most matter. This moves the problem one step, without giving a definitive answer.

Since the positive and negative fields exert their influence independently of each other in the same space, singly-charged particles are exposed to the repelling forces of its like charges of the other body and to the attracting forces of the opposite charges of that body.

They are not exposed to any of those complementary forces which their lacking companion particles would have received. Thus they are not parts of the environment of forces common on Earth.

The weight of singly charged particles measured as single particles is not significant for their role in matter.

As soon as ^1H becomes a part of a molecule, its charge is related to those of other atoms; and the sum of their potentials will decide their inertia and their weight relative to Earth.

The quantitative relation between charge and substance has not been defined once for all. Though mechanical functions are exerted by matter defined by its constituent substance, its potentials producing these functions are the charges, which are unequally distributed within matter, even to the point of wrecking our measurements.

Still worse for our understanding and measuring the situation will be where large bodies or fluids consist of particles of one charge only.

This is the case of the Sun, where positively and negatively charged particles are separated in its large outer compartments.

The main force of the inter-material potentials, gravity, is a small surplus of attracting force directed mainly against the electrons of the other atom. This force is small in relation to the sum of electrostatic forces involved. The model can be represented by ^1H.

In heavier atoms, a greater number of charges is concentrated in a volume not much greater, so that their sum will be greater, and probably also the sum volume of their fields. The greater relative forces give them a higher density and a greater mechanical strength.

Atoms are kept together, forming molecules, by the sum of electrostatic and electro-dynamic forces of their moving electrons. The static and dynamic forces coexist. Their ranges are great, from light H_2 and weak water to heavy iridium.

In some molecules, the electro-dynamic, or magnetic, forces from the electrons' orbits are dominant in keeping the atoms together in molecules.

In two atoms, the electrons of each will adapt their orbits in parallel. Three atoms can form magnetic bonds. On these conditions, the water monomer is a strong molecule; and its outward force is, by consequence, weak.

Magnetism and gravitation are dynamic and static forces, respectively. They show that the sums of the fields of atoms have an enormous extension relative to that of the single fields of particles and atoms.

The sum of attraction between static fields is somewhat greater than the sum of repelling forces, partly because of the unequal proportion of substance and charge of positively and negatively charged particles, partly because the attracted negatively charged fields are filling, or moving in, a greater space than that of the positively charged particles, relative to their inertia.

The main part of gravity is due to the electrons receiving a greater attraction relative to their substance.

Light's field ?

Light is special in consisting of one charge only. The positive charge is left where the light was produced. Light is an electro-dynamic and dominating force relative to the forces holding matter together. Its dynamic fields are small, as the photons are propagated in one direction and are not laterally spread.

Light is therefore not seen from outside the ray, except where it is dispersed in the electro-dynamically bonded molecules of the atmosphere, *e.g.* water, in fluid water itself, or in other greenhouse molecules.

Photons exert no outward lateral pressure. This will be due to light's lack of a mechanical potential.

Bernoulli's $\Delta p = - \frac{1}{2} \rho v^2$ is a general relation between a stream and a force. The force vector is magnetic and directed into the stream at a right angle to its movement. The potential producing it is the difference of velocity between charges.

Light should at the outset be expected to exert a lateral force. This is imagined on the condition that light could exert forces known from mechanics. Since light is dynamic, its relation to matter is limited to its radiation.

Light is influenced by magnetism, but not by mechanical forces, like gravity. Its unidirectional magnetism will account for the consistency of the light ray.

Light's magnetism could also be the physical function of sunburns and skin cancer at a lack of melanin. It would consist in the removal of essential parts of the metabolism of the skin, impeding contact between the parts. It could be a general mechanism of radiation-induced cancers.

Different organic molecules have a large register of size and composition; and they will therefore respond to energy producing different frequencies. Water beds heated by single-way AC-cables have been accused of producing cancer, which seems probable.

Mass, charge, and velocity.

Inertia, whose measure is called mass, is a body's resistance to an external force or to its product, which is acceleration. It is seen, *e.g.*, in the momentum, kg m s^{-1} or newton-second, Ns, left in an accelerated body when the accelerating force is removed.

Mass is defined by Newton's second law as $m = F / a$, the relation between a body's accelerating force and its acceleration. This does not remove the dependence upon phenomena or their interdependent definitions. Measuring acceleration, as Galileo did, does not point to any function.

Newton's second law is a postulated relation, by which the phenomena force, mass, and acceleration are defined relative to each other. Thus they are all relative. They are based upon phenomena; thus their places within a body of physics based on primary functions are undecided and not searched.

A body exposed to a gravitational force from a greater body is subjected to this body and will either fall into it or move in an orbit relative to it. A transient gravitational force will change the direction of a passing body. Inertia is a vector, like the force of gravity. Mass, as it is defined by Newton's second law, is the name of the measure of inertia.

Singly charged particles respond to external electrical fields by their single charges.

Since the mechanical reactions of a body depend upon its charges, the empirical measures of, *e.g.*, weight, are not significant for understanding its composition as long as the mechanical, or Newtonian, measuring cannot be calibrated to the changing conditions of the matter or substance concerned. An instance of this is the electron of ^1H, *v.s.*

The lack of a possibility of measuring substance by mass has implications for the understanding of the relation between mass, substance, and energy. The "mass energy", or rather, the energy of primary interactions of substance, is not described as a function of matter quantified as mass, since mass is a function of mechanics of bodies, which are aggregates of matter, while the primary interactions take place as functions of charged particles not systematically coordinated.

A measured effect of gravitation on matter used for presuming properties of substance presupposes that the measured matter should be representative of those properties relative to the force of gravity. If a body of matter should be representative, it should contain an approximately equal number of positive and negative charges.

The "mass defect" is measurable in ^1H, ordinary hydrogen, and in comparing neutrons to their constitutive electrons and protons. It is currently referred to the transference of mass to energy needed for the atomic bond.

The binding energy is a postulate derived from the theory of the equivalence of mass and energy, which, in its turn, is a postulate identical with Newton's second law. If the argument of the purported equivalence should be based on $E = m \cdot v^2 = m \cdot c^2$, which is Newton's second law multiplied by metre, there is no equivalence, but a functional relation, in which the square of velocity is the relational factor. From this relation it is seen that the differential of energy is produced by the change of velocity, not by any change of mass.

The mass defect is not a defect of mass or of measurement. The problem is caused by a lack of understanding of what has been measured, in combination with a belief in the measuring as the adequate registration of the relevant property of the matter concerned. This is an instance of the empirical fallacy: believing that empirics constitute their own model.

In the case of ^1H, this implies that the velocity of the electron of the atom could play a role, though less important than the absence of a neutron in the nucleus of ^1H.

Acceleration can be defined as a phenomenon, as long as it takes place within low velocities and does not involve physical functions.

At electro-dynamic velocities, the relation between force and acceleration is no longer described by N 2. An electro-dynamic function replaces the phenomena described by N2; and the character and dimension of the products ask for an adequate description.

The electro-dynamic potential, $4 (\pi \rho v/c) v^2$, has the dimension coulomb meter squared *per* second squared, or $C m^2 s^{-2}$.

'Mass' is the name of the quantity of inertia; or of a quantity of matter, or of the force from a quantity of matter measurable on Earth? The consistent definition is the first.

Mass has been technically defined by bodies having positive and negative charges in approximately equal numbers.

Gravitation is perceived as produced by bodies' force. In weighing bodies or measuring gravity, matter's charges have not been taken into account; and this has not led to any known discrepancies of measurement, since the imputed mass defect has been ascribed to the relation between Newton's second law and a postulated function of energy in the constitution of matter.

In the *Système International d'Unités*, the unit of mass is defined by the platinum-iridium prototype of one kilogram, kept at Sèvres.[53] It does not seem clear whether the definition concerns its quantum of matter or the force exerted on it by the local gravitation.

"Mass is a measure of the quantity of matter contained in a body."[12]

Mass is "… the resistance that a body of matter offers to a change in its speed or position upon the application of a force." As the standard of mass, the platinum-iridium prototype of one kilogram is referred to.[15]

Inertia is the "property of matter by which it continues in its existing state of rest or uniform motion in straight line, unless that state is changed by external force".[55]

It is not clear whether the "mass" defined should be a quantity of matter measured by any method, the quantity of matter producing a certain weight on a certain point of the Earth, or the quantity of matter having a certain inertia, *i.e.* producing a certain resistance to external forces.

Newton's second law contains three definitions:

$F = m \cdot a$: force equals the product of mass and acceleration;

$a = F / m$: acceleration equals force divided by mass; and

$m = F / a$: mass equals force divided by acceleration.

As these reciprocal definitions define the relations between a functionally limited group of observations and measurements, they are not fit for establishing a functional model, not even of these three factors, since they are defined by each other.

As the parts of N 2 are interrelated, there is some logic in Einstein's calling the extended system "relativity". Including them in a model is a questionable enterprise.

The function of the unprofessional, form of Newton's proposition should be to defend himself against his guilt for nearly intruding into the complex reality of his God's creation. By describing the physics of the world he exposed himself to the danger of doing wrong to his God.

By limiting himself to describing phenomena, the apparent, and avoiding the real functions, he probably, in his own eyes, did not commit any intrusion into the real world, which he seemed to regard as his God's domain.

Formulating a theory or expressing any opinion on his God's creation would have been too much for his creed and his paranoid lack of self-confidence.

His avoidance is seen in his words. As he wrote his letters in Latin, they are *"hypotheses non fingo"* [10] ("I do not imagine theories.")

There is a coincidence between Newton's explicit avoidance of theories and his circular definitions in the second law. From the point of view of epistemology, these circular definitions are unprofessional. Relative to their referred intention, that of describing physics, they are misleading. Seen as an expression of religious paranoia, they are understandable, though hardly acceptable.

Even if Einstein's formula should have had some other origin than N 2, this would not have given it a greater credibility, since its formal content is the same as that of N 2.

If, for a moment, we accept $E = m \cdot c^2$ as a description of something, what should this be?

Inertia is a secondary phenomenon of matter. It is not involved in the physical function behind a stone falling on your head, though the harm caused is measurable by N 2.

If we lift the happening out of physical bonds and look at it in a detached, airy connection, we can disregard physics and see the falling stone as an autonomous phenomenon. In that case, it has a weight and a velocity. Going further into the matter, we shall find the empirical value of the Earth's acceleration of matter.

If matter could have been accelerated to the velocity of light, its inertia-generated momentum would not have been convertible to energy, since matter's charges would have produced an electro-dynamic potential *c.* 10^9 times that theoretical momentum. The energy needed for the production of this potential does not reside in matter, but should be added to it for acceleration.

The acceleration would have to be the interaction between some external potential working in relation to the potential of its own substance, which would respond with its charges, not with its inertia, whose name is mass, indicated by the m of the formula.

The energy equivalents of all the atoms of a body will consist of electrons and protons which nearly met, at high velocities, a long time ago.

The potentials of their relative movement are conserved in their orbits. These potentials are not on a level corresponding to the energy of particles moving at the velocity of light.

The mass m of $F = m \cdot a$ and of $E = m \cdot c^2$ is the measure of a body's inertia. Its significance as a measure is limited to the cases where the body is passively accelerated; and where its particles' quality and capacity for interaction are not considered.

Their momenta at meeting are described by $m \cdot v^2$; and v will have to be significantly lower than the velocity of light, as it is not possible to accelerate any substance to that velocity.

The closer their encounter when the particles met, the higher their potential today. Their momenta were not the decisive property for the interaction in their permanent relation for millions of years. Their decisive property was and is the charge, its kind and size, and its relation to the charge of the particle to which it established a relation.

In small atoms, the radii are small; and the electronic velocity is high. The atoms of a body constitute an apparent energy bank, since a lot of energy went into the formation of the atoms.

Apparent it is because it was used for the formation of the atoms and will not be useful for other purposes. Separating electrons from atoms will cost as much energy as that sunk into their bonds when these were formed.

In the atoms as they are, this energy, now on the permanent level of potential, serves the maintenance of matter. It is no longer useful as energy; though it is un-losable as the force holding the particles of substance moving at distances making our flesh bearable on Earth.

The potentials of matter and of its constituting substance are products of charges and their relations, not of inertia. Starting from N 2 or $E = m \cdot c^2$, one cannot arrive at a description of the energetic situation of matter, as the conditions of potentials of substance and their relation to matter are not parts of that model.

A model in science is our concept, our mental representation of a connection. If we use it for calculation only, the way mathematical models are used, we do not always get any answer as to its applicability or to its correspondence with reality.

The main problem is to avoid the belief in a model as the complete and final description.

The problem of understanding related to matter, mass, and substance has been that taking the model as normative for reality is too easy. The world, though, does not correspond to our models. In order to relate adequately to it, we should rather build better models. A first step could be to realize what is wrong with the present model. A second step could be to find the parts of a new model.

$E = m \cdot c^2$ contains two impossibilities. The first is the acceleration of a body of matter or a particle of substance to the velocity of light. If that were possible, the potential of the moving particle would have been several times greater than it is as a part of a body moving at terrestrial velocities.

The second concerns the cohesion of matter under acceleration to the velocity of light.

Mass does not represent that property of matter or substance which produces the energy characterising matter or substance.

At the outset, the Newtonian postulate or definition does not concern or imply any physical function, but concerns the phenomenon of force produced through the inertia of a moving body by means of forces external to the body.

The possibility of producing a force by the physical properties of the body is not a part of the postulate or the calculation. This force is a product of interaction between the primary property of the body in question and that of other bodies, *e.g.* Earth.

The use of N 2 as a model is based on Newton's avoidance of physical functions. It has a significance limited to the cases of movement initiated by direct movement, like a throw. A fall to Earth is initiated by the potential between the Earth and the falling body. This potential and the force created by it are not parts of the calculation by N 2.

One characteristic of light, its small particles, will exclude the possibility of accelerating matter to the velocity of light.

Protons do not reach that velocity; and electrons do not reach it as particles; only as their very small parts. An inertial body or particle cannot be accelerated to the velocity of light.

A phenomenological description delivers an appearance of science that can be taken to make up for a real functional description. History shows that accepted science has been produced by evading reality; and our culture has a more than two thousand years tradition of doing this.

Ptolemy was explicit in doing it; and though Newton was not explicit in detail, he was clear in his purpose, *cf.* his letter.[10] His second law cannot be interpreted as a genuine approach to science, but as a deliberate leading astray.

The combination of evading reality and delivering an apparently useful model has been socially useful, especially in domains where the possibilities of control were not present, *cf.* $E = m \cdot c^2$.

A theory is a postulate about a part of the world, a proposed explanation of the character of that part. We are apt to believing that the world is arranged as our theories.

Every theory is made according to what has been perceived; and it is an interpretation of it, in words or mathematics. It proposes an explanation of what is known at the moment. A theory will often include postulated entities.

A theory is not a proof that its theme should be as the theory says, or exist at all. A prime instance of this point is the Church's case against Galileo Galilei. Ptolemy's calculation model was taken as a proven theory; and the presumed celestial movement of one full turn of the stars every twenty-four hours was taken as real.

This was the Church's proof against the Copernican model. A modern version is: "But relativity theory says …"

The Vatican's judgment on Galileo fell in 1633, formally for his support of the Copernican theory of the planetary system, in reality for his denigration of dignitaries.[20]

Already in 1609 and 1619, Johannes Kepler had published the modern version of the planetary system. This had not influenced the Catholic Church, which rescinded its judgement on Galileo in 1992.

The Vatican had not cared about what was known north of the Alps, but so much more for its prestige in its own eyes.

Energy and velocity.

When grain or meat is boiled, it becomes soft. Iron melts at 1808 K, tungsten boils at 5933 K. High levels of energy produce changes of aggregate form. These instances concern changes of molecular structure. A high level of energy will dissolve the atoms.

In order to give a body a high velocity, an amount of energy is needed. When a body receives energy above the potential level of its internal bonds, it is dissolved.

The reason is not that its bodily form impedes its further acceleration, but that a higher velocity requires an additional energy, which dissolves the body.

Energy is a sum of transients; and each of these is the release of a potential between charges. In matter, they take place as changes of potentials when relations between primary particles are shifted, by contact or by fields.

As parts of negative entropy, they take place at the reception of photons in the substance of matter. The opposite transmission, from matter to light, will not be possible. The transition from substance to light takes place between electrons under certain conditions, *cf.* the sun.

A high energy will surpass the binding potentials within the molecules and atoms of the body, which will be dissolved before its subatomic parts can approach the velocity of light. High velocities exclude bodies. Before the velocity of light is reached, an accelerated body will be dissolved into its constituting particles.

The sun demonstrates a zone combining substance and velocity. Protons are emitted whole. Electrons are beaten to pieces through thousands of years of collisions and reciprocal repulsion. When the pieces are small enough for reaching the velocity of light, they escape, if they hit the escape angle. Their energy is carried by their infinitesimal charge at the velocity of light. This energy is what our eyes are built to register.

The velocity of protons emitted from the sun is less than one *per cent* of that of light. The weight of the proton is $1{\cdot}672648 \, . \, 10^{-27}$ kg. This weight is mostly without interest to us terrestrials, as protons' impact on Earth is made by their positive charges and their effects, called "magnetic storms", which disturb and inhibit electronic communication and the use of electricity distribution networks.

A higher energy level than that of the sun is produced by nuclear bombs. As these are not included in our everyday, the sun is on top of our normal experiences of energy. The technology of nuclear energy is apparently in conformity with its theory, thanks to the political interest in developing the consequences of Lise Meitner's (1878-1968) perspective on subatomic physics.

This is deployed in contrast to the failing understanding of everyday physics. The difference will be of interest to the sociology of knowledge, religion, and power.

If a body could have reached the velocity of light, it would have been deformed, according to the Lorentz-FitzGerald transformation postulate, incorporated in relativity theory. The idea of relativity is a heritage from Newton's second law, whose parts are defined by their relations to each other.

Its imagined consequences are not physically possible. The involved physics are not steered by the relations of the model, but by the properties of the participating particles and by the limits of their potentials.

Einstein's $E = m \, . \, c^2$ is identically equal to Newton's $F = m \, . \, a$. Its parts are defined by their relations to each other. As they do not have any definition links to physics proper, only to each other, which are the phenomena regarded by Newton, they are free-floating as well in their relation to other phenomena as in their relation to physical functions.

Their lack of precision is general, since the inertial measures and calculations are used instead of dynamical functions, which are therefore not correctly represented. The inertial force $m \, . \, v^2$ of the moved matter, is, relative to the moving force, a phenomenon.

As its producing force is not a part of the model, it is not explained, and its effectuating variable has not been taken into account.

Newton's establishing a part of mechanics as a phenomenological model detached from the physics of matter has produced difficulties of understanding and of consolidating the science of Nature in contiguous branches.

The different parts and functions of Nature's primary matter should rather be seen in compatible ways in the different branches. Now these are separated by our lack of a common understanding.

The momentum of the prime mover was not considered by Newton, though it is a physical necessity, as some force is needed for initiating a movement. This evasion of Newton's underlines his avoidance of functions and his clinging to phenomena.

At high velocities, this avoidance of Newton's has been taken as normative for the limits of later studies and has led to postulated results not consistent with the physical conditions, like the postulates concerning matter's behaviour at the velocity of light.

At high velocities, though below that of light, the physical conditions of substance remove the applicability of the Newton-Einstein model. This is seen from the absence of charges. As these are the prime quality of substance, they are the origin of the dynamical momenta of matter and should have a place in the model.

There is a lack of functional and non-phenomenological models of mechanics valid at high velocities. This was exposed by the research in electricity and magnetism during the 18^{th} and 19^{th} centuries, *cf.* Maxwell's synthesis.[8]

The question of significance in the zone of everyday velocities rises out of the physics of force production. Mechanics offers a description of movement and forces within a limited field. It was not intended for the description of physics of high velocities or marginal conditions.

Gravity is a necessary consequence of the difference of quantities of substance in matter, as negative charge is the property of electrons; and the positive charge of the same size is the property of protons 1838·6 times heavier.

These charges are effective in static relations between aggregates of matter; and the resulting forces are still active at velocities above those of everyday transportation, even in interplanetary flight, until now performed at velocities below eight *per cent* of that of light.

At velocities approaching that of light, the electro-dynamic function of the charges of matter will overtake the potential of the static charges, *cf.* Maxwell's factor 4 π (equal to 12·5 times) at the velocity of light. This transition removes the bonding forces of matter, which are the static charges.

The ray of light consists of negative charges only. At the velocity of light, the static forces are no longer present. The dynamical force is unidirectional and does not exert the lateral pressure producing a diverging ray, thus we see the stars as luminous points.

The Lorentz-FitzGerald transformation is built upon a presumed relativity of space, time, and mass. It postulates a shortening of bodies, dilatation of time, and augmentation of mass at velocities approaching that of light.

The precursor of that model is N 2, which is a description of the apparent relations between bodies, force, and movement. According to Newton himself, these variables are phenomena, not the physical functions, *cf.* his explicit avoidance of proposing theories about reality.

A second characteristic of N 2 is the interdependence between the phenomena juxtaposed as factors by Newton. The equation N 2 is a definition of its three elements; and each of them is defined by the two others. This is a simple way of avoiding any connection with the functions of reality.

For three hundred years, we have calculated mechanics from appearances. This has worked up to a point. In marginal situations, N 2 will deliver wrong results. Added to this, the relativity believed to exist between the described parts is a projection of the relativity built into the model as interdependent factors.

Europe has a history of relying on appearances instead of searching for the real variables.
Ptolemy built his model upon appearances in order to hide the shame of God.[23] Newton avoided the real, maybe because he wanted not to interfere with God's work. The method was coincident with that of Plato, more than 2200 years ago. What keeps us from handing Plato and his followers over to history?

Together, relativity theory and the lacking descriptions of functions make it impossible to deduce from N 2 propositions about reality outside the region of low velocities.

The ensuing problems have been relieved by technical approaches to phenomena, like the SI-definitions of length, time, and mass. This adaptation has not given N 2 the foundation of definition needed for its use as a model of physical reality.

The interdependence of its parts has followed from N 2 to Lorentz-FitzGerald's postulate and to Einstein's $E = m \, . \, c^2$ which is another form of Newton's second law.

Newton's avoidance of an unequivocal description of functions of mechanics has thus been followed by models with a weak connection to phenomena and without any connection to the reality of physics.

The energy postulated by Einstein is the secondary effect of movement, *i.e.* the inertial momentum of the moving body, which is also the effect considered by Newton.

The initiating energy is not a part of Newton's model, thus nor a part of Einstein's. The moving potentials of matter are described above, *cf.* gravity.

One shortcoming is the postulated $E = m \, . \, c^2$. Applied to light, this implies a presumption of the dependence of the energy of light on the inertia of its photons. This is a part of the inheritance from Newton, and it is not correct.

As will have been seen above, light is a magneto-dynamic function of the charge of the moving particle. The mass and momenta of photons disappeared through their production. Inertia is no part of the photon's transmission.

The phenomena postulated by FitzGerald and Lorentz are derived from the relativity which is an *a priori* part of N 2, as its parts are, by their definitions, relative to each other. The changes of length, time, and mass are imagined products of high velocities, the way they are projected from the model. The actual physical functions are not parts of the model.

These functions, like those seen and measured at low velocities, are products of the properties of matter or its constituent substance. One of them is the energy input needed for acceleration, which does not take place by inertia.

Another is gravity. A third is the transition to electro-dynamic, or magnetic, function of the charges of bodies.

The transition from static to dynamic function takes place during the acceleration of substance, or matter, above a certain velocity. The significance of the static forces of attraction between the positive and negative charges will be lowered at a higher energy input.

Bodies are held together by their static potentials, though are overridden and dissolved at the energy of heat or high velocity.

When a charged particle is accelerated above a certain velocity, it acquires the electro-dynamic quality. It is then no longer capable of receiving the force of a static or low-velocity charge. It is then not held together with particles constituting matter; thus matter is dissolved.

The velocity of light is not attained by bodies or particles of normal substance. The smallest of these are the electrons. Only when broken down to photons under appropriate conditions, as in the sun, they are accelerated to the velocity of light.

The Lorentz-FitzGerald transformations are postulated products of the relativity of the origin of the empirical description of mechanics, which is N 2.

As is seen, they were postulated without considering the prime movers of matter, which are the potentials between the opposite charges of the substance constituting matter.

Space has no property beside extension. Its size is a function of movement.

Forces or asymmetry in space have their origin in light, and in the fields of bodies and substance found in space. Their origins are located in space; though without any physical relation to it, as space has no physical quality except distance; and even this is introduced by the presence of bodies.

Time is relative movement, which is a function of static charges.

Gravity is the static force of the substance of matter.

Light is the electro-dynamic force of negative charges moving at the velocity of light. The magnetic force is not a separate property of the radiation carrying light, but the mechanism of light, which carries itself.

The cells of the eye will have to be receptive to the magnetic force of light, which they are because this force dominates the static forces.

The calcite ($CaCO_3$) rods, found in the eyes of the oldest known trilobites, could have been the lenses of their compound eyes, with up to 3000 lenses in one compound eye.[27]

One property is essential to eyes: the free passage of light through its refractive parts to its bottom of receiving nerve cells.

Compound eyes are excellent for detecting movement, *cf.* the rapid reaction of flies.

The mechanism of neural communication, which is performed by sodium- and potassium-atoms, constituting ions with water polymers, points backwards to the light-receiving cells of the eye bottom. These will have to be pervious to the signal consisting of one or several photons.

Normal cell substance does not have a systematic reaction to light, except by the photoelectric effect, which does not seem to take place in water.

It should therefore be expected that the matter of the eye would let light through without interacting with it.

It is therefore probable that the calcite rods of the eyes of the first trilobites were not their lenses, but the former clear matter of the eyes, having absorbed the mineral during their 500-million years rest in the calcium-rich sea.

This is a crucial question for eyes, as any interaction between light and the matter of the eye, except refraction in the lens, will impair the eyesight if taking place before the sense-cells.

Light and forces.

The deviation of light at the solar eclipse in 1919 was not a function of gravity or other forces of static charges, since light has no residuum of static charge and does not interact with static fields, thus not with gravity.

The interaction between the light from a star and the sun was magnetic, as light was deviated by the sun's magnetic field.
The concept 'mass' is the name of the measure of inertia of matter. Inertia is not an active partner in mechanics, nor an independent factor of it.

Inertia is matter's passive part. The charges of the particles of substance are the active parts of matter.

N 2 is, therefore, misleading when promoted as a description of an active part of mechanics.

When matter is moving at low velocities, relative to that of light, *i.e.* below a few thousand km s^{-1}, it

1. carries the moment of the moving inertia, $m. v^2$, or kg m^2 s^{-2}.

This is not the same as

2. a prime moving force, which includes the charges of the substance, *cf.* gravity, *v.s,* and refers to the prime force of charge, C m^2 s^{-2}.

This illustrates Newton's substitution of phenomena (or symptoms, or the apparent) for the function taking place.

When a stone falls to Earth, it carries an inertial momentum. Its initial energy was most probably overlooked by Newton

This was, though, conforming to his program of avoiding "hypotheses", *i.e.* theories about the real, and staying at the symptoms, the phenomena.

This led Newton away from the realities of physics.

Newton replaced possible theories by phenomena. When these were combined, as in his second law, they did not bring any validity as descriptions of real physical functions.

The consequence has been that active and passive parts of physics have been confounded.

Important parts of physics were kept out of description by Newton and overlooked by posterity.

Newton's prejudices should no longer be normative to our understanding. We should leave phenomena and approach reality.

The imagined phenomena of matter's behaviour at the velocity of light are projections of the reciprocal definitions between the parts of Newton's second law and its successors of the 20^{th} century.

No matter or entire particles of its constituting substance can reach the velocity of light.

Light versus matter.

Light is a moving multitude of sub-parts of substance communicating potentials to aggregates of substance, which are matter. As is seen from the origin of light, this consists of negative charges only. Its material origin is reformed; and its particles carry negative charges only.

Seen from the outside, light has a defined velocity.

At the velocity of light, neither time nor matter will exist, since light's magneto-dynamic potential cannot take up or respond to matter's static potentials of charges.

Seen from light itself, nothing exists, except the magnetic potentials of fast moving charges. These are the only potentials which can influence light or other magnetism. They are technically exploited in electro-motors, transformers, and electrical instruments.

At the velocity of light, there is no time, since time is a measure derived from relative velocity within the realm of mechanics, *i.e.* matter moving at low and medium velocities. The forces of moving substance or matter are those of the static charges of substance.

Time is the relative movement of bodies, which takes place driven by the static potentials of substance. As any interaction initiated by the static and low-velocity charges and directed towards light does not exist, there is no connection between time and light, or between everyday velocities, their initiating potentials, and light.

The presumed interaction between the static potentials of the charges of substance and light's electro-dynamic force does not exist. Thus light does not interact with gravity.

The presumed interaction interpreted from the apparent displacement of a star at the solar eclipse of 1919 was not a product of fields of static charges, thus not a product of gravity. It was produced as the interaction between the electro-dynamic field of the light and that of the sun, which conveys its magnetism and its light.

An analogous phenomenon is the refraction of sunlight at the sunset. The function behind the phenomenon is the deviation of the sunlight by the small magnetic fields of the water molecules of the air in combination with the magnetic field of the Earth.
The effect should be stronger in damp air and in air with a high content of CO_2. These effects would be due to the magnetic bonds of O:C:O and H:O:H. These molecules have two magnetic

bonds, which make them susceptible to magnetic, or electro-dynamic, cooperation.

This molecular property makes the atmosphere visible as blue by water's absorption and re-radiation of weak radiation from the sun, and makes them both strong greenhouse effect molecules by their absorption of photons re-radiated from Earth.

Ultraviolet light is retained in the atmosphere for the same reason, since the short-wave end of the spectrum is its part of lowest energy. Besides, the molecules of water, CO_2, and N_2O are among those interacting with light by their solenoid bonds.

The velocity of light is constant because light, by its magnetism, does not interact with the forces of bodily movement or the movement of particles. The impossibility concerns the two-way interaction, as light is taken up by matter; but light does not take up material forces, *e.g.* gravity, from the potentials of substance.

This was proved by Lene Hau, who lowered the velocity of light to seventeen kilometres *per* second in a cloud of very cold Na^+-ions, a Bose-Einstein condensate. The force of the ions is electro-dynamic, like that of light itself.

Light is thus seen to be impervious to forces of static and low-velocity origin. It reacts to potentials of its own kind, which are the electro-dynamic, or magnetic, forces. It does not interact with matter's relative movement, or with gravity, the force producing it.

The relative movement of matter is what produces time; and it is as well the measure of time. Light is not influenced by time, nor by the forces producing time.

Time is a function of relative movement at mechanical velocities and forces, well below those of light. Time has its origin and function where the static forces of the charges of substance are dominant. *Cf. ch.* 9.

Light's physics is electro-dynamic; and its forces override those of the static and low-velocity regimen of earthly movements and their relations, time included.

The lack of contact between light and time is not a product of relativity, which is a phenomenological model. The postulate of relativity in mechanics is a projection of $E = m \cdot v^2$, or $E = m \cdot c^2$, both derived from N 2:

$$(F = m \cdot a).\ m \equiv (F \cdot m = m \cdot a \cdot m.) \equiv E.$$

Beside the lack of a physical relation between light and the movement of static charges, the understanding of the physics of high velocities is hampered by the postulates of relativity and the use of the Newtonian-Einsteinian model of mechanics, which applies to phenomena only.

The possibility of measuring the velocity of light is left to indirect methods, like that of Ole Rømer's in 1676. This is one instance of mechanics' lack of influence upon dynamics.

The independence of light from matter is the product of the removal of inertial momentum from light. The photon's imagined residual inertia does not exist. Inertial momenta do not belong to the energetic system that could have influenced that of light.

This shows the postulate $E = m \cdot c^2$ to be inadequate for any purpose.

Light interaction.

Matter is composed by particles of substance. Neither matter nor its composing particles can be accelerated to the velocity of light.

The inertial momentum and force described by Newton's second law are not identical with the electro-dynamic force produced by photons, which are the only material residua existing at the velocity of light.

The general lack of interaction between electrostatic forces and the electro-dynamic force is seen from the lack of spreading of light's rays, and from the stars' small points in the sky. As this is not perfect, and it is more pronounced in a cold arctic night, the presence of electro-dynamic forces in some of the particles of the atmosphere has been proved, *cf.* above.

The static potentials of matter cannot initiate any interaction with the electro-dynamic forces of moving charges. This implies that light reaches matter without taking up any force.

Time is a measure of the relative movement between static charges. Time is thus not capable of communicating with light.

This implies that the velocity of light is a dimension outside time. Travelling at the velocity of light, the measuring of time would have been impossible.

Atoms have different sizes and different internal potentials between electrons and nuclei.

Light reacts with the magnetic fields of electronic solenoids, except those of the smallest molecules, and leaves its energy in the atoms.

This interaction consists in the atoms' absorption or reflection of light.

The opposite is possible in those cases where the intra-molecular bond is produced by a high-velocity potential of the electrons. This is seen in some of the molecules of the atmosphere, among them water.

This mechanism depends upon the two electro-dynamic bonds within each water monomer, as their inter-monomeric bonds are of another type, *v.i.*

Since time is a relation between moving parts of matter, it does not interfere with light. For light, time does not exist. The measurement of the velocity of light therefore takes place, since Ole Rømer, by indirect methods. Even these methods are not free from variations influencing the measurements, which will therefore have to be variable.

Light is the vehicle of a one-way transmission of energy. It is not "pure" energy, which does not exist. Energy is the release of a potential. This implies that, in order to produce any energy, a photon will have to meet a particle relative to which it has a potential.

Photons may leave residuals like cancer; and the growing plants assimilate light for their formation of specific chemicals. Light also influences the cells and chemicals of our eyes and our skin.

In principle, light should be measurable by magnetic instruments.

Space has no definite size. It is defined by the time of light's passage, provided we have got right its measurement by redshift, which is the way of estimating the size of the space. Its calibration is unknown by 2009.

Light interacts when a photon hits an electron in an atom and is reflected. This is possible because the solenoid of electronic movement, except in the smallest atoms, is a transition between mechanics and electro-dynamics, *cf.* its role in transformers.

It also interacts *in articulo mortis*, when it hits a particle of an atom and is assimilated; and when photons from or the sun or a lamp are neutralized by protons.

Since light has left the domain of static forces, it has no inertia or weight. Absorbed light should add its photon to the matter hit. The energy of the photon will heat matter by reflection or absorption.

Mass is the measure of inertia of matter. The measuring will have to take place relative to a sum-field of positive and negative static charges, like the Earth.

The current understanding of time and velocity seems to be built on N 2 and E = $m \cdot c^2$. This is a product of reciprocal definitions, not of any description of physics. It seems that time is regarded like gravity has been understood; "… nice to have as a calculation unit, but without any real physical existence, or, perhaps a kind of physical existence, but inaccessible to our understanding, as far as we know…"

This lack of an approach to a possible understanding also casts a shadow over N 2. Should it be a kind of fairy tale of physics instead of a one-to-one description?

A description of the physics underlying the phenomena of N 2 is needed and possible. The reason is that N 2 gives a wrong picture of the physical functions connected with its theme.

The history of science as it was formed from central parts of physics by Plato, Ptolemy, Newton, and Einstein, is a tale of deceit. It could be seen as a progress that the deceit was intentional only from the parts of the first three.

We can correct our perception by supposing that the world has properties open to human understanding. They will make matter interact by them, not by religious principles.

As religious principles are not open to human understanding, they are well suited for the subsuming of problems whose solutions are not wanted or imagined.

This also contains an aspect of power: "If the understanding of a problem is advantageous to anybody else, preventing the understanding is important" or "We cannot let anybody use this insight." Cynicism is a part of power; and any means is useful.

The properties are expressed in knowable and quantifiable symptoms of a definable physical character. The symptoms belong to the physical character of the functions.

Measuring will have its start in the fundamentals of physics, and within their limits, as far as they are known. These fundamentals are the potentials and forces.

From the empirical understanding of electricity and gravity we have the concept of 'field', which may be useful as a general part of descriptions or models, as it can denote the range of effect of the two parts of a potential, each denoted by the concept of 'charge'.

Physical light and the power of moving charges, C m^2 s^{-3}, offer a foundation of units leaving phenomenology and the interrelations of Newton and Einstein.

Among the phenomenological models we may include relativity, since it is based on interdependent measures, not on functions or their real parts.

Light and energy.

Mass is a relation between moving bodies, their moving forces disregarded. Thus, mass is a measure of relative inertia. Matter will have to be moved by some force. In gravity, matter is moved by the sum of its charges in cooperation with the sum of the charges of other matter, *e.g.* the Earth or the sun.

The constituting substance of matter has four properties. They are substance, extension, charge, and field. These are distinguishable from each other, though they coexist in substance.

Neutrinoes are an exception casting some light over the common condition.

Relativity was introduced by Newton in his second law, $F = m \cdot a$; force equals mass times acceleration. The three parts of this equation are defined by each other, thus mass is the relation between force and acceleration; $m = F / a$; acceleration is the relation between force and mass; $a = F/ m$, and force is the product of mass and acceleration; $F = m \cdot a$.

Velocity is a measure of movement relative to time. Acceleration is the differential of velocity relative to time.

Time is a part of the physical world by being physically defined as relative movement. Without any relative movement, there would not have existed any time. Whether the relative movement is performed by stars or by parts of atoms, it can be the measure of time.

As time is relative to movement, or a relation between different movements, it is not an independent function or factor.

The relative movement is a function of the static charges of substance. Time is therefore an indirect function of the forces between positive and negative charges, at very low velocities compared to that of light. This is the realm of mechanics.

The velocity of light belongs to the realm of dynamics. Light is a moving negative charge without any counterpart of positive charge. Light does not interact with time or its measuring.

Light interacts with electro-dynamic functions, thus with magnetism in the Earth, in the sun, in ions, and in technical magnetism.

It is deflected by electrons moving above a certain velocity, *cf.* its reflection from surfaces of bodies, making them visible; but light gases are invisible.

The SI-second is established on an atomic function. It seems to be based on the hope that the atomic movement should be stable under changing conditions of temperature, magnetism, and velocity.

Since these conditions are questions of energy, which is produced by potentials between different charges, there will have to be limits to the reliability of that accepted measure of time. The physical reason for this is the transition from static to dynamic electricity and its change of energetic dimension at high velocities.

At the bottom of this function lies the character of matter and its substance. Its parts are charged particles, and they are influenced by changes of energy to the point of changing their character, even to the point of losing their capacity of measuring time, *cf.* light.

The velocity of light *in vacuo* could, maybe, be a more stable measure, though there is no interaction between light and the charges of matter, except when light is extinct at meeting matter; and its energy is absorbed in an atom.

Neither the daily conditions of light nor their marginal variations are well enough known for having been incorporated into the general body of phenomena believed to be adequate (or, at least, sufficient) descriptions of physical functions. Time belongs to this general body. Light and other high-velocity functions do not belong to it.

The relations of N 2 were built into it by Newton, because of his avoidance of theories and because of his establishing its three elements as reciprocally defined. It is clear from what Newton wrote[10] that he avoided formulating “hypotheses”, or theories (in the vocabulary of our days), as well about physical functions as about reality in general.

His law of gravitation should then be taken as a calculation model for the characteristics of a phenomenon, not as a model of a physical function. In modern notation, his gravitational constant is $6{\cdot}670 \cdot 10^{-11}\ \mathrm{N\ m^2\ kg^{-2}}$.

From his intense religious activities and his letters, we can understand that he did not want to trespass upon God’s domain by having opinions about the Godly order of the World. He probably saw phenomena as so worldly that his God would

allow him to approach them, or he regarded his laws as so far from reality that his God would not care.
When utterings about the real world are referred to Newton's second law, they are wrong for three reasons:

1. Newton's intention was to describe relations between phenomena only; and this he could do on the basis of N 2 as a model for the calculation of phenomena.

2. Newton's use of phenomena was a conscious avoidance of reality and of statements about it.

3. A phenomenological calculation model does not give the correct results obtainable with a calculation model based on physical functions.

It is therefore unfounded when Newton's relations between phenomena are used for postulating relativity between real physical bodies and their real functions. Realities of physics include that no particles of known roles in matter can be accelerated to the velocity of light. Not even the electron will reach it.

The smaller particles, quarks, *etc.*, of which the smallest particles of macro-physics are now believed to be composed, are of no functional interest in the everyday questions of the physics of bodies, fluids, light, gravity, or electricity.

The atomic bomb and its physics do not seem to be of any general relevance to the daily questions of the world in which we live, except as sources of cancer, of heat in celestial bodies, and in cancer treatment.

The relations of our everyday world are not understood. The knowledge of their functions has been in a mess since Plato, who died *c.* 248 B.C.; and its correction should have the priority of interest. The mess has existed for 2250 years; which is no excuse. The need for consistent models is not relieved till they are here.

From the sun, light is emitted as photons, which are broken-down electrons. Their complementary particles are protons, which are emitted whole from the sun at a velocity below a few hundred kilometres *per* second, less than one or two *per mille* of the velocity of light.

The imagining of effects of relativity at the velocity of light was possible because

1. N 2 is a set of interdependent definitions; describing its parts as relative to each other;

2. N 2 offers no precise foundation of the units depending upon time;

3. the parts of N 2 are relations between phenomena, not between functions;

4. inertia is the passive function of matter, which makes it the passive part of mechanics; and

5. the specific differences between mechanics and dynamics were disregarded.

These conditions account for the presumed relative changes of measures of time and length at approaching the velocity of light.

A physical function which may help the understanding of the production of forces under changing conditions is the transmission of static forces between charges of bodies, overtaken at very high velocities by the dynamic force of moving charges, *cf.* JCM 3.

An intermediate function exists, as the solenoid bonds of some molecules do interact with light and photons of lower energy. Among them are the water monomer, O_3, CO_2, and N_2O. Their electro-dynamic bonds make the greenhouse effect possible.

The conception of light as a compound wave of electricity and magnetism is misleading, as well by its picture of a wave, whose production method in Nature is unexplained, as by its presumed carrying some static electricity together with its magnetic function.

The arriving light is an actor in the dynamical relations between electrons and nuclei in atoms.
The introduction of metre in $F = m \cdot a$, changing it to $E = m \cdot c^2$, has not changed the relation between its parts; and the lacking connection to physical functions is the same as in the first version of N 2.

A postulate of modern physics is that of light's equal velocity regardless of its direction relative to its observer, and of the observer's velocity. This postulate has a physical reason in the absence of cooperation between the static and the dynamic forces of the charges.

There is no interaction between the static fields of charges at rest or in low-velocity movement, and light. This lack of interaction also comprises the possibility of measurements. It implies that light ends at the moment it is perceived.

This will be a reason for the measuring of light's velocity by indirect means, *i.e.* noninvasive means of observation. In 1676, Ole Rømer (1644-1710) measured the velocity of light by the different times of appearance of one of Jupiter's moons at different relative positions of Jupiter and the Earth.

The bodies and particles of the world have a finite size, and potentials of finite dimensions. There is a limit to their possible energy uptake relative to their constitution as bodies or particles.

Accelerating a body or a particle presupposes an energy uptake proportional to the square of its added velocity.

The level of the bonding potential as a body or particle is the limit of the possible uptake of energy as body or particle. Any further energy uptake will cause the disintegration of bodies into separate particles, and, approaching the velocity of light, even the disintegration of the electrons.

The structure of matter is produced by the potentials of its parts. They are produced by the static potentials between the positive and negative charges of their substance.

Approaching the velocity of light, these potentials lose their relevance. The transition to the domain of light will presume the removal of the properties producing the functions characteristic of mechanics.

All matter must renounce structure in order to reach a high velocity. The velocity of light can be reached by photons and neutrinoes. No matter can approach the velocity of light.

At some high velocity, substance will have to shed its protons in order to be accelerated to a higher velocity, since only electrons are small enough for reaching the velocity at which they are banged sufficiently fast together for being broken down to photons.

Electrons cannot reach the velocity of light. Photons cannot stay within the functional frame of matter. Photons originate from negative charges and bring their energy and charge back to matter when they are stopped and absorbed.

The momentum of a photon is delivered as a charge moving at the velocity of light. The size of the electro-dynamic momentum is $4\pi\rho c^2$. Photons carry the dynamic product of negative charges. They augment the potential between negative and positive charges of the atoms hit.

Photons are partly selectively reflected by the negatively charged electrons of the atoms of the surface of matter. Depending upon the electronic momentum, this makes matter visible.

Some photons are absorbed by electrons, augmenting their potentials relative to the nuclei and heating matter; and some of them are reflected into the atom. The interaction takes place through the direct encounters between photons and electrons, *cf.* the absorption spectra of the elements.

Since the velocity of light is constant in empty space, the observed redshift of light from far stars cannot be the effect published in 1842 by Christian Doppler (1803-1853).

The effect was presumed to consist in the elongation of light waves at light's passing a greater distance when its source moves away from the observer. This effect was originally described from a moving sound source in air.

Light is, though, not carried by a medium.

Light's velocity is not a function of the distance covered.

Light's velocity is not a function of the relative movement of its source and its point of observation.

Light is a magnetic radiation and is impervious to forces from the mechanical parts of physics.

Light's redshift will therefore have another origin.

Redshift could be consistently interpreted as the loss of the least energetic photons from a light source. This loss will take place at the crossing of light rays from different sources.

Light's velocity is constant.

The photons having the smallest potentials will lose most of them; and the strongest will carry most of their higher potentials along.

Since these are carrying the red light, this is visible as the residual potential of the radiation from each source. This is not an argument against the expansion of the universe, but against the current interpretation of redshift for its calibration.

The misinterpretation of light as consisting of waves is caused by the use of measuring instruments by necessity consisting of molecules, whose electrons communicate the periodicity of their electronic solenoids.

The periodicity of the electrons is ascribed to the reflected photons and interpreted as a wave movement.

This is also a relic of the wave as the picture of movements in fluids. This interpretation is borrowed from mechanics and has blocked the understanding of light's proper nature.

The energy of light is incorrectly described by the frequencies or wavelengths of instruments, whose mechanical character has been projected into the interpretation of the light, thus misrepresenting its character of radiation.

This has a consequence for the interpretation of the relative movements of stars. Their variable redshift is known; but this is not the case for their different velocities. The redshift is presumed to be significant for their movement away from the Earth; but its calibration is not yet founded upon an acceptable measurement.

The wave model should be given up, as light's own character has been understood.

H_2O, CO_2, O_3, and N_2O produce parts of the greenhouse effect by the electro-dynamic bonds of their three atoms. In H:O:H, O:C:O, O:O:O, and N:O:N, the electronic orbits will arrange each other in parallel and produce magnetic fields by their solenoid or quasi-solenoid structure.

The fields are permanent and will respond to the magnetic field of the Earth by occupying specific angles relative to it. They will also refract light.

The greenhouse effect takes place as the electro-dynamic photons of the reflected radiation from Earth are absorbed by the magnetic fields of these molecules and others having similar properties.

N_2O probably does not belong to the oldest generation of molecules on Earth, since oxygen could not have been at disposition for other composites until after the organic break-down of NH_3, CO_2, and CH_4. Minerals, like SiO_2, were probably not a source of free O_2.

Because of its persistency, water should probably be classified as a mineral.

Water is a partner and medium in all parts of biology and in much of the inorganic world. It is a physical participant in energy transmission and in the syntheses of organic matter and its surrounding conditions.

Though not chemically engaged, it is a participant in biochemistry and physiology. With its strong inner bonds, it can establish subtle external bonds, easily loosened, tolerant to nearly everything, except fats.

Water will transport molecules and distribute energy under biological potentials, which, seen as functions, are electrical.

The external bonds should be empirically seen as those of ions. The structure of the electrically active water molecules is, though, different from the ions of chemistry proper, as is their function. The ions of water are intermediaries rather than participants, though they also perform the important part of element of the composites of ligaments, skin, and bone.

This chapter's description of water's physics is mostly built upon that of reference 29.

External potentials can be stronger than the inner forces of molecules; thus keeping them from certain relations. Magnetic fields and high temperatures are strong actors in this respect.

Water is more resistant than the compounds with which it is interacting. This can be ascribed to the high potentials and energetic equivalence between its two parts, oxygen and hydrogen, whose ionization energies are, respectively, 13·61 and 13·60 eV. Few elements have higher potentials than these two.

At 2750 K, 90 *per cent* of a quantity of water is still intact. This is due to the static charges of most matter, as the forces of these charges have no effect on the electro-dynamic bonds of water, *cf. ch.* 8.

Its strong internal bonding forces leave only small potentials for external use. This is seen in water's extreme versatility at transporting nearly everything in Nature. The differentiation of the functions performed seems to go down to nano-newtons. Even the atoms of Na, K, and Cl are carried by water ions through our axonic membranes as they conduct their signal.

Water ions are whole molecules and not comparable to the ions of atomic physics or inorganic chemistry. 'Ion' is understood as an atom or molecule having a degree of polarity and therefore being movable in a field.

Water turns conspicuously to ice at a low external energy; but we have problems at understanding its changes between thawing and boiling. Its expansion at freezing is the opposite of other matter's behaviour. The changes of structure and functional possibilities at different temperatures indicate specific mechanisms proper to water.

Water consists of polymers of the monomer H_2O. In vapour, it has the form H:O:H. The magnetic fields of the electronic orbits hold the atoms together on a straight line until the monomers meet in condensation. Ice is a continuous, three-dimensional grid of polymer water.

In each polymer, O is the node and link between the monomer parts. (The word “monomer” will be used here for the H_2O-part of the polymers as well as for the true monomers.) A hydrogen-atom of one monomer forms the H-bond to the oxygen-atom of the neighbouring monomer H:O:H.

At melting, *c.* 13 *per cent* of the H-bonds are loosed. Water above 0 ºC is still polymeric, though not molecularly homogeneous. It is a kind of gel of polymers of different sizes. Its properties vary according to the proportion between three polymers, which is variable according to temperature.[32]

It will also vary according to added energy in other apparent forms than heat. The capacity of water for receiving and communicating energy is variable according to its temperature, partly with great differences at variations of a couple of degrees.

Our physiology is based upon water’s polymer distribution and electromagnetic properties at 37 ºC. We do not tolerate great variations, *cf.* deadly fever and exposure to cold.

Its ions’ capacity of dissolution is the function giving water its potential for participation in chemistry and biology. Its apparent low pressure on the nano-level is due to ionization, which gives water its high chemical affinity and physiological flexibility.

Oxides are strong, especially those of the first periods of the periodic system. The metal bond is weak because some of the electrons do not participate in it, but can wander freely and with a low resistance in the crystals. Metals have low coherence. They can be formed by cold pressing; and the softest of them can be drawn to thin thread.

They become harder at receiving energy by hammering. They become brittle because a greater energy augments their resistance to a load without a change of form, thus they are not deformed before breaking. At heating they will release the added energy that has bound the electrons in the crystals.

Metals are useful for their flexibility, their property of taking up forces by the dislocation of atoms within the crystals. Alloying, hardening, and tempering are means of exploiting the mobility and binding forces of the electrons, producing the useful combination of softness and strength.

The molecules of water are not composed by ionized partners. They seem to be covalent by not being rigid, since each monomer can change its form like a spring. The form of the monomer is determined by the electrical fields of its constituting atoms.

The bond of water, rather than covalent, should be seen as the magnetic bond between three atoms’ solenoids of electronic charges moving in parallel and producing close, opposite magnetic poles leading to the bonding, *cf.* the right hand rule.

Each water monomer contains two solenoid bonds. As they are electro-dynamic, they are not broken by the forces of static charges, *cf.* water’s resistance to high temperature. In most meetings between water and other matter, this matter’s bonds are loosed, not those of water.

The forming of water ions takes place without any profound change of the water monomer, as its electro-dynamical bonds do not take part in the external forces of the ions.

The electro-dynamical bonds of each monomer are impervious to electrostatic or mechanical forces, *v.i.*

Magnetism influences the electrical fields of ions, atoms, and crystals. A few of them can be permanently magnetized, *e.g.* Fe, iron. Oxides are not influenced by electro-magnetism, except some piezoelectric crystals, *e.g.* quartz, SiO_2. Its structure is the same as that of water: O:Si:O. As constituted by two solenoid bonds, it is a part of the magnetic world.

The extrovert forces of the monomers form polymers. Water ions are polymers of both polarities. They occur spontaneously at a rate of one mole times 10^{-7} of each polarity *per* kilogram water, *cf.* Avogadro’s number and the Sørensen scale of hydrogen-ion concentration.

One mole of water weighs 18·01534 g. The functions of the water molecule will be understood by presuming that

1. water consists of polymers of H:O:H, that

2. the size of the polymers is variable between ice and vapour, that

3. its fundamental properties are produced by the magnetic bonds of its monomers, that

4. its empirical properties are produced by the H-bonds between its monomers, that

5. its chemical, physiological, and anatomical usefulness and properties are produced by its ions, and that

6. the hydrogen bond between its monomers is established by a reciprocal polarizing.

Above the boiling point, there is no connection between most of the monomers, thus each of them will be straight. Below that temperature, the H-end of one monomer and the O-middle of the next one will polarize each other.

Monomers are vapour, but vapour also contains a little part of dimers.[33]

A monomer of water not influenced by external field forces will have its forces distributed so as to place the two H-atoms diametrically opposite to each other: H–O–H. With an eye to the solenoid origin and magnetic character of the bond, it can be written H:O:H

In a dimer of water,

$$\begin{array}{l} \mathrm{H} \\ \quad \mathrm{O}^{(-)} - {}^{(+)}\mathrm{H\ O\ H}, \\ \mathrm{H} \end{array}$$

the monomers will be reciprocally polarized. The H-end of one monomer is bonded to the O-middle of the other. Their polarity is induced at their meeting.

As indicated by the parentheses, the induced forces of this hydrogen-bond are weaker than those of normally ionized atoms. One half of the dimer molecule is straight because of the absence of a force transversal to its axis.

In greater polymers, the monomers between the others are polarized relative to molecules on both sides. They are therefore more strongly bonded as well as more strongly polarized. This could account for the deviations from a linear function of temperature in water's absorption of energy.

This is seen in its minimum of specific heat capacity at 34 ºC.

In metals, electricity is conducted by electrons in free movement. They get their direction from an electric or magnetic field.

Solids are strong when their electrons have permanent potentials to their atomic nuclei and are not easily moved from their orbits.

Mechanical strength of solids depends upon the low capacity of the electrical potentials between electrons and protons in each atom for communicating electrons to the next atom and molecule.

When electrons can slip away, electricity is conducted. This takes place at the cost of strength, which is the capacity of holding the atoms in the same relative positions, depending upon the potentials between the particles of the atomic substance.

Water's hydrogen and oxygen do not let their electrons loose. At Nature's energy levels, there is no possibility of ionization of either.

Lightning and thunder follow the specific form of ionization of water. We shall return to that.

Pure water is a weak conductor of electricity.

The functions of water are dependent upon temperature. This has raised the question of its distribution of polymers. It is presumed that, at 0 ºC, the proportion of trimers, $(H_2O)_3$, is *c.* 30 *per cent*, and of tetramers, $(H_2O)_4$, 70 *per cent*. These are supposed to be below 20 *per cent* at the boiling point; and the share of the first is thought to rise to around 60 *per cent* at 50 ºC. Between 25 and 50 ºC the dimers, $(H_2O)_2$, show their presence.[31]

The deviation from a linear function between temperature and water's absorption of energy is seen in its minimum of heat capacity at 34 ºC. This could be due to the presence of dimers.

The monomer as a part of a polymer will take up force and potential as a variable change of angle, a tension. Like a bow is curved by pulling the string, the monomer is given an angle by the push on the two H-atoms from the other monomer hanging on to its O-middle.

A general mechanism is involved in this form. When energy is used in the production of a permanent potential, like the angles of water or protein molecules, it is bound in this potential and will not be at the disposal of other bonds.

The active sites of molecules are not locked in angles. In water, this is seen in the straight part of its ions, which are their active sites.

The property of force distribution is exploited in structures like skin and bone. The bonds between minerals, proteins, and water are established by the water ions, not by the current polymers.

The bonding of ice is three-dimensional since the H-bonds can be rotated. They are locked at freezing; and their positions are not accidental, as the charges will keep the parts of the polymers at certain angles and distances. This is seen in the six-armed snow crystals.

We also see the forces of nano-electricity when they have been converted to chemical dynamics.
The possible structure of a tetramer:

```
H          H
  O – H O
H          \
           H
             O – H O H
           H
```

The angle of the first three monomers is 104·5° in ice and will be a little more in water. In each polymer, the last monomer is straight.

The H:O:H-bond is electrodynamic, *i.e.* magnetic. The bonds between the monomers are hydrogen bonds. These are weaker than the magnetic bonds within each monomer; and they are successively broken from thawing to boiling. The potentials of the bonds between the monomers will have to be smaller than one elementary charge.

The H-bond is not determined in a plane, as it does not contain a momentum impeding torsion. It can be rotated; and the angle of (360° - 104·5°) . ½ = 127·5° is kept.

In ice, the rotation is locked by the equal forces of the branches of the polymers, resulting in a crystalline structure.

Possible structure of a tetramer cation, hydronium, $(H_9O_4)^+$:

```
H          H
  O -  H O
H          \
           H          H
             O - H O
           H          \
                       H+
```

Ionization of water is different from that of atoms. It takes place by the translation of an atom of hydrogen from one polymer to another, producing a pair of ions.

The size of their potential is probably smaller than that between electrons and protons.

A possible dimer anion, hydroxyl, (H_3O_2):

```
H
  O - H O -
H
```

The ions of di-, tri-, and tetramers will most probably have analogous forms. It is not indicated that dimers exist at temperatures below 25 ºC, while ionizing has taken place.

A small part of dimers is found in normal vapour.[33] They could be molecules of a higher energy by having the structure and potentials of hydroxyls or hydronia. It seems probable that a majority of the straight molecules of normal vapour is kept from the contact needed for the exchange of H-atoms. This is also indicated by the thunder cloud, *cf.* below.

The electrical potentials of the ions produce an environment of forces for the dissociation of salts, and for buffers. The potentials between the quantity of ions can exchange energy with everything from ions of the neurons to protein molecules of thousands of atoms.

It could be the ions that permit water to wet matter, especially organic matter. The ions dissolve matter; and the wetting could be the starting condition of dissolution.

The production of ions could be initiated by a lack of equilibrium, as it is initiated by a too great distance between the positive and negative ions. For the role of prime mover for this function, the Earth's magnetism is a strong candidate, *cf.* below, this chapter.

This implies that the presence of new ions is needed for maintaining equilibrium within the sum of magnetic fields.

The empirical fact is that the lack of one ion provokes the production of a new pair. The ion disappears when it is bound to another molecule, or when the distance to its partner becomes too great. One of these conditions is necessary and sufficient for producing a new pair of ions.

This mechanism is that of the formation of thunder clouds as well as that of formation of acids and bases.

The ionic effect of an electrolyte is performed by the water ion not bonded to the molecule characterizing the ionic compound.

Electrolysis is not a transport of ions, in any meaning, from one pole to the opposite pole, but the depositing of dissolved matter at one pole or both.

Water ions are continually produced in the middle of the electrolyte; and they transport their molecular or atomic load to one of the poles.

Blood consists of 45 *per cent* water. The main part of the rest is red blood corpuscles. Negative charges on their surfaces repel the particles and hold them at a distance from each other, thus letting the blood run. Without this electrostatic function, blood would have had the consistence of porridge.

The ionizing of water takes place by influence from the ions of dissociated matter. At any pH, there seems to be equilibrium, since there is always a free water ion counterpart to the bound ion. Though pH 7 is the ionizing of twice 0·000 000 10 mole, this part contains $1·2.10^{17}$ molecules *per* kg water. The distance between the ions will be 200-250 nm.

A quantity of water could be sensitive to its multitude of magnetic fields. Some field force will have to operate between the ions. This force could most probably be the magnetic fields of the monomers of water. In ions, the fields will be different from those of the normal polymers; and the absence of this difference could be the force initiating the differentiation of two new ions.

The ionization at pH 7 could be produced by the magnetic field of the Earth. The magnetic field of a quantity of water could be the necessary physical connection between the solenoid structure of the bonds of the water monomer and the magnetic macro-field of the Earth. This could be tested.

In each polymer, one of the monomers is straight, as it is not exposed to lateral forces within the polymer, *cf.* above. The straight monomer H:O:H fills a smaller volume than that formed by a lateral force:

H H
O

This difference accounts for water's expansion at freezing.[29]

The presumed lower pressure observed in water[32] could be the effect of ions. They do not offer any resistance to dissolving great quantities of matter without appreciable expansion. It is not known whether tetramers and trimers are cleft at ionization. If that is the case, the sum of their volumes, plus that of the dissolved matter, will remain constant.

With the distribution of 70 to 30 *per cent* at 0 ºC,[31] the tetra- and trimers have 17·5 and 10 *per cent*, respectively, of the constituent monomers of a quantity of water in straight form between 0 ºC and *c.* 30 ºC. Each of them fills *c.* 0·024 nm^3. Bound in ice, which is a continuous network of angled monomers, they fill a greater volume, *c.* 0·032 nm^3.[29] At 0 ºC, the volume of ice is 9·034 *per cent* greater than that of water.

The expansion at freezing takes place by the greater volume occupied by the straight monomers when they are angled by the moment received from a hydrogen bond.[29]

Why should water then not shrink as the polymers are split and one part of them occupies a smaller volume?

The added energy, seen as a rise of temperature between thawing and boiling, makes the molecules' relative movements more intense. This takes place in all fluids, making them occupy a greater volume at rising temperature.

The expansion is between 1·12 and 1·66 *per mille per* centigrade in acetone, ethanol, benzene, ethyl-ether, carbon disulphide, carbon tetrachloride, methanol, and trichlorine ethylene, while in glycerol, it is 0·5 *per mille*.

Water expands at 0·207 *per mille per* centigrade at 20 ºC and 0·67 *per mille per* centigrade between 80 and 90 ºC. On average, it expands 0·426 *per mille per* centigrade between 3·98 ºC, where its density is at maximum, and 100 ºC.

The other fluids expand three or four times that amount. These fluids are, in several ways, not comparable to water. Can we then compare them? In many aspects, we cannot; though it seems well indicated that the expansion of water should be a product of other molecular processes than those taking place in other fluids.

Water shrinks 0·133 *per mille* from 0 ºC to a least volume at 3·98 ºC. A number of H-bonds is probably not broken at melting, but a little later. At the first centigrades above melting, the rise in the common molecular movement is not great enough for compensating the shrinking produced by the forming of new oligomers.

The expansion above 3·98 ºC takes place by the ordinarily augmenting molecular movement, which is visible by the Brownian movements. It takes place together with the shrinking making their sum lower than the expansion rate of other fluids.

The expansion of water is small because its monomer parts not receiving a lateral moment from a H-bond will keep their straight form and smaller volume. Their number is augmenting at rising temperature.

Water's dynamic viscosity at 0 ºC is $1·787 \cdot 10^{-3}$ $kgm^{-1}s^{-1}$, or pascal second. It is higher than that of mercury, at $1·681 \cdot 10^{-3}$ $kgm^{-1}s^{-1}$; and it is lowered by 27 *per cent* from 0 ºC to 10 ºC. This says nothing about the form of the molecules, only that the sum of their form and size gives a 37 *per cent* greater viscous resistance at 0 ºC than at 10 ºC.

Pascal second is the empirical unit of dynamic viscosity. It is derived from Newton's second law and its foundation in inertia, which is not a physical function, but the secondary phenomenon upon which Newton built his second law.

The function at work is the magnetic field strength, performed by the charge of the matter involved. It is measured in coulomb; and the new unit will be $\boldsymbol{H} = \mathrm{C\ m^{-1}\ s^{-1}}$.

In so far as the transitions between polymers take place at unequal rates, this can explain that water has unequal values of specific heat capacity. This can be presumed to have part of its reason in the different strengths of the H-bond. Monomers in the middle of a polymer are exposed to forces from both sides, making some bonds stronger than others.

Several polymers can have the same energetic situation at the same temperature. They can be broken simultaneously, so that a higher energy uptake and a lower rise in temperature are measured as a higher specific heat capacity. The same polymers will be reconstituted at sinking temperature, releasing energy.

The unequal expansion at rising temperature indicates that fewer H-bonds are broken closer to the boiling point, giving the thermal movements an upper hand over the shrinking of molecular volume. Simultaneously, the gradient of the change of viscosity is lowered to ten *per cent* between 90 and 100 ºC.

The gradients of water's energy uptake are unequal and rather great. The potentials of the dimers will have to be higher than those of tri- and tetramers. This should be the reason for the temperature-dependent variations in the energy needed for hydrolysis, *v.i.*

The strength of the H-bond is limited. It is formed at condensation, when energy is removed. It is weaker at high temperature.

Condensation at different combinations of pressure, temperature, concentration of dissolved matter, and, probably, magnetism, will be the mechanism for forming new matter.

It could be the mechanism of unexplained forming of matter. It could be understood by its reverse process, which should be the known dissolution of proteins at 140 ºC and 360 kPa.

The combination of pressure and temperature is probably a constraint on the process. What we interpret as enzymes could be the surplus participating protein from the condensation in the original cosmic cloud on its way to becoming the Earth.

Changing magnetic fields are prohibitive for water's biological functions, *cf.* the microwave oven, which divides the polymers of water and makes them useless for biological purposes.

The static magnetic fields of the Earth pose the frame round water's function in life. The detailed functions of life will be better understood as dependence upon water's magnetic constraints. These are the same as those active in the relations between water and inorganic physics.

It seems a paradox that our neural function should be inorganic. It is built upon water's transport of single atoms of metals in our nerves, combined with the specific structure of the inorganic water ions. Our complex organic chemistry is working within a frame of physical conditions which are those of the inorganic world, of which we are a part. This indicates physics as life's conditions.

Between the potentials of vapour and ice there is a transition through water from monomers to the crystal of ice. When the H-end of the monomer is not exposed to the energy level of boiling, it can approach the O-middle of the neighbouring monomer. The fields of the electrons of the O-atom will push away the electron of the H-atom. The hydrogen bond is established between the H-end of one monomer and the O-middle of the next.

This can be understood as the reciprocal, though unequal, repulsion of the electronic orbits of the two atoms. The electron of the hydrogen atom is alone and is pushed to the point of exposing a part of the nucleus, which will then be attracted to the electronic fields of the O-atom, in this way letting the positive charge of the H-nucleus be bonded to the electrons of the oxygen atom.

The bond formed is weak, compared to the magnetic bonds of each monomer, so it is the first to break. The two bonds of the water monomer are among the strongest of molecular physics; and they persist to above 2500 K.

Their participation in chemistry is at a distance, by the ions, as the internal bonds of each monomer are electro-dynamic.

The static forces between the fields of external atoms are not among the electro-dynamic forces of the internal bonds of the water monomers. Thus, water's chemical role is performed by the transient bonds of the water ions. In bone and other long-lived structures, they are renewed through the years.

The reciprocal polarizing will let one monomer's H-end be bonded to the O-middle of the other monomer. By the static field of the electron of the H-atom, the two H-atoms of the other molecule are pushed away from the hydrogen bond, thus forming an angle, since their like charges keep them from meeting. In ice, this angle is 104·5°. It is seen that the angle is not spontaneously formed, as it depends upon the presence of the other monomer.

The bond's magnetic mechanism makes it strong. As the field of the monomer is magnetic, its polymers and ions will be oriented in a magnetic field; and in a changing field they will turn at each turning of the field.

The transmitted energy will tear the polymers apart as the water is heated, *cf.* the microwave oven.

This should also be seen as changes of density, viscosity, and specific heat capacity relative to the normal at the actual temperature.

Water can enter into dynamic interaction. The nerves function by the passage of water ions through their membranes. The passage goes through holes, 10^{11} *per* mm^2, each leaving space for one water ion, which should be a trimer or a tetramer, *cf. ch.* 3 and 8, with one atom of Na or K attached.

The membrane passages are fatty and repel the composite ions. The energy needed for the mechanism is provided by the protein bodies scattered in the membrane.

The nerve signal is the moving magnetic field of return passages. Calling this a 'wave' is not an aid to understanding the mechanism.

This magnetic mechanism is possible because of the two solenoid, thus magnetic, bonds of the water monomer. As a small magnet, it will move in the magnetic field produced in the axon membrane by its small inclusions of proteins. The moving molecule in one passage influences that in the neighbouring passage and initiates its movement.

Through its ions water takes up forces and can transmit energy. The ions form the links between water and other molecules. The body tissues are held together by the H^+-ends of water ions joined to the hydroxyls ($(OH)^-$) on proteins and phosphates.

The strength of the body tissues depends upon water as the link between proteins and, in the bones, between proteins and hydroxyapatite. The bonds of water transmit and distribute forces through changes of distances and angles.

At sinking temperature from condensation at 100 °C, water's dimers, trimers, and tetramers are successively formed.

The energy of a number of H-bonds equals that needed for their loosing and transferring ice to vapour. It is 54·179 kJ mol^{-1}. The new unit should be $Cm^2s^{-2}mol^{-1}$.

In the ice, each molecule was bonded to the neighbouring molecule. Avogadro's number is 6·022045 . 10^{23} mol^{-1}.

The average energy used for the loosing of one bond is 9 . 10^{-20} J, or rather Cm^2s^{-2}.

This loosing energy is a difference between conditions. It is lower at higher temperatures, as the energy of water is higher. This explains part of the difference of energetic conditions between water and the organic fluids.

Sublimation is an energy transmission depending upon the thermodynamic potential between ice and air. Hoarfrost on the roof in a winter night adds noticeably to the internal temperature of the house by lowering its loss of heat. 0·1 millimetre precipitation as rime gives 36 MJ (or MCm^2s^{-2}) on a 120 m^2 roof, corresponding to 10 kWh or one litre petroleum in the stove.

The monomer of water has an average volume of 0·03 nm^3. The last monomer in each polymer is straight; and its volume is somewhat smaller. This monomer is *c.* 0·3 nm long; and its average transversal area is less than 0·1 nm^2. Its volume is *c.* 0·024 nm^3.

One cubic millimetre is one milliard milliards (10^{18}) cubic nanometres. If we imagine a model of one cubic millimetre water at one million times linear enlargement, it will be one cubic kilometre.

One cubic nanometre would be rendered by one cubic millimetre; and its 33 water monomers would be visible under a good light. Grains of sand the same size would be easily felt between the fingers; and a corresponding sanding paper would be medium rough at 80 mesh.

The distance between the O-atoms in ice is 0·276 nm.[32]

If the H-bond works over *c.* 0·14 nm, its force will be *c.* 6.10^{-7} N (or Cms^{-2}). If the extrovert force of the bond corresponds to 0·56 of one elementary charge, its potential difference will be 0·3 V. The field strength will be in the order of 10^{12} Vm^{-1}. The units should be reformed as new units, *i.e.* not as related to the phenomenon inertia, but to the actual physical forces.

Organic reactions require different energies at different temperatures, often at differences of a few degrees. Alcohol changes the water structures. Splitting the polymers takes energy. At mixing alcohol and water, the energy taken from the fluid lowers its temperature.

Some life processes require more energy in a water-alcohol mixture than in pure water. The difference is variable and greatest at 37 ºC.[35]

After a succession of conditions, we humans have received a chemistry having its minimum energy cost at 37 ºC, while ants (Formicidae) have minima at 12 and 26 ºC, *cf.* the difference in metabolic energy cost, ref. 35.

This should make us suspect hot drinks and alcohol to leading to brain dystrophy and cancer; perhaps together with specific proteins, especially the amino acid glutamine, whose compounds are not dissoluble in water, but in alcohol, and specific poisons, like aluminium and mercury, *cf.* ref. 29 and 41.

Water's high frequency permittivity, calculated from measurements with microwaves up to 100 GHz, shows a fall of 20 *per cent* between 35 and 40 ºC.[34]

To a sinking high frequency permittivity should respond a rise in water's magnetic susceptibility, *i.e.* its absorbing energy from a magnetic field, which takes place on a nano-level in neurons. The reciprocal rise to a fall of 20 *per cent* is 25 *per cent*, thus our nerves are probably ten *per cent* more efficient at 37 ºC than they would have been at 35 ºC. Thus, it is important to protect the brain against any loss of heat.

Induction could also be a part of hydrolysis and synthesis. The magnetic field of the Earth will influence the micro-fields of bio-molecules and water and the output of their functions.

The dissolving force of water is higher at high temperatures; and its binding force is stronger at low temperatures. This could have a relation to the polymer size of the water ions relative to temperature. It is important in the condensation of amino acids.

It could cast light on the shells and skeletons of the Cambrian animals and their dominating descendants. They are different in essential functions from the pre-Cambrian hot-water fauna, whose living relics are found in our blood during infections, in hot springs in volcanic areas, and close to hot ocean vents.

The Precambrian glacial period was close to be a termination of life, as its hot-water conditions were nearly destroyed.

Size and structure of protein molecules, mineral ions, and water molecules should be significant for the function of proteins, *cf.* the magnetic susceptibility.

The Cambrian cool-water restart of life showed that its development was not autonomous, but a product of changing conditions.

The new calcium salts augmented the energy circulation of life and provided the shells and backbones of new structures as well as new constraints on physiology.

Our prehistory could be generalized into the postulate that

a greater number of constraints is a necessary condition of development.

Our body temperature of 37 ºC has probably given us the best possible function of our brain and nervous system. Other constraints have kept the temperature down, *e.g.* the polymer composition of water, which is deadly at 42 ºC.

42 ºC seems to be an absolute limit to human life and probably to most of the life forms we meet in our everyday world. Even fungi living on plants are killed at 42 ºC, so flower bulbs can be saved. Their limit function could be the coagulation of some proteins.

Fever is provoked by infections caused by micro-organisms. It seems that those organisms have some means for producing the local climate they prefer, including dimers of water.

It does not seem probable that sick persons should be capable of producing a mortal fever. It seems probable that the proteins are smaller at higher temperatures; and that 42 ºC is a critical transition, since we should expect the complexity of structure and function to be higher in our proteins than in those of, *e.g.*, malignant bacteria surviving from the Precambrian hot-water fauna.

Water, proteins, and coagulation are different above and below 42 ºC. When life started on the new cool-water track around 600 My ago, the exigencies were enormous and absolute: "Continue life on new conditions, or die out!"

The Precambrian bacteria and hot-water fauna bear witness to the change from the hot-water world to our cool and complex life.

There is no indication of a neural system in hot-water mono-cellular fauna. The dimers of fever at 42 ºC could cause the collapse of our neural function, leading to death, *cf.* below.

Before the Precambrian glacial period, life was a soup of chemicals produced by their temperature and pressure. Sinking temperature would lead to condensation of new composites.

Above 140 ºC, water probably had the form of dimers only. Its pressure was above four atmospheres, *cf.* the dissolution of proteins, above. A few spontaneously formed chemicals were present: methane, CH_4, ammonia, NH_3, and dihydrogen sulphide, H_2S.

The forces of water could combine them into high-potential matter, stronger than Nature will offer today outside the sulphur pools of, *e.g.*, Yellowstone. Free oxygen was not present, as the oxides of silicon and hydrogen were formed earlier. CO_2 and N_2O seem to be younger.

The high temperature is seen as a lower limit, since the protein chains today are split into single amino acids at a pressure of 360 kPa ($Cm^{-3}s^{-2}$) and a temperature of 140 ºC. Their parts were produced under higher energies and condensed under these conditions.

Life before the Precambrian glacial period consisted of bacteria and small worms. It was weakly mineralized, as is seen in their descendants. Hot water and sparse minerals were favourable to bacteria thriving in water having a high proportion of dimers.

Our best drinking water seems to be cool and rich in the right minerals, especially calcium. This water will consist of tetramers and trimers.

Monocytic plants had produced the oxygen-rich atmosphere before the Cambrian. The monocytic life survived the glacial period close to springs so hot as to exclude tetramers from the water. The oxygen available was limited.

The glacial period ended when the sea-bottom sprang open *c.* 600 My ago. Calcium carbonate in fossils was first found in the Nama Group, Namibia.

The significance of this find is that calcium forced the primitive animals into an evolution they could not resist.

This find signals the start of the 100-million-years' development of mineralized multicellular animals. They continued life in a sea 60-100 ºC cooler than that in which they were developed several hundred million years earlier.

The malignant bacteria could have survived in the hot springs, and by producing dimers from the water contained in the organisms invaded. This could explain their present mortal activity at 42 ºC. Here, Cambrian multicellular life cannot follow them. The dimers support a fast metabolism and a low structural complexity.

Inheritance could not have been a condition of biological change, *cf.* the properties of birds. Their body temperatures up to 43 ºC are different from that of their reptilian cousins, but, maybe, an answer to a "Develop or die!" from 150 My ago. We mammals are younger, after development in a cooler world.

Individual properties cannot always have been a question of heredity. Life does not have an infinite history— there was a beginning to DNA.

The cleaving of a cell could have been a process through which its parts are separately divided and recombined. The transition to defining the function of each part of the cell and characterizing it by a code was a long step to making reproduction fast and secure.

Its downside is the lack of adaptive capacity, as all resources of reproduction are invested in the constancy of the inheritors. This is a doubtful method, as is seen in the low adaptability of most animals more developed than earth worms (Clitellata). The lack of change can lead to stagnation; but a stubborn defiance of conditions leads to a loss of survival capacity, *cf.* our deficient protein metabolism, ref. 29.

Do we have any possibility of running after Nature and remake our capacity for living with the iridium from the meteorite of 65 My B.P.?

No. The stability of heritage is a guaranty of malady before death, *cf.* our pandemic cancer; not of survival under changing conditions.

The Cambrian was introduced when the sea bottom was cleft by volcanoes. They heated the sea, removed its ice cover, and released great quantities of calcium salts. They did not produce enough heat for reconstituting the conditions of the ancient life. The differences were water's temperature below 42 ºC, and calcium's and polymer water's constraints on life.

Life was forced to take new directions. The change would have shocked any scientist from 600 My B.P. The realm of life was redefined.

In spite of the new cooperation with trimers and tetramers of water, the proliferating molecules could take up great energy.

This was due to the new minerals from the sea bottom. In succession of volcanic activity, they were calcium carbonate, $CaCO_3$, calcium sulphate, $CaSO_4$; and calcium phosphate, maybe in the form it exists in animals today, calcium hydroxyl phosphate, $Ca_5(OH)(PO_4)_3$. This succession is visible from the layers of fossils.

A difference is seen between the carbonate of Mollusca and the sulphate of Crustaceae, which are deposed as shells and carapaces, separated from the metabolism of the animals, on the one hand, and the bones of Vertebrata on the other, as these are metabolic parts of the body. To our luck, the phosphates became compatible with our metabolism, or *vice versa*.

The potentials of pH and inorganic salts gave new possibilities of animal size and motility. The new minerals supported bodies more complex than the old. A few hundred million years later, they crept ashore and became land animals.

The old hot-water fauna is still found in hot springs. Some of its descendants have become malignant bacteria in warm-blooded animals. If they produce their conditions by separating water dimers from the mixed water, or by cleaving water polymers, that could explain fever, which does not seem to be spontaneous.

If bacteria use the small dimer part of water at 37 ºC for producing heat, that could be their completing method. The limit to our life at 42 ºC could indicate that the human metabolism is handicapped when dimers are more than a small part of the water it uses.

This should warn us against using the microwave oven for preparing food. Trimers and tetramers of water are the conditions of a more complex life than that of the worms of hot springs. We should drink cool water.

It seems probable that water molecules at below *c.* 42 ºC, and stabilized in the magnetic field of the Earth, can offer us the right energy level. Fields and ions outside our conditions will distort the syntheses upon which we depend. Fever-producing bacteria are an instance.

Diseases possibly depending upon metabolic deficiencies could be related to functions of water, *cf.* cancer, *v.i*.

At 37 ºC, our metabolism works close to two optima, that of minimum energy needed and that of maximum output of magnetic induction, together giving us an efficient metabolism and neural system.

Tissue syntheses could take place on the same conditions as hydrolysis. Proteins are cleft by hydrolysis of the peptide bond. We may suppose the coincidence between the magnetic properties of water and its energy offer to hydrolysis to be a necessary condition of man's development of complex functions, *cf.* ref. 29, *ch.*19.

Water molecules are impaired by the energy from high-frequency electromagnetic radiation. Water takes up energy from the middle of the UV-spectrum, from 190 nm downwards. The resonance frequencies are from 1·58 PHz upwards. At one point the ions will be shaken loose; and at a certain frequency, the ions will be cleft and destroyed. Anabolic sequels of this mechanism are known, *e.g.* skin cancer.

The interaction of ions is exposed to high-frequency energy. Frequencies above PHz produce energy on the level of atoms and are ionizing. Other types of radiation will attack atoms regardless of the presence of water.

Foetuses are hurt and deformed by technical magnetism. Syntheses of organic molecules depend upon polymers of water, which are broken down by strong magnetism.

Resonance between interfering fields can keep the water molecules moving and produce dimers and monomers, even at 37 ºC. This will impede syntheses, as the function of enzymes depends upon their cooperation with water ions at their correct potentials for the syntheses.

Leukemia is observed in weak changing fields, perhaps by the inhibition of anabolic enzymes in the interference between the magnetism of the Earth and single-phase conductors of alternating current. Variations could be due to technical installations producing local changes of the magnetic field.[36]

As water is constituted by magnetic bonds, it will react to external magnetic fields. The microwave oven can show how changing fields influence the structure and potentials of water, and could demonstrate its participation in the syntheses of bio-molecules. Fields of varied frequencies combined with static fields could be an aid to finding some of the keys to biological syntheses and their misbegotten variants.

There is a need for knowledge about the effects of magnetic fields, radar, and microwaves on physiological and anatomical syntheses. The link between the effects from technical installations and the organic defects is the magnetic structure of water.

Airplanes above the airport of Oslo met problems, as long as the automatic landing system was based on the magnetic field of the Earth.[74] This system is now left.

The magnetic disturbance was due to the vast deposit of water in the ground under the airport.

Magnetic fields, though permanent, are not static, but products of moving charges. This implies that their relations to other moving fields are complex, though predictable when the relevant functions are found.

In the body, the distribution of water polymers is hardly a sufficient reason for the differences of metabolic energy levels around 37 ºC, though it is one of their conditions.

Salts formed by exothermal reactions will have to take up energy at dissociation; and this energy should make syntheses possible.

Buffers should transfer potentials from thermal to chemical use without influencing the temperature; or for stabilizing the conditions for the enzymes, which is the same.

It seems possible that our electrolytic buffers, which transmit energy for the syntheses, are assisted by the potentials of water at optimum distribution of polymers. This implies that the distribution of water polymers is highly significant for life.

The connections between magnetism, other electromagnetic fields, water polymers, and normal and malign conditions of biology, are not known and should be the objects of study.

One element of the complex is that water dissolves more at higher temperatures; but it makes greater and more solid compounds at lower temperature.

Our fever-producing bacteria live by what they can dissolve of us at 37-42 ºC.

Our constitution is at its healthiest at 37 ºC.

A physical difference between these two conditions is the greater proportion of dimers in water at the higher temperature. As water makes up 72 *per cent* of grown-up human individuals, the difference does not seem great. Still, the bacteria could have some specific advantage at 42 ºC, *cf.* the nerves, above.

Water could add energy to syntheses by forming greater polymers. This would be the complementary function to the need for external energy in order to produce the dimers of higher temperatures.

It is possible that the development of bones in animals should not be a product of phosphate and calcium only, but also of the useful polymer composition (tri- and tetramers?) of the water.

Our phylogenetic past makes syntheses now possible under specific conditions only. The coordination between the Earth's magnetic field and, through our body water, our physiology, is the mechanism of high vitality.

This also indicates that water and its high temperature in the interior of the Earth are necessary conditions of life on its surface, as the conditions of magnetism fathom all life and coordinate its functions.

It should be possible to arrive at a quantified model of potentials and mechanisms involved, *e.g.* the effect of magnetic fields on water with dissolved matter, relative to temperature.

Water is a mediator of energy, an insulator, and a partner in all bonds of life. Its mediation fathoms all functions of biology.

After the negative entropy of sunshine, water, its partner in dynamics, is the most necessary condition of life. Relative to life, water is an extrovert, unselfish medium. We can use its capacity for energy transmission on certain conditions. We should know these conditions in order not to destroy them.

The water we drink should probably be our source of minerals, though not of aluminium[41] or heavy metals. Distilled water is, though, not our first choice. Gas-free water is more easily absorbed than gaseous. Tri- and tetramers are better than dimers; so we should prefer cool water.

If it is heated, it should not be above 37 ºC, and not in a microwave oven, which will destroy its cool-water structure, as its magnetic bonding is the condition of its function, upon which we depend for our life.

The function of water is the mediation between dynamics and mechanics. The energy for life's activity is received from the sunshine. It is hardly possible to see life as a product of mechanical energy.

Lightning and electrolysis.

In the thunder cloud, positive and negative charges are vertically separated. The positive ions are found in the upper parts of the dark and high clouds, 8-13 kilometres above the land or sea.

The part of the cloud 3-8 kilometres from the ground is negatively charged. The bottom of the cloud is positively charged.

The temperature of the cloud is +5 ºC in its lower parts and -45 ºC in its upper parts. Its water is partly frozen. There is a strong upwards draught in the cloud.

The charges of the cloud parts are 40 coulomb; and the potential between the cloud and the ground is in the range of 10^8 volts.

The separation of charges produces the discharges seen as lightning. They produce plasma, whose volume changes and transitions we hear as thunder; and their temperature reaches 30 000 K.[15]

Since the upper part of the cloud is its coldest, the vertical draught will not be thermal, but due to the size of the hydronia.

The first water molecule above thawing is the tetramer. A monomer is angled only if its middle oxygen atom is exposed to the force from the hydrogen-bond of a neighbouring monomer. This bond is marked here by a hyphen or a slash.
On the known conditions, the tetramer $(H_2O)_4$ will have this structure:

```
H          H
     O – H O
   H          \
                H
                  O – H O H
              H
```

The ionization consists in the removal of one hydrogen atom from one polymer to another.
The anion differs from the neutral polymer by the absence of one hydrogen atom.
The structure of the tetramer anion, hydroxyl, $(H_7O_4)^-$, could be this:

```
H          H
     O – H O
   H          \
                H
                  O – H O-
                H
```

Relative to its volume, the anion is the heavier of the two corresponding ions:
The structure of the tetramer cation, hydronium, $(H_9O_4)^+$, could be this:

```
H          H
  O –  H O
H           \
              H        H
                   O – H O
                 H          \
                              H(+)
```

The potential between the hydronium and the hydroxyl will be smaller than that between one electron and one proton.
There is no known method for measuring the size of the charges of single water ions. An indication of neutrality is that the angled monomer parts of a polymer cannot have any active site; thus the charge-carrying part of a polymer ion will be its straight part.
The ions of water are the link between the physics of dynamics, represented by the monomer of water and its two solenoid bonds, on the one hand, and the physical foundation of chemistry on the other. The molecules of water do not participate in the chemical reactions; but the structure of the cooperation consists in the forces of water's physics and the apparently chemical reactions performed with the assistance of water ions.
The clearest instances of this cooperation could be the function of neurons and the carrying of molecules across cell membranes.
The concept 'elementary charge' is not instrumental when single charges of electrons or protons are not the theme.
The ions of water will be equally distributed. Any air current in the cloud will provoke the production of more ions. In a cloud consisting of small drops, the relation between volume and weight leads to rising or sinking. The relative atomic mass of hydrogen is 1·0079; and that of oxygen is 15·9994. The weight of the oxygen atom is nearly sixteen times that of the hydrogen atom, though its volume is not much greater than that of this atom.
The hydronium's greater number of hydrogen atoms gives it a smaller weight relative to its occupied volume. The hydronium molecule will therefore be lighter than the corresponding hydroxyl, and lighter than its corresponding neutral water molecule.
A drop containing a surplus of hydronia will therefore rise and create the upwards draught observed in the thunder cloud. In this environment, the hydroxyls will sink. As these are not a part of the upward draught; new ions of both polarities are produced, creating a level of division.
The lower temperature in the upper part of the cloud also indicates that the forming of the ions, and the upwards draught of the hydronia, has cost some energy.
As the positive charge rises, it leaves the negative charge in the lower part of the cloud; and this provokes the production of a new pair of ions.
The mechanism of ionization together with the size and weight of the water ions is therefore responsible for the displacement of charges within the cloud and for the production of new charges of both polarities.
In hot climates, the clouds will consist of dimers and trimers, whose relative differences of weight and volume are greater than those of tetramers. Most thunderstorms take place in the tropics, where the vertical draught of hydronia will take a short time.

(The fast developing cyclones and their local storms in the Arctic are of a different origin, as they are local thermal convections whose turbulence is reinforced by the strong effect of the Coriolis force at high latitudes.)

The hydroxyl-hydronium pair of ions is produced by the removal of a hydrogen atom from one polymer to another.

At middle temperatures, water is a mixture of di-, tri-, and tetramers. It is not clear whether the hydroxyl-hydronium pair is always constituted by partners of equal size. This may have some significance in marginal situations, *e.g.* fever.

The differentiation of charges is initiated by the distance between the two partners of another pair of ions; and when one water ion is bonded to an atom or molecule of something else than water, a new pair of water ions is produced. This accounts for water's great capacity of dissolving.

It also accounts for deviations from pH 7. When a quantity of one of a pair of water ions binds a quantity of electro-active molecules, and the other water ion of each pair stays free, new pairs of ions are produced.

The charges of the free water ions produce a deviation from pH 7. Thus, the charges of the unbound ions produce the electro-activity of the solution.

The quick production of new ions could have a relation to the electro-dynamic bonds of each water monomer. These magnetic bonds of the monomer give water a special relation to the magnetic field of the Earth.

The magnetic function of the tripartite bond H:O:H will produce a magnetic field around each monomer. These fields will influence each other and become coordinated. Each of them is therefore influenced by the other magnetic fields.

This gives molecules a permanent relation to the magnetic field of the Earth, *cf.* the spectrum from the window frame. This will facilitate reactions or bonds involving water.

The angled parts of the water polymer are locked and inaccessible to new bonds, as their potentials are used for keeping the angle of each monomer part, except one, of the polymer and for maintaining the H-bond to its neighbouring part.

The reaction to an external field will take place in the straight monomer part of a polymer. It is this part of the polymer that will shed a hydrogen atom at ionization; and the similar part of one of its neighbours is prepared, probably by the same magnetic mechanism, to receive this extra atom.

A possibility is that the strength of the Earth's magnetic field can support a sum of magnetic fields in molecules, thus a number of water ions *per* cm^3. This would make ionization the product of the capacity of the relation between the Earth's magnetic field and those of the water molecules.

The potentials of water's intra-monomeric bonds are, though magnetic, not in the range of the potential of light. The potentials of the hydrogen-bonds between the monomers participate in the system of mechanical forces. The hydrogen bond is static and broken at temperatures up to boiling.

The combined magnetic fields of the water molecules create a common field of magnetism which excludes the possibility of interaction between static electric fields and the monomer even in its straight form.

As the dynamic fields are strong; and static fields are incapable of interacting with them, water cannot lose any hydrogen atom to dissolved matter.

All physical activity and apparent chemical activity of water takes place between its ions and external atoms or molecules; and it takes place on a lower level of energy than that of physical bonds. Thus they are easily entered and easily dissolved.

An apparent exception exists, as the dissolution of some light metals takes place by their nuclear forces' domination of water, *v.i.*

The electro-dynamic character of the bonds of the monomers of water implies that they should have a smaller weight than that indicated by their composing atoms. Since the single atoms show a lower weight than those forming molecules, it will not be easy to confirm this postulate.

It can be generalized to the question of the degree of lacking relation between static and dynamic forces. The span between light, which is electro-dynamic and out of bonds, and the static bonds of water ions, is also a span between magnetism and un-magnetic bonds. Because of the water ions' small part of a quantity of water, it will be difficult to verify this by weighing.

It is imaginable that the magnetic fields of water monomers exert an effect on each other and keep each other stable.

When the field pressure changes its value by the bonding or removal of ions, two new molecules are ionized; and the electro-dynamic field pressure relative to that of the Earth is re-established.

As the monomer is constituted by two solenoid bonds, which will each produce a magnetic field, there is a reason for presuming that the field of pressure is that of the two solenoid bonds of the water monomer.

Electrons transport a charge by moving through matter whose electrons are mobile. The transmission of a lightning could hardly be the movement of water ions over kilometres during a small part of a second. It seems probable that, at a certain moment, the density of charges of one polarity exceeds a certain value.

This high potential initiates a plasma, which provokes the release of more energy and produces the known canal of plasma seen as lightning. Its temperature is estimated at 30,000 K. Most lightnings take place within the cloud.

Most clouds let light through. Their micro-drops disperse light. The thunder cloud is dark, as the dispersed light is not let through it. Light consists of negatively charged particles with electro-dynamic potentials. Light interacts with magnetic matter and is absorbed by its positive charges, in this case those of hydronia.

The electro-dynamic potential of light and the two solenoid bonds of the water monomer have their electro-dynamic function in common, thus they can interact. Water monomers will therefore absorb the light, which is then not let through the part of the thunder cloud carrying the hydronia.

The mechanism of ionization is a part of electrolysis. The apparent conduction through the electrolyte would need carrying particles travelling from pole to pole. Such particles are electrons; but free electrons are not compatible with the composition of a watery electrolyte.

Ionization of water will take place in the middle of the electrolyte, followed by the transport of the water ions to their poles and liberation of the matter transported.

At the poles, the water ions are de-ionized and release their load, or the water is decomposed into hydrogen and oxygen.

Dimers and death.

Some mechanism will have to lead to death at a human body temperature of 42 ºC. The known part of the condition is an infection.

Like all biological evolution, the Cambrian explosion of higher life was not autonomous. The new conditions were the differentiated potentials enforced by the new calcium salts and the cool water's tri- and tetramers.

Microbes belong to the hot-water fauna, which survived the Pre-Cambrian glacial period in hot-water preserves and still subsists in them. This fauna consists of bacteria and small multicellular animals with a limited metabolism and structural differentiation. The mono-cellular animals have no neural system.

A revolution in life was the Cambrian neural mechanism, the transport of a Na- or K-atom with a tri- or tetramer of water.

Bacteria invading a post-Cambrian animal can, maybe, cleave polymer water. Their need for dimers seems to be filled at 42 ºC. The dimers are used for the purpose of the invader, with mortal consequence for its host.

Dimers have higher potentials than tri- or tetramers. Our neural function depends upon the specific potentials of the tri- and tetramers.

Post-Cambrian life was developed on new conditions. Hot water or its parts cannot support the neural functions of multi-cellular life, maybe because the potential of each dimer is too high for permitting the release of the metal atom after its neural transport.

A certain proportion of dimers will lead to a collapse of the mammals' neural function, thus death.

This could also be the mechanism of alcohol intoxication, since its narcotic effect seems to be a lowered neural communication. This is a consequence of alcohol's known cooling of water, which will take place by alcohol's dividing water's polymers, thereby using a part of its thermal potential.

The medical side of ethanol could include that it dissolves some of the polymers of the amino acids of the Tertiary. This could be the reason for the absence of arterial deposits in alcoholics.

Our Cambrian metabolism cannot produce enzymes for the metabolizing of modern amino acids (after 65 My B.P), whose compounds and polymers seem to be the main cause of our most important diseases, cancer included. Some of the connected diseases are mentioned in ref. 29.

Trimers and development.

There should exist a measurable difference between the cell membranes of Post-Cambrian life and hot-water life, since they operate upon water of different properties.

The difference between life's properties before and after the Cambrian proves the properties of water under different conditions, and of the functions in the relation between water and life. Cool water has a higher proportion of tri- and tetramers and can sustain a more complex life.

Our polymers of water carry an atom of sodium or potassium through neural membranes, producing and moving a small charge, which is the neural mechanism. This communication system was new to life around 530 M years ago.

It works as long as the archaic water does not interfere. Dimers do not have the right potential for carrying and releasing the metal atom.

Cool water and sea water are the conditions of a nerve system and a complex brain development. The significant factor is the cool water's high proportion of trimers and tetramers.

The development of humans during millions of years in a tropical sea was pointed to by Alister Hardy, *cf.* ref. 50. Sea mammals have many properties in common with man. One of them is a brain having a potential for combining and for complex motions.

The main distinguishing property between man and primates is the developed brain. The conditions mentioned here, and their relations to brain and nerves, give a high probability to the theory of man's aquatic past, *cf.* ref. 70.

The distinctive function is the development of the brain by tri- and tetramers of water.

Earth's magnetic field.

The lacking compressibility of water, even under a very high pressure, is due to its magnetic bonds, which are impervious to mechanical forces.

The magnetic fields of the solenoid bonds of the water monomer will have to be parts of the Earth's magnetic field. Water's presence in the Earth's interior should be inferable from the relatively fast changes of the magnetic field of the Earth. These also indicate that water could be present in layers below the oceans.

Water was found in the rocks at the Kola Peninsula. The hole was sunk to more than twelve kilometres.

Up to *c.* 2,500 K, water conserves its structure. This has been observed at the surface of the Earth. As it is impervious to mechanical forces, the structure of the water monomer should be conserved as long as it is not overrun by magnetic forces.

The low probability of magnetic forces from metals or minerals below the crust is due to the limit of their magnetism at high temperatures.

Magnetism of metals and minerals disappears at their Curie points, temperatures discovered by Pierre Curie (1859-1906). Except in a few metals, these are mostly below 1,000 K. Iron's Curie point is among the higher, at 1,043 K.

As the Curie temperature seems to be a point of transition of atoms or molecules, it seems probable that the loss of magnetism seen in metals and minerals does not take place in water, *cf.* the structure of its monomer.

Though this conjecture could be wrong, and the points might be higher at the higher pressure, the Curie points of the minerals and metals should be passed at the Earth's internal temperature of several thousand K. No magnetic field from minerals should then be present for influencing the magnetic field of water.

Water's magnetism is produced by the high $\Delta v/\theta$ of the electrons of the solenoids of its monomers.

There seems therefore not to be any reason for a Curie point of water, *cf.* the systems of energy, *ch*. 7.

As the monomer or dimer of water exists at high temperature and pressure, the forces of water's magnetic fields should be stronger in the interior of the Earth than those of water polymers at its surface.

The magnetic fields of water should also have higher potentials than those of metals or minerals. This is due to the water molecule's magnetic property and to the absence of a Curie point for water.

These properties and conditions make water the producer of Earth's magnetism.

The electro-dynamic bonds within each monomer of water are inaccessible to electrostatic forces. The two magnetic bonds of each monomer leave no access for electrostatic potentials. The current, non-ionized water polymers are therefore impervious to chemical bonding.

An apparent exception exists even here, as nuclear forces dissolve water when they are given a chance, which they are by the smallest metal atoms. Nuclear forces are, though, not parts of chemistry.

The electrons of an atom are those parts of it which meet other matter. In some metals, the low potentials of their electrons relative to their atomic nuclei will lead to the exposition of the potential of the nucleus.

The splitting of water monomers by the dissolution of light metals could be a product of the metals' low electronic potentials. A low force is needed for producing the ionization energy of the first electron of lithium (Li), 124 kcal/g.mole, potassium (K), 100 kcal/g.mole, sodium (Na), 119 kcal/g mole; and a few other light metals.

A nuclear potential will dominate electro-dynamic potentials as well as electrostatic potentials. Water is characterized by the electro-dynamic potentials of its monomers, which make them impervious to the electrostatic forces of ordinary chemical bonds. The electro-dynamic potentials of the water monomer are, in their turn, dominated by nuclear forces.

The dissolution of the metal would be started by the displacement of a few of its electrons by the magnetic field of the water monomer. The field of the partly exposed nucleus of the metal will then divide the water monomers by its magnetic force. The oxygen from the divided water will then oxidize the metal; and this oxide is immediately dissolved as a metal hydroxide. Hydrogen from the water is left alone and escapes. The process is conspicuous in some metals. The reaction can be so fast that the heat of oxidation is not dissipated, but ignites the liberated hydrogen gas. The burning gas gives the impression of boiling water burning. The last part of the process is the burning hydrogen producing heat and water vapour.

The products are heat, atoms of the metal, and reconstituted water after the burning of hydrogen.

In this case, we see the nuclear potential dominating the electro-dynamic potential.

The electro-dynamic bond is a peculiar property of water, though not unique. Hydrogen and oxygen have high, and equal, ionization potentials. The two conditions of the character of the bond and the properties of its partners make the water monomer, H:O:H, very strong. Its composition of three atoms on a line leads to two equal bonds resulting from the magnetic fields produced by the quasi-solenoid currents of the orbits of their electrons. These bonds are strong and stable.

The external bonds of water are entered by its ions, which are formed by the removal of one atom of hydrogen from one water polymer to another. None of the atoms is ionized in the meaning of physical ionization by removal of electrons.

The extra H-atom conveys the possibility of engaging a molecule or an atom in a hydrogen-bond-like relation, thus forming the positive ion.

As the hydrogen atom has been taken from another molecule of water, this molecule is now terminated by an oxygen atom. Because of the hydrogen bond between the monomers, this atom now has a surplus of negative charge, perhaps as a field directed away from the main part of its molecule.

The immediately noted character of the bonds of water ions is their slightness. They are easily entered and easily broken.

The low persistence of the connections of the ions is the reason for the multitude of tasks performed by water in the service of life. It is, though, easy to overlook the permanent structures maintained by water's binding to proteins and calcium salts in molluscs, crabs, and our bones.

Water makes up more than two thirds of our bodies. It performs functions and builds structures in ways not yet fully apperceived. The anatomical and metabolic functions and their bonds point to a permanent equilibrium.

Crystals of minerals have high melting points and are broken at a few *per cent* of the force needed for breaking a fresh and raw bone.[37]

Collagen gives the bone its composite structure, the mineral hydroxyapatite gives it form stability; and water takes up energy under changing loads.

The volume consistency of water under changing pressure is due to the magnetic bonds within each monomer. As they are electro-dynamically as well as directionally settled by their solenoids' function, they are not influenced by the forces of electrostatic potentials. They also exchange forces with the magnetic field of the Earth.

The first water on Earth was formed by a high energy, *i.e.* at a high temperature and a high pressure. It is still formed at burning. Its lacking possibility of static electrical bonding keeps water from chemical engagements like those formed by static electrical bonds.

The magnetic potential of water keeps the chemicals of life, when bonded to water ions, from engaging in most of their surroundings. When a reaction takes place, a water ion is a partner.

As its level of magnetism is one of physics' and life's first conditions, water will ward off other fields and keep the biological product intact. Earth's magnetism will incorporate the product.

In life, water acts as a censor against impermissible chemical reactions and as a guardian for the biological syntheses made.

This is efficient up to a point. The average natural magnetic field has a lower strength than the technical fields pervading most of civilization. Sunlight is a magnetic radiation, whose weakest part, the ultra-violet, UV, will penetrate our skin to a depth where its metabolism is affected. Melanin is man's defence against this part of the sunlight.

It is, though, unequally distributed.

It seems to be lost among most non-tropical humans, as this loss lets them produce vitamin D in the skin.

There are at least two reasons for life's lacking resistance to the strong sunshine. The first is that the condensation of the first organic substance from dihydrogen sulphide, ammonia, and methane, took place in the sea or in a dense cloud, thus not directly under the sun.

The second reason is that it took place at a depth or density great enough for the ultra-violet part of the sunlight not to reach the first molecules condensed.

A possible, though not probable, reason could be that the molecules formed what was to become the ectoderm.

A fore-runner of the synthetic chemical industry was the iridium-contamination 65 My ago. The sum of products is not neutralized, but followed by chemicals foreign to any life.

A modern consequence is that cancer is a problem, though seldom in young individuals. Metabolic processes lead to cancer when their products are not compatible with the tolerance of our organs or our metabolism.

The regimens or systems of energy are produced by the potentials within the main regions of material connections.

0. Neutrinoes interact with matter when they hit an atomic nucleus, producing a change of isotope. It is a question of definition whether this should be called an energy interaction.

1. The potentials of static electricity between positive and negative charges are dominant as long as the charged particles are moving at moderate velocities, below *c.* eight *per cent* of the velocity of light. This is the domain of mechanics, where gravity and time belong.

2. The electro-dynamic potentials of charges moving at higher velocities produce dynamic as well as static forces at medium velocities. At the velocity of light and at velocities approaching it, the electro-dynamic force, or magnetism, is the only force produced.

3. The forces of atomic nuclei.

There is no interaction initiated by 1 relative to 2 or 3; and there is no interaction initiated by 1 or 2 relative to 3. The magnetic forces (2) are not influenced by the presence of static forces (1). Light passes electrostatic fields without reacting to them, those of gravity included.

The forces of electrostatic fields are also overcome by light. This is seen in the production of electricity by the photoelectric effect of sunlight meeting, *e.g.*, silicon.

Sunlight is produced in the long process of accelerating and breaking down electrons in the sun. The added energy to nano-particles removes them from the forces of static charges; their own as well as those of other particles.

Static potentials cannot influence the electro-dynamic forces. One of the conditions of the process in the sun is the production of magnetic fields by the fast moving particles. The fields keep the electrons separated from the protons and make the process possible.

The process shows that the exclusivity of the electro-dynamic system is a part of light through its production, emission, and reception in matter. This function makes impossible any influence on light from static fields, like gravity.

Some apparent exceptions exist. Among them are water, CO_2, and some other compounds. The reason for this is that these three-atomic molecules are constituted by two solenoid bonds, thus are magnetically bonded molecules.

A further exception is the visibility of most matter, *v.i.*

The water monomer is magnetically bonded to the point of not entering into ordinary static bonds. The static bonds of water are entered by its ions only. Thus, water does not participate in chemistry in its current form. Its chemical and physiological bonding is performed by its ions only. These bonds can be lasting, *e.g.* in our bones.

Light has no weight, as its pressure is exclusively electro-dynamic. Thus light is not influenced by gravity. As light is an electro-dynamic radiation, at peace time and away from nuclear test fields it is influenced by magnetism only.

The presumed deviation of light in a gravitational field, seen in 1919, was a deviation of the magnetic field of the light by the magnetic field of the sun. High-voltage AC-fields are electro-dynamic and influence light, seen in its flicker.

The effect of protons is a lowering of the energy of the light. It is seen in the shimmering light from distant lamps in periods of high emission of protons, called “solar activity”.

The sunset refraction of sunlight should be understood as a deviation caused by magnetic molecules in the atmosphere. These are water, CO_2, N_2O, *etc.*, possibly together with the magnetic field of the Earth, *cf.* above.

A consequence of light’s separation from the system of forces of static fields will be that the growth of entropy is counteracted by sunlight.

As only small parts of starlight reach living matter, the output of this function is limited, though decisive for life on Earth. Life is phenomenologically taken as negative entropy.

The physical function making negative entropy possible is light’s potential, which dominates the primary energy production of matter.

The distribution of climate over the Earth is a question of energy, though not in any form. A livable climate can be sustained by energy producing negative entropy. Life cannot use any form of energy for sustaining life, climate and negative entropy.

Life’s extension and its capacity of keeping a reserve of potentials, its buffer capacity, is decisive for its permanence as well as for the distribution of climate.

The present rise of temperature at high latitudes is a sign of civilization’s lack of regard for its own conditions. Entropy is a question of distribution of energy by the action of potentials.

Their distribution is not discovered as thermal differences, in spite of Clausius’ use of heat as the key phenomenon behind his naming of entropy.

Behind the phenomena of heat there are functions of distribution of potentials. They are the producers of climate.

Their prime mover is sunlight. The first condition of understanding the functions of light and life is to recognize the distinction between the different systems of energy.

Light’s origin in electrons and its electro-dynamic mode show that it constitutes the negative magnetic monopole. It has left the protons behind, as these have no mechanism for their acceleration to the necessary velocity for producing an electro-dynamic force.

Einstein predicted that light would have the same velocity relative to an observer regardless of his movement relative to the source of the light. This he could have seen as a consequence of relativity theory.

It should rather be seen as a part of electromagnetic radiation. Light is not any part of static charges or fields. Light is electro-dynamic and belongs to the system of dynamics. It does not cooperate with mechanical forces, thus will have to be indirectly measured.

Matter and physical particles are known by their properties, which are substance, extension, charge, and field.

Light’s properties are negative charge and a very high velocity, thus it belongs to magneto-dynamics.

Light interacts with matter at hitting fast electrons. It is seen where it ends, and as reflected by the electrons of most bodies.

Magnetic interaction takes place between light and fields of dynamic charges. As it has a scale of energies, its measuring is not unambiguous. Measuring light in an instrument consisting of atoms is an interaction; and the contribution of each of its parts is not obvious.

The interaction between light and matter in crystals, lenses and microscopes takes place with the magnetic fields of the atoms. As the electrons have to move in order to keep their potentials relative to the nucleus, they establish orbits; and these produce magnetic fields of different strengths.

The velocity of the electrons is not high relative to that of light, though the orbiting in the atom gives them a high $\Delta v \theta^{-1}$. Most of them acquire a magnetic function like that of a solenoid; but light gases are invisible.

Mechanics and dynamics.

A limit between the two systems is seen where mechanics end. In the solenoid, the fast changes of direction of the current produce the transition to its transformability. In the sun, the electrons' changes of direction are fast; as they take place in collisions with short intervals.

It is possible to take the solenoid as the symbol of the transition from mechanics to dynamics.

The calculation of mechanical phenomena is centred on Newton's second law. This relation between interdependent phenomena has no valid application outside the realm of mechanics. It is acceptable only as a description of the apparent, not of real functions.

In dynamics, magnetism is a key product. The transition to dynamics begins at *c.* eight *per cent* of the velocity of light.

Magnetism and black holes.

Black holes are imagined as matter condensed by its own gravitation to a degree where not even light can escape.

Neither gravity nor light is an autonomous function. Relative to gravity, light is autonomous. Gravity is a static force produced by the charges of substance at low velocity.

Light is produced by the energy of charges of substance by heating and moving a part of the substance to the velocity of light. Thereby it is removed from the cooperative forces of matter to dynamics, the second system of energy, which is exclusive among the everyday forces on Earth.

Movements or forces on the dynamic level are not influenced by the static forces, like gravity.

Since gravity and light are functions of two different systems of energy, the model of black holes should be revised. Light is an electro-dynamic function, not influenced by gravity.

Disappearing light, except that hitting matter, would have been removed by a force of its own system of energy, or higher.

If light were influenced by gravity, it would not have been reflected by matter, but absorbed by it. The earthly world would have been invisible; and our days would have been dark.

If light should be attracted to a black hole, this would have had to consist of matter having magnetic properties. This would imply that it should displace the apparent position of a farther star.

Today, the black hole could not have grown from more added matter than that hitting it by accident. Its gravitation would not grow faster than that of any celestial body known.

If black holes exist and if they have any influence on the movement of light or that of celestial bodies, they should be reinterpreted as electro-dynamic bodies, *i.e.* stars; but stars are not dark.

The electro-dynamic effect is not unknown in our everyday. It is induced by the alternating current of the first coil of the transformer, because of its high $\Delta v \theta^{-1}$. The potential difference is induced by the ratio of turns of the second coil to that of the first.

The electro-dynamic bond between hydrogen and oxygen in the water monomer is strong and removes water from the realm of electrostatic forces.

This explains the versatility of its external bonds, which are entered at arm's length by the water ions only.

The ionized part of the water polymer offers a weak bond to external molecules and atoms, probably at the potential level of the hydrogen bond.

This H-bond is a normal part of the water polymer. It is the bond between the monomers within the polymers of water.

Depending upon external conditions, it is ephemeral, or lasting for the years life will use it, since structural bonds in living creatures are renewed after a few years.

Electro-dynamic bodies exist in space. Those we know are too hot for including the reception of matter in their activity. They are the outer parts of stars; and they will swallow what hits them. They are small parts of the stars; and they are the hermetic shields around the stars' inner transforming of matter.

The magnetism of the outer part of a star makes it impervious to the main body of mixed particles in the rest of the star. The magnetism of this outer part is the reason for stars' longevity.

As long as its radiation consists of magnetic particles, the star is conserved and participates in the maintenance of negative entropy on a planet in a lucky position relative to it.

Water's participation in tectonics is indicated by the subduction of the sea bottom, whose variable content of water will be a part of the potential and polarity of the Earth's magnetic field.

The oceans' content of CO_2 could produce variations of the magnetic field.

The subduction of water and CO_2 will have some effect on the sub-continental crust. A layer of water under the continents should facilitate their drift. The combined magnetic field force of water and minerals will be influenced by variations of temperature, pressure, and content of CO_2.

Currents of the magnetic inner part of the Earth should produce variations of the force and direction of its magnetic field. The known variations of the field are so great and fast that they can hardly be produced by currents within the high-viscosity, hot Ni-Fe core.

As those currents would have been turned off at their Curie points, they are not the probable source of the Earth's magnetic field, *cf.* above.

The Curie-points of metals and minerals are the temperatures at which their magnetism vanishes. We may suppose that the measuring of these points has been made on dry specimens at temperatures and pressures of the surface of the Earth.

Since water has magnetic properties, there should be significant information to gather from an investigation of the magnetism of metals and minerals in water under high pressure and temperature.

One factor is the distance from the source of change. The Earth's equatorial radius is 6378 km. As the main source of magnetism is presumed to be its inner part, its distance from the surface could be a sufficient reason for other magnetic forces to influence the measurements of magnetism at the surface of the Earth. Water seems to be the candidate, since it has not been ascribed a Curie point.

Major tectonic events and volcanic eruptions should have some effect upon the magnetic field. The variations of the field are partly ascribed to tectonics. They are very fast relative to the presumed properties of the core.

The effect of crust water on local variations of the magnetic field should be a theme of research. The water content could be found by some electro-dynamic method. The level of frequencies and energies used for exploration should be limited in order not to hurt life.

Water is transparent to a certain degree. Light is absorbed by water after a passage between twenty and fifty metres.

A possibility concerning Earth is the inclusion of water in minerals as a cause of magnetism. An inclusion should bring the effect of a weaker reflection of the crystals.

The greater absorption of light should be seen in magnetic metals as a stronger heating under sunlight.

The use of copper and bronze as mirrors since antiquity shows that their lower absorption of light has been appreciated.

The strength of iron could have been referred to its magnetic properties and its low suitability as a mirror. The opposite properties of silver and aluminium account for their use as mirrors under glass. The softness of silver limited its use as an uncovered mirror.

Aluminium was unknown until 1809. It became available for practical purposes in 1855; and it is used uncovered in astronomy.

Magnetism arises from atomic or molecular properties; and these lead to the interaction with light. This characteristic of water is seen in its refraction of light and its limited penetrability.

Molecular or crystalline properties could produce the same effects. As we do not have the occasion to put a black hole under the electron microscope, we should look for the magnetic properties of matter relative to light. It seems difficult to obtain unequivocal models from empirical data only.

Carbon is not broken down by heat, but sublimes around 3640 K and melts at *c.* 3820 K. Thus, its physics has something in common with water, as its bonds are not broken by static forces.

Carbon is the only one among the lighter elements having high-temperature properties comparable to those of water. Its absorption of light is more complete than that of water. It seems to have a strong affinity to energy system 2 and light, also through its oxide, CO_2.

This oxide is a partner as well as exerting a function of negative entropy between sunlight and the metabolism of plants, thus, at the next step of metabolism, of animals.

The compound CO_2 could have a structure and bond not unlike that of water: O:C:O should be held together by the magnetic fields of the four outer electrons of C combined with the O-solenoids. The bonds of this configuration are stable because of their magnetism.

This molecule plays a role in the greenhouse effect. Radiation from the Earth will consist of low-energy photons; and the most important molecules producing this magneto-dynamic effect are water and carbon dioxide.

The structure, or lack of structure, of carbon black will swallow light. Carbon will reflect light when it has a crystalline structure.

Carbon and its oxide have properties placing them in the energy system 2, thereby giving them a role in life's negative entropy.

Light is not reflected from blackbodies; and it is not emitted from them at temperatures below the beginning of glow heat, *c.* 800 K. A black hole consisting of iron ore, water, and carbon, would not reflect light. It would have a magnetic field absorbing light and would deflect light passing at a distance, *cf.* the deviation of light by the magnetic field of the sun at the solar eclipse of 1919.

On the other hand, even a blackbody will adapt to the common circumstances of matter by exchanging low-energy photons with its surroundings and acquiring their temperature.

The lens effect of far galaxies is not produced by gravity. The deviation of light will be produced by the magnetic fields of stars and galaxies. A celestial body will reflect light if it has magnetic minerals or water at its surface.

A black hole could consist of water and magnetic metals. It would retain the light hitting it, like any cold celestial body. It would not attract light by gravity, but by magnetism.

Lasting stars.

Stars last for long periods; and some last longer than others. Looking behind the empirics, we should perhaps find a mechanism of the longevity of stars.

The outer parts of stars produce their light by electrons' breaking down and transition to magnetism. Electrons do this since they are alone in their compartments, unhampered by particles of opposite charge.

The inner parts of the sun and probably most stars are more complex and keep a starting energy for their heat in nuclear processes, whose unequal distribution could be the reason for stars' variable longevity.

The reason for stars' durability could be that there is a difference between the two systems of energy to which, respectively, the inner and outer parts of stars belong. The inner parts produce energy from different sources of nuclear potentials, reaching high temperatures.

The outer parts of the stars are divided into homogeneous sections. The protons' parts are passive, though producing outbreaks at irregular intervals. The electrons' parts use their energy for changing the electrons' mode of negative charge from static to dynamic potentials.

Since this second system is impervious to the charges and forces of the first system, the activity of the electrons' parts of stars is not disturbed by its inner potentials.

This implies that the outer parts of stars are enclosing their inner parts, preventing the loss of matter and potentials.

The incompatibility of the two systems of energy is therefore the necessary and sufficient condition of the lasting existence of stars as shining objects.

Reality or description?

It seems that much of science describes reality in a way keeping it outside the world we know. This could explain the quasi-fairy-tale style of physics. The references to God from Plato, Ptolemy, Newton, and Einstein were followed by deviations from a straight description.

Kepler's system of imagined polyhedrons intercalated between the planetary orbits, *cf.* ref. 20, was perhaps more than typical as a detour; and it can be compared to the wave mechanics of the 20th century.

His three planetary laws are, contrarily, conspicuous for being straightforward, though conceived

1. by a very religious man,

2. in spite of the Godly references for the Ptolemaic system, and

3. in spite of the accepted knowledge of the scientific community.

Two questions present themselves. What is the intention of the description? What is the object of description?

The answers can be taken from theology and sociology rather than from epistemology.

On the background program of not moving too far from the already accepted, a new model will traditionally be kept within the frame of the known models, not disturbing the souls or the authorities.

One characteristic of that method is the building of new models within the frames of the old and seeing the world's parts and relations as the extension of the models describing them.

I am not sorry for not being able to follow that method. I discovered that it is possible to follow physics' ways in biology and medicine.[29] This method should be possible even in physics.

Pythagoras (d. *c.* 490 B.C.) founded a religious community and professed the significance of numerical relations. He lived in a close relation to the world though he was a religious man.

The last Pythagorean was Aristarchus, who died *c.* 230 B.C., nearly 120 years after Plato. With him disappeared, for 1500 years, the idea of a sun-centred planetary system.

Some of the scientists have given their reasons. Plato (427-348/347 B.C.) avoided the factual. He produced the totality of his work as a quest for the understanding of the world as something else than that which it is.

In the 2nd century A.D., the Platonist Ptolemy made it his program to cover up the elliptic paths of the planets in his elaborated model of circular deferents and epicycles on them, forty in all. He built on the mathematics of Hipparchus, who, in the 2nd century B.C., had used this model for describing the movements of the sun and moon.

They had built upon Plato's all-embracing model, postulating the Earth as the centre of a spherical world. In it, sun, moon, and the planets were imagined to move according to God's perfect figure, the circle, *cf.* ref. 16.

Ptolemy was explicit in his purpose of hiding God's shame at letting the planets wander in ellipses, since Plato had said that the circle should be God's perfect figure. In spite of Ptolemy's writing this in his main work[23] the resulting forty epicycles of his description were taken as the real movements of the planets.

The Ptolemaic system, with its Platonic theses, was taken literally by the Catholic Church until 1992, when it rescinded its judgment on Galileo, in 1633, for his support of the Copernican model of the planetary system. This had happened before the dogma of papal infallibility, when speaking *ex cathedra*, was accepted by the first Vatican Council (1869-70).

Nicolaus Copernicus' (1473-1543) understood the planetary system; but he relied upon the Ptolemaic method and used 48 epicycles for describing the planets' movements.[20]

Johannes Kepler (1571-1630) was a strong believer and used many years for convincing himself that the planets could follow other paths than God's perfect circle. The observations of Tycho Brahe (1546-1601), and his own calculations, convinced him of the planets' elliptic orbits, published in his *Astronomia Nova* in 1609. His model of the planetary system is that accepted today. He seems to have been one of the few physicists who did not let his religious belief overrule the physics indicated by observation and confirmed by calculation.

Galileo Galilei (1564-1642) was the first to look at the stars through the new spyglass, the telescope. He was the first to see Jupiter's four moons, in 1610. He discovered acceleration, measured it at fall from different heights, and found the quadratic relation between the height of fall and the velocity reached. He did not discover the main work of Johannes Kepler.

Rockets were used in warfare in China from about 1150 A.D; and in Europe they were used in 1380 in the battle of Chioggia[1], not far from Venice. It could have been Marco Polo (1254-1324) who had brought the knowledge of them to Europe.

The exhaust of the rocket pushes against its walls, but escapes behind. The rocket is pushed forward from the inside. This, as a general principle of mechanics, is called a reactive force, formulated by Newton as his third law.

Isaac Newton (1642/43-1727, born on Christmas Day 1642, O.S.) lived and thought within a tradition of Christianity. He built on Kepler's model of the planetary system and Galileo's acceleration; and he generalized them to gravitation between celestial bodies and his three laws of the motion of bodies, concerning inertia, force, and reactive force[7], respectively.

They were published in 1687; but as late as 1940 professional authorities in USA were against jet propulsion and rockets for military purposes and interplanetary travel.

It seems that the reactive force was seen as a belief rather than a physical force; and the authorities did not share that belief, in spite of Newton and of the methods patented in USA by Professor Robert H. Goddard before 1940.

In 1738, Daniel Bernoulli described the indirect, non-inertial, or dynamic, force of a moving fluid,[2] later put into mathematical form by Leonhard Euler.

This physical function was not accepted by the Norwegian patent authorities. A patent application of 1990 was refused in 2008[3].

It seems difficult to communicate a new model, even of low complexity. Theories and models have been variably received. Leonhard Euler (1707-83) put the thesis, or "law" of Bernoulli into mathematical form; and it was taught at European and American universities in the 20th century[56] apparently without avail.

In 1997, NTNU, The Norwegian Technical-Scientific University denied the possibility of this effect.[22]

It is a part of the lifting force of aeroplanes; though, as far as I know, without reference to Bernoulli.

During the nineteen-thirties, the Germans followed the news of Professor Goddard's experiments and used two rocket versions against England during the war 1940-45. A reason for the difference of interest could be better communication between scientific and technical circles in Germany than in the USA.

Communication does not seem simple, since history shows accepted descriptions of physical functions to be misleading, *e.g.* gravity, light, mechanics, and dynamics. It seems that the apparent suffices for our civilization, which even protests against reality. Is it easier to believe in a spirit or graviton than in forces of matter?

Independent thought, perhaps the first since Pythagoras, 1800 years earlier, came to several learned men of the 14th century, among them Bishop Nicole Oresme (1325-1382), who was the greatest economist of the middle ages (*De moneta*). He was also a mathematician who understood the fundamentals of astronomy and celestial mechanics. His *De caelo* ("About the heavens"), was a refutation of the Aristotelian astronomy. Bishop Nicole attributed the daily round of the stars to the rotation of the Earth.

The learned men did not influence the politics of the Church; shown by the case against Galileo, in 1633. The new astronomy of the Protestant Kepler (1609 and 1619) was overlooked by the Catholic Church; but gained influence during the 17th century.

The central ideas of a society are its religion; and among them is the model of the world. The religion-based models of physics have troubled European thought after Pythagoras. As they have been enforced by the Church, it is understandable today that it is difficult to leave them.

On the background of the mental rigidity characterizing our societies, where egoism and power have priority to the survival capacity of society, *cf.* Gibbon[4] and Toynbee[5], it is strange that parts of the knowledge of physics have been planted in reality as new technology, since new technology can be a threat to old power.

It is not strange, however, that our consciousness about the external world, also called physics, is so limited that the apparent is given a reality value not imparted to the real and underlying concretes. It is, therefore, to be counted among memorials of culture when textbooks of physics, *e.g.* ref. 57, pass over most of functions and limits its theme to the mathematical treatment of phenomena.

Niels Bohr said that the theme of physics is not how the world is, but what we can *say* about the world.

That was an avoidance manœuvre, as our words are never identical with their theme. But this saying also produces trouble as to the impression Niels Bohr wanted to give. Did he mean that his words about the world were more important than their possible correspondence with a referred theme? If the correspondence is excluded, as it seems to be, any word and any meaning will have a justified place in physics. An answer to Bohr could be: "You can say anything. What are your criteria for saying what you say?"

A distance exists between the properties of the world and those utterings about it that are accepted within social, religious, and political frames. A reason for this distance is the coincidence between religion and the accepted model of the world, and the coincidence between state, religion, and accepted knowledge.

This institutional frame of the use of words is a greenhouse for new phrases and formulations of the already known, provided they do not threaten the existing social system directly or through its version of learning.

The Catholic ("universal") Church is the historical precondition of the universities. They became the managers and censors of knowledge.

This makes it close to impossible accepting anything they have not accepted already. Every day more knowledge is developed and used outside the universities, which are becoming managers of knowledge as abstract as religion.

The astonishing about positivism[13] and phenomenology[14] in the 19th and 20th century is not their success at the universities, but their success outside them.

Their proclaimed need for "positive data" and "phenomena" had been filled since the time of Ptolemy. Their success today consists in removing models from science, and in filling scientists' heads and papers with primary data.

Newton had followed suit by not imagining theories[10]. Within his religious perspective, he would not infringe God's domain by imagining theories about the reality of physics.

After all, it is perhaps not so strange that Newton continued the Ptolemaic method of building phenomena, *"apparentia",* together, producing a theory of the apparent.[7]

After Plato's relegation of reality,[16, 17] we should perhaps applaud Ptolemy for not constructing an all-synthetic universe?

Most of produced knowledge after Pythagoras, that of Newton included, consisted in description of phenomena. This could be the case also for most of science after Newton.

Even some scientists who opened new perspectives did it on the level of appearances, like Gibbs and Planck. Their new perspectives are still within the realm of phenomena, where the real functions are not touched.

Seen in the perspective of Plato's intention and teachings, Newton does not expose the frank disclosure of his intention that Plato and his follower Ptolemy had shown.

Newton's second law, $F = m . a$, says that force equals mass times acceleration. Its three parts are defined by their interrelation. The empirical phenomenon acceleration, which he had from Galileo, did not bring physical functions into the perspective. N 2 is intended for the description of phenomena at low velocities. Its limitation to phenomena leaves in a void functions at any velocity.

This, combined with Newton's religious domination of his thought, alas, leaves no reason to believe that he had any allegiance to reality. His second law was made up of phenomena defined relative to each other.

Thus he did not injure the feelings of his God; but neither did he approach the reality of which people for three hundred years were cheated to believe he should be speaking.

Albert Einstein (1879-1955) multiplied Newton's model with metre and got $E = m . c^2$. If he did not do this himself, he took a responsibility by using it. The parts of this version are defined by this relation only. Its lack
of external reference leaves it no validity.

From Plato until today, physics has been dominated by deceitful representations, with the exception of the period from Kepler's *Astronomia Nova* in 1609 to Newton's *Principia* in 1687.

A consequence of Newton's second law is that parts of Einstein's work are misleading by having a scarce relation to reality.

Already at velocities above *c.* eight *per cent* of that of light, the electro-dynamic effect described in Maxwell's third equation will wreck Einstein's predictions concerning the behaviour of bodies at velocities close to c.

The change of length of a body was imagined as a consequence of high velocity by George Francis FitzGerald (1851-1901) in 1892 and by Hendrik Antoon Lorentz.(1853-1928) in 1895.

Einstein projected on reality the misrepresentations of Newton's reciprocal definitions. Logically, he called it "relativity".

In Newton's second law, its parts are defined by each other only. "Relativity" is another name for the interdependence of the law's parts, thus a property of the model, not a representation of any part of the external world.

The qualities ascribed to reality are projections of the model's properties, taken from the intentionally misleading N 2.

Newton's second law has distance as its only reference to reality. N 2 is a definition of a relation between phenomena, which even are defined by each other.

The phenomena are not brought into a relation to those functional parts of the external world upon which they depend for their existence.

N 2 has therefore no relation to reality other than being a definition of the relation of phenomena to each other.

The problems arise because

1. their measures are related through this definition only, because

2. phenomena are not the representatives of the functions of the world, and because

3. the phenomena considered are not set into a functional relation to the prime movers of which the movement of bodies depend.

Functions and units.

Our measurements of mechanical phenomena are not measures of functions of physics, but of phenomena somehow related to them. Measurements and calculations made possible by N 2 have been taken as definitions since Newton's time. Their common factor is inertia.

This deficient relation between functions and their representation demand a revision.

Charge is the common physical factor of the potentials, force and energy upon which the cooperative functions and movement of bodies and particles are built.

The prime moving potentials should have their place in the calculations of force and energy, and in the units of derived functions.

Except in gravity and the apparent "magnetic storms" of protons, the size of potentials or energy perceived is determined by the negative charges of the functions.

The units should start with definitions of the physical entities engaged. The dynamics of high velocity should be included. To this, JCM 3 offers the clue. Besides, coulomb is a more applicable unit than ampere.

The difference between Newton's and Einstein's teachings on the one hand and reality on the other is shown by $E = m \cdot c^2$.

Photons have no weight, as they are not parts of mechanics. They reach the velocity of light. The velocity of low-energy photons, which are produced at lower temperatures, is not known; though it will probably be c.

On the other hand, particles and bodies, whose inertia, m, has a physical relevance, cannot be accelerated to the velocity of light.

Einstein's equation therefore describes a situation that does not exist.

There does not seem to be any indication that Newton should have intended to include light in his description of mechanics, $F = m \cdot a$.

The electro-dynamic force of a photon the size 1/1000 of an electron will be the product of its part of the elementary charge, Maxwell's factor 4 π as the relation between electro-dynamic and electrostatic potential, and c^2, the square of the velocity of light.

Thus, its electro-dynamic potential will be

$$\Psi \cdot 4\pi \cdot c^2, \text{ or}$$

$$1{\cdot}602\,1892 \cdot 10^{-19} \cdot 1/1000 \text{ C} \cdot 4\pi \cdot 9 \cdot 10^{16} \text{ m}^2 \text{ s}^{-2}$$

$$= 1{\cdot}8 \cdot 10^{-7} \text{ C m}^2 \text{ s}^{-2}$$

The energy of the photons will be in the range upwards from

$$E_{ph} = c \cdot 1{\cdot}5 \cdot 10^{-10} \text{ C m}^2 \text{ s}^{-2}.$$

This unit is an instance of units based on charge instead of inertia.

It makes possible the demonstration of the specific electro-dynamic property of light, as it indicates the photon's function as a magnetic monopole.

Neutrons and magnetism.

It is known that a material relation is a bond or a structure of moving particles of substance. It is established by the potential between its parts. The strong potentials between particles in relative movement keep their configuration stable. This is the mechanism of atoms' durability.

It is known that neutrons last as long as they hold together protons in the nuclei of atoms, plus, on the average, seventeen minutes.

The neutron seems to show the magnetism of an electron orbiting a proton at a very small radius, smaller than that of ^{1}H.

Its configuration is not unlike that of a transformer, indicating similarity of function.

The dissolution of free neutrons shows that they are not constituted by an amalgamation of their two particles, but by a reversible relation between them. Thus they will have to constitute a very small, atom-like system.

Such a system will, by its solenoid structure, constitute a magnet; and magnets between the protons of the nucleus will be the necessary and sufficient mechanism for neutralizing the reciprocal repulsion between the protons of most atomic nuclei.

At the same time, they are held, without contact, in the same relative positions.

The neutrons are thus the mechanism behind the two nuclear forces.

Matter and energy.

If the potential of a structure is surpassed by energy added, the structure is dissolved. This implies that the coherence or existence of matter ends at a velocity far below that of light, at a temperature of a few thousand K, at a high pressure, strong radiation, a strong magnetic field, or strong vibration.

The substance of matter consists of particles, whose relative forces constitute matter.

The smaller particles known or postulated are not known to be parts of matter's macrofunctions.

The functional particles of substance are protons and electrons. Like matter, these particles cannot be accelerated to the velocity of light, *v.s.*

N 2 is not the model intended for a description or calculation of matter's behaviour at high energies. Einstein's intervention has not brought any functional change into the model.

Its empirical calculation of inertia is not valid in cases where inertia is not a conspicuous factor.

Ptolemy, Newton, and Einstein produced calculation models for phenomena; and they ignored decisive physical variables and functions involved.

Newton's words concern the necessity of a force producing the movements in the sky:

"It is inconceivable, that inanimate brute matter should, without the mediation of something else, which is not material, operate upon, and affect other matter without mutual contact; as it must do, if gravitation, in the sense of Epicurus, be essential and inherent in it. And this is one reason, why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential to matter, so that one body may act upon another, at a distance through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it. Gravity must be caused by an agent acting constantly according to certain laws, but whether this agent be material or immaterial, I have left to the consideration of my readers." [10]

It seems that Newton, after accepting the phenomenon of gravitation, *cf.* his empirical formula G $m_1\, m_2$ / R^2, finally left the question of the physics of gravity to God.

Relative to reality, this left his second law in the void.

As Newton did not include the realm of electro-dynamic functions in N 2, and Einstein adopted it, these functions are not described together with the phenomena described by Newton. The later descriptions are formed as extensions of N 2. These are, however, not valid for the electro-dynamic forces.

Even after Einstein, gravitation has been taken as a postulated autonomous phenomenon, not as a physical function.

The Lorentz-FitzGerald correction $(1 - v^2/c^2)^{1/2}$ is therefore not needed in order to account for the impossibility of measuring the velocity of light relative to a moving body.

The physical difference between the functions of static electric charges and those of electro-dynamic fields indicates that Einstein's postulates, founded on Newton's model of inertial mechanics, are insufficient for describing matter's reactions to high velocities and that of light, since these reactions are not inertial, but initiated by charges.

The apparent displacement of a star during the solar eclipse of 1919 was interpreted as an instance of gravity in curved space, or as gravity as the function curving space.

The star displacement will be better understood as produced by the electrodynamics of the charge of the photons of the starlight, as the light from the star is deviated by interaction with the magnetic field of the sun, *cf.* JCM 3.[8]

Gravity is not an autonomous force, nor a function of space, but a mechanical function of the charges of the particles of the substance of which matter consists.

The nineteen-twenties let sailing close to the wind be understood as something different from sailing with the wind into the sail.

This led to boats sailing faster than the wind, and quite close to it. The hydrodynamic principle of this sailing was that of Bernoulli, published in 1738[2].

The lack of this insight had not kept sailing ships from being developed into the means of warfare and international trade.

The physical function of this hydrodynamic principle is the lowered lateral pressure of the moving air.

The same hydrodynamic effect in water was not recognized by the Norwegian Patent Office[3] or The Norwegian Technical-Scientific University[22] thus not accepted as a basis of technology.

The existence of atoms was a postulate from antiquity which had not been taken seriously until John Dalton combined it with the empirical chemistry and published his theory of the existence of atoms in 1808.[11]

Optics has not been kept from technical development by the lack of consensus about the nature of light. The telescope predated the slit experiments of Thomas Young (1773-1829) by more than two hundred years.

In 1807, Thomas Young sent light through slits and concluded from their interference patterns that light should consist of waves. The patterns were light and dark zones between light from one source meeting after passing through a set of parallel slits.

His experiment was performed before the publishing of Dalton's theory of atoms, so he and posterity have interpreted light as waves. His experiment was taken to prove light's wave nature.

The second century after Young has even seen a development of mathematical models apparently making this possible and taken to confirm light's wave nature.

The theories concerning the atom should permit a more adequate theory of light.

It is insufficient to interpret an effect of light as particle or wave when it has been sent through an instrument whose potentials interfere with the energy or the function that we want to identify.

Electrical phenomena were a fashionable theme of the period, though perhaps not for the serious scientist Young. His slits and those of other experiments have been material. Their edges consisted of atoms; and the interaction between electrons and photons was an exchange of forces between electrons and photons.

Light and its properties are not understood by references to the material part of the world. The break of symmetry will therefore be a necessary product of light's origin in one only of matter's charges.

The break of symmetry is a part of light's origin and properties. The positively charged particles can no longer cooperate with those of negative charges and are left alone.

The break of symmetry is not spontaneous, but is produced at the production of light; and it is a part of this production. It is followed by processes that are not understood or correctly interpreted within models presuming equivalence or symmetry.

Since the electrons cannot stand still; and most of them produce solenoids, which are magnetic spools, the moving electrons of most elements, the lightest gases excepted, will interact with the particles of light entering the atom.

The specificity of the interactions indicates that the photons are very small relative to electrons and to the distances between them. This specificity is seen in the spectra of absorption and reflection.

The periodicity of the electrons will be communicated to the photons as these are reflected or absorbed.

The photons are absorbed or reflected at meeting the electrons of the matter of the slits.

The electro-dynamical reflection of light by the electrons of atoms makes matter visible.

Another condition is that of the high and dynamic energy of the electronic circuits. The small atoms of light gases have too low potentials for reflecting light, thus the air and some other light gases are invisible.

Periodicity is not a sufficient characteristic of waves. Waves should not be taken as a property of light, as its periodicity is induced by interaction with matter.

The after-interaction periodicity of the photons producing the interference fringes seen by Young was produced by the periodicity of the electrons as they met the photons.

This is an instance of interaction between light and optical instruments taken as characteristics of light. It seems that the purpose of those experiments could be to avoid recognizing light as a physical function.

By being a calculation model for one of its manifestations at interaction, not a model of a physical function as such, the wave model of light is insufficient and misleading. Like other models accepted by their use, it is a hindrance to searching for better models.

We do not get rid of the past. We ought to see its perspectives and understand the conditions of its insufficient or misleading models, thus what conditions are to be avoided when we want to approach reality in a new model.

Understanding by models.

The quick production of new ions could have a relation to the electro-dynamic bonds of each water monomer. These magnetic bonds of the monomer give water a special relation to the magnetic field of the Earth.

The magnetic function of the tripartite bond H:O:H will produce a magnetic field around each monomer. These fields will influence each other and become coordinated. Each of them is therefore influenced by the other magnetic fields.

Through the fields of their electrons, molecules give atoms a permanent relation to the magnetic field of the Earth, *cf.* the spectrum from the window frame. The field will facilitate reactions or bonds involving water.

The reaction to an external field will take place in the straight monomer part of a polymer of water. It is this part of the polymer that will shed a hydrogen atom at ionization; and the similar part of one of its neighbours is prepared, probably by the same magnetic mechanism, to receive this extra atom.

It seems probable that the strength of the Earth's magnetic field should support a sum of magnetic fields in molecules, thus a number of water ions *per* cm^3.

This would make ionization the product of the capacity of the relation between the Earth's magnetic field and those of the water molecules.

The potentials of water's intra-monomeric bonds are, though magnetic, not in the range of the potential of light. The potentials of the hydrogen-bonds between the monomers participate in the system of mechanical forces. The hydrogen bond is static and broken at temperatures up to boiling.

The combined magnetic fields of the water molecules create a common field of magnetism which excludes the possibility of interaction between static electric fields and the monomer even in its straight form.

As the dynamic fields are strong; and static fields are incapable of interacting with them, water cannot lose any hydrogen atom to dissolved matter.

All physical activity and apparent chemical activity of water takes place between its ions and external atoms or molecules; and it takes place on a lower level of energy than that of other physical bonds. Thus they are easily entered and easily dissolved.

When the field potential changes its value by the bonding or removal of ions, two new molecules are ionized; and the electro-dynamic field potential relative to that of the Earth is re-established.

Since each monomer is constituted by two solenoid bonds, which will each produce a magnetic field, there is a reason for presuming that the field of potential is produced by the two solenoid bonds of the water monomer.

Post-Cambrian life was developed on new conditions. Hot water or its parts cannot support the neural functions of multi-cellular life, maybe because the potential of each dimer of water is too high for permitting the release of the metal atom after its neural transport.

The disappearance of muscular function and neural reaction at 42 °C will probably be due to water's higher proportion of dimers.

A certain proportion of dimers will lead to the collapse of the mammals' neural function, thus to death.

This could also be the mechanism of alcohol intoxication, since its narcotic effect seems to be a lowered neural communication. This is a consequence of alcohol's known cooling of water, which will take place by alcohol's dividing water's polymers, thereby using a part of its thermal potential.

The medical side of ethanol could include that it dissolves some of the polymers of the amino acids of the Tertiary. This could be the reason for the absence of arterial deposits in alcoholics.

Our Cambrian metabolism cannot produce enzymes for the metabolizing of modern amino acids (after 65 My B.P), whose compounds and polymers seem to be the main cause of our most important diseases, cancer included. Some of the connected diseases are mentioned in ref. 29.

Electrical phenomena were a fashionable theme of the 18th and 19th century, though perhaps not for the serious scientist Young.

His slits and those of other experimenters have been material. Their edges consisted of atoms; and the interaction between electrons and photons was an exchange of forces between electrons and photons.

Light's interference with atoms of the edges of the slits has apparently not been considered.

Peter Higgs postulated a spontaneous break of symmetry which should have consequences for the physics of light, and should produce problems of discontinuity in physics.

It seems that the production of light from one part only of bi-charged matter cannot be spontaneous. Light is produced by adding energy to the negatively charged particles of matter in their state of high-energetic, forced separation from the heavier, positively charged protons.

This takes place only at temperatures above a few thousand K. Light is thus not spontaneous, but a product of energy concentration.

It has produced at least one new category of physical, though not material or quasi-material cooperation.

Light and its properties are not understood by references to the material part of the world. Light's break of symmetry between positive and negative charges of matter will not be spontaneous, but a necessary product of light's origin in one only of matter's two charges.

The break of symmetry is thus a part of light's origin and properties. The positively charged particles can no longer cooperate with those of negative charges and are left alone.

The break of symmetry is thus not spontaneous, but takes place at the production of light; and it is a part of this production. It is followed by processes that are not understood or correctly interpreted within models presuming gravity, equivalence, symmetry, or any other common trait.

Since the electrons cannot stand still; and most of them produce solenoids, which are magnetic spools, the moving electrons of most elements, the lightest gases excepted, will interact with the particles of light entering the atom.

The specificity of the interaction indicates that the photons are very small relative to electrons and to the distances between them. This specificity is seen in the spectra of absorption and reflection.

The periodicity of the electrons will be communicated to the photons as these are reflected or absorbed.

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The electro-dynamical reflection of light by the electrons of atoms makes matter visible.

Another condition is that of the high and dynamic energy of the electronic circuits. The small atoms of light gases have too low potentials for reflecting light, thus the air and some other light gases are invisible.

Light's origin in one part only of the doubly charged matter places it in a physical category apart from matter as well as from bipolar forces. Neither its description nor its physics will be understood if it is subsumed under one of those conceptual categories.

Periodicity is not a sufficient characteristic of waves. Waves should not be taken as a property of light, as its periodicity is induced by interaction with matter, though not all matter.

The after-interaction periodicity of the photons producing the interference fringes seen by Young was produced by the periodicity of the electrons at their meeting the photons.

This is an instance of interaction between light and optical instruments commonly taken as characteristics of light. It seems that the purpose of those experiments could be to avoid recognizing light as a physical function, having its own and unique characteristics.

By being a calculation model for one of its manifestations at interaction, not a model of a physical function as such, the wave model of light is insufficient and misleading. Like other models accepted by their use, it is a hindrance to searching for better models.

We do not get rid of the past. We ought to see its perspectives and understand the conditions of its insufficient or misleading models, thus what conditions are to be avoided when we want to approach reality by means of a new model, provided we want to use the model as a concept describing and communicating some essential property of its theme.

Epistemology concerns the question of how we specify that about which we are talking. This is the start of thinking and communication; and it is its un-circumventing and most important part.

Needing a clear idea, we should use a concept clear enough for denoting that idea in our thought. Communicating the idea, we should use a concept denoting it to the listener. Since the world consists of parts cooperating by different functions, understanding these parts is necessary.

The Pythagorean method was developed on the basis of these distinctions. It has resurfaced at intervals, *cf.* Roger Bacon (1214-94) and Nicole Oresme (1320-82), but has not gained a secure place in science. The first Pythagorean of our time was probably Johannes Kepler (1571-1630).

If we have any reason for not wanting to understand, we will refuse the distinguishing. This was the method of Isaac Newton (1642-1727), who shrank from the real, which seems to have frightened him. His second law is a kind of tip-toeing between real functions, picking up signs

and leaving the real, that which his God did not permit him to approach.
Inertia is undoubtedly a sign of movement and force. This sign is not the force itself.

Science as known consists in describing the general qualities of the world. Science consists in principles of the understanding of the character of the world. Plato's codifying of this method has been nearly generally accepted.

A characteristic of that method is the postulate that the character of the objects does not reside in the objects themselves. This is its connection to the religions of the societies which have developed systems of knowledge.

Science also consists of specific knowledge about everything that might evoke the interest of somebody having a place in the scientific community.

This Aristotelian method does not always lead to a seamless body of knowledge, as it does not seem to be led by principles.

The seams of Plato's method do not coincide with those of reality, since he ascribed reality to the abstract idea only (Greek ειδος, eidos, "sight, view, idea", *cf.* Latin *videô*, "I see" and English "wit").

Models are mostly taken as sufficient descriptions of their theme, as well in scope as in details. This is, of course, not a character of models, but of the society using them as the picture of its world, and of society's belief in itself as it is.

Society will not believe that it should not be close to perfect, or, at least, better than sufficient for its needs. This is seen in its technology and its science, where the models used are taken as the ultimate truth about their theme.

Aristotle believed architects, engineers, *etc.*, "…no longer to be necessary, because *applied science and technology had already completed their task*." [20] Plato's arguments did not descend to this level of concreteness, but stayed in an abstract world from which it was hardly possible to deduct propositions relevant to humans or society.

Between A.D. *c.* 170 and 1640, the general scientific understanding of the system of Heaven and Earth was that the Earth was the immobile centre of the World; and, *inter alia*, that the stars made the tour of the heavens every twenty-four hours. This scientific understanding was also political and religious.

Copernicus' publication (1543) of the sun-centred system notwithstanding, the politics of knowledge, executed by the Church, were strong enough for condemning Galileo, in 1633, for his allegiance to this new system, though the social reality of his crime was the defamation of prelates, *cf.* ref. 20.
The same allegiance is seen in the belief that the Newtonian system should be the last word in mechanics, though Newton himself had stated his avoidance of theories about reality, *v.s.*

This implies that we have for three hundred years calculated mechanics from the inertia of moving bodies, not from the forces moving them. Newton built upon the celestial mechanics of Kepler and the terrestrial mechanics of Galileo. None of the three had any key to the prime movers of moving bodies.

The phenomenon of gravitation is still generally known as such, not as a function, though keys to the physical functions have existed for more than a century, *cf. ch.* 3.

Still, the Platonic idealism reigns through great models. They have got a high prestige and central positions in our knowledge; and they are society's blinkers against other, possible models.

The models of the common teaching of physics are not debated, though the model of macro-physics is founded upon Newton's second law, which concerns phenomena only; and these are even defined by each other.

Should we ask ourselves whether we want models of the real functions, or whether we should be happy with signs, symptoms, phenomena, appearances, or whatever can remind us of our theme, though without making us approach reality, or rethink?

Many theories and models are tentative, or they include features taken from several parts of physics, like particles or waves. Should we search for the particle of gravity, the graviton, or for its waves? Is there no third possibility? What should be the property or the way of working of the particle of gravity?

Taking the model literally seems to be a human frailty. We easily take a model as a complete representation of the phenomena described; and we can even believe products or phenomena to be the active parts of a function. Instances of this are inertia, the passive part of movement, and light, which, at its velocity and potential, needs a strong mechanism behind it.

These instances show that we should distinguish between the phenomena observed and the active parts of a function. Newton's second law consists of three parts, which are force, mass,

and acceleration. Acceleration is referred to force and mass, which are defined by each other.
The Galilean-Newtonian acceleration is a *post hoc* phenomenon, not taken as produced by a prime mover.

N 2 describes phenomena, whose functional, or physical, relations are not described. Nevertheless, it has, in Einstein's version, been taken to describe the changes of the phenomena, based on the implicit postulate that the functional changes at velocities near that of light are sufficiently described by this model of phenomena of mechanics, with the supplement of Lorentz and FitzGerald.

Those presumed changes are, though, projections of the model. Relative to reality, they are postulates.

If the model were correct for physical functions, if its presumed forces were present at velocities near that of light; and if the physics of light were correctly presupposed, the effects would have been seen. These conditions are not present.

The world does not heed our models, so they are not normative for reality. It cost Kepler seven years of doubt and calculation before he could convince himself that the planets could deviate from God's perfection and follow elliptic paths. Maybe God was not as perfect as Kepler had believed and Plato had said?

The common function of models could perhaps be illuminated by the example of Ptolemy, who, according to his own words, had the intention of hiding God's unGodly elliptic planetary orbits, *v.s.* Ptolemy knew the correct orbits; but his model was complicated enough for holding most mathematicians away from it.

Aristotle's model was probably total enough for the totalitarian Church. Through Ptolemy, the Earth-centred model became a part of its creed.
It seems that Nicole Oresme, in the fourteenth century, was the first to criticize the Aristotelian model of the Heavens. In *De coelo,* he attributed the daily movement of the stars to the rotation of the Earth.

The possibility of a sun-centred planetary system seems to having been discussed towards the end of the fifteenth century, when Copernicus was a student, *cf.* ref. 20. The Church put Copernicus' book on the *Index librorum prohibitorum* ("List of forbidden books") and punished Galileo for supporting his theory, though Lutherans were the first to criticize the Catholic cleric Copernicus.

The theory of the Universe seems to be a part of religion. A religion first accepted is not easily repudiated.

For a society it seems more important to have an object of belief than a realistic model of the universe. A reason for belief is the distance from the everyday world and the inaccessibility of control. Saint Thomas Aquinas said *"Credo quia absurdum";* "I believe because it is unreasonable".

The theory of the universe, gravitation and light included, is apparently an object of belief more than a part of physics. This can be inferred from the difficulty with which it is reformed. This has been underlined since Aristotle, who was perhaps the first to declare the work of science to be near completion, *cf.* ref. 20.

In our time, the scientific body does not harbour any doubt. The student is kept from new angles of approach; and the object of belief is kept safe from being degraded to common and paradox-free knowledge.

In our days, the veneration for Newton and Einstein is understandable from the need for saints, and from the prestige of their theme rather than from the consistency of their teachings. This shows the connection between religion and science, but not science's proximity to reality.

When Planck started his studies of physics in 1874, he was told that nearly everything needed was already known.[24] Today, we are told that a few problems await their solutions, and that CERN is working at high energy at their solving.

One characteristic of all times is that the unknown as well as the known has been taken as parts of accepted theories. As will have been seen, the unsolved problem of each age has been that comprising the accepted, from Plato to the 21st century. It seems that paradoxes and self-contradictions have been more acceptable than searching for a better description or theory.

History of science shows the predilection for phenomena as its theme, even when a real function is in sight. Symptoms may be real, but are often more conspicuous than essential, perhaps like thunder and lightning? It also seems awkward or beside the target when a symptom is made the essential of a model at the cost of a function, *cf.* N 2 and inertia.

Mathematics is abstracted from reality. Mathematics confers an authority which can preclude discussion. Interpreting mathematics into reality is an ambiguous task.

The reasoning of mathematicians includes the possibility or necessity that a mathematical consequence should describe reality, *cf.* ref. 18, *passim*, or Planck's way to his constant.

If we say that matter is a wave, then wave mathematics does not lead us closer to understanding the physical nature of matter. If we say that matter is a collection of particles, this does not communicate any understanding of how substance is made to hang together as matter.

A mathematical model of the distribution of particles is possible without including functions making particles constitute matter.

The same is the case when waves are the objects of a mathematical model. Taking the mathematical consequences of the model as a description of physical consequences of the conditions described is too easy. It becomes difficult when the distribution depends upon functions of potentials between the particles, and when these functions are not parts of the model.

A similar instance is that of gravitation as a phenomenon: it does not lead us to gravity.

I wonder whether mathematics adds to the understanding of its object of description, or detracts from it. Mathematics produces a high level of abstraction. The function or phenomenon described is not always far removed from the disregarded details.

The purpose of weighing a heavy object does not include the identification of its molecular functions. Will its chemistry, then, disclose the physics involved in the material conditions of weighing? And do its subatomic functions have any significance?

The description of matter as a system of waves, *cf.* ref. 40, permits a modelling of many forms and functions of physics, though not to the bottom, and not without contradictions, since we know the existence of particles. If their interaction is described as waves, what is the form of the forces between the particles?

At some level, the distributive aspect of a wave model will be of lesser importance than the great potentials between small particles.

The form and degree of distribution depend, after all, upon these potentials. This shows that a wave model can describe phenomena detached from functions, even without mentioning that functions are the performing parts of the world.

Wave descriptions have a disquieting similarity to aesthetical descriptions of products of engineering. Neither will be instrumental.

The epithet of the science of Plato, Ptolemy, and the 20th century, is 'modern'. It is intended to produce a nice picture of the world and society.

Plato was the father of modernity by removing concepts of reality and the below-nobility interests from his language, making it acceptable in the best social, religious, and scientific circles.

The cost paid was the consciousness of functional details of Nature and society. According to Plato, this was a gain.

Whose was the gain? Ptolemy and Plato referred their avoidance of reality to the values and system of God. Plato has been more than a shadow in the periodic removing from language of thoughts outside social values.

One other purpose of modernity in science seems to be the construction of models rather than exploring the properties and consequences of Nature itself, as this task is left to technology.

The grand models produced are thus seen and evaluated from their beauty and simplicity rather than their capacity of description. Aesthetics is a part of the social values of the dominating class of any society.

The Platonic method seems to be part of a constrictive phase of society, in which all resources are used for the purpose of keeping the power of society where it is, even when the fulfilment of this purpose is the dissolution of those resources and of the structure of society.

Expansive phases of society bear new ideas, new concepts, and an evolution of vocabulary, *cf.* ref. 5. The characteristic of this phase seems to be that the resources used for development are not yet incorporated into the general system of power of society. A corollary of this is that a society in becoming will be creative.

A consequence of the investment in great ships of the sea and space, and in great equipment of exploring the particles smaller than small, is the divestment of those functions of Nature and society not adding to the prestige of the scientific or economic parts of society. This is the political part of Plato's teaching.

Its consequences have not received great attention. Gibbon[4] and Toynbee[5] did not get a great following. They pointed to the facts of societies' crumbling and fall after their periods of work, investment, greatness and expansion.

They did not display the lack of attention to the fundaments of society, neither material nor human. This is in keeping with the praxis of observing and judging from phenomena.

The purpose of the present work is to find functions of some parts of the world generally described in discontiguous models.

Functions can be reached when Plato and his followers are left. The modern mathematics has not removed the spirit of approach far from that of Plato. Perhaps a new approach can remove contradictions and doubles of Nature, which are not characteristics of Nature, but model-induced defects of our understanding.

The not understandable is the producing of models by the command of prejudices. The essential is not whether these are called “God”, but whether they prevail over knowledge taken from Nature, which should be the object of description.

Even absurd (St. Thomas) or impossible (Thomas Browne) results are accepted as qualities of Nature.

Today, paradoxes are parts of physics taught, *cf.* light’s double nature, ref. 9.

Ole Rømer (1644-1710) and Antoine Laurent Lavoisier (1743-1794) asked the World about its properties. Rømer found the velocity of light; and Lavoisier found the role of oxygen in combustion and respiration.

James Clerk Maxwell (1831-1879) condensed the information about electricity and magnetism into four equations. He combined the two classes of properties and their similarity of functions into equations which became a cornerstone of physics.

In the light of Maxwell’s equations and the 20th century’s understanding of atoms, it should be possible to find the functional relations behind the phenomena interrelated in N 2.

It is evident that matter’s forces reside in the potential between the two opposite charges of its substance. Until other sources of potentials should be discovered, these are the candidates for explaining the internal and external forces of matter.

It would have been too much expected that Newton should have known the functions of substance that are producing the potentials and forces of matter.

Besides, there has not been used a method of measuring that could have shown the difference between the force received from an electrical potential and the inertial force delivered from the body moved.

Einstein apparently did not distinguish between functions and phenomena. His postulates about bodies’ behaviour at high velocities, even at the velocity of light, are not compatible with the physics of substance or with the physics of high velocities. He seems to have taken N 2 at face value.

We cannot rely upon models leading away from the functions of reality. We cannot build upon Newton, *cf.* his confessed lack of understanding of the physics of gravity. History is not a sufficient reason for not understanding the physics of mechanics.

Ptolemy’s codification of phenomena as the objects of science was challenged by Kepler after nearly 1500 years. In spite of Kepler’s method, Newton’s three laws of mechanics, and his model of interplanetary gravitation, were phenomenological, as they were products of his avoidance of theories of the real.

Historically seen, and as a part of epistemology, Newton’s method was therefore a regression from that of Kepler’s.

After the pressure from positivism and phenomenology in the 19th and 20th century, there should have been a rising conscience about the consequences of these two, converging schools, and, more important, about alternatives to their recipe. The two schools were united through the “positive data” and “the things themselves”.

Phenomenology wanted to use “the things themselves” as the foundation of philosophy and science, without describing further methods than critical reflection. The immediate was taken as more important than that understood by some other means than itself. “The radical absence of prejudice” and “the immediate intuition” are recommended, since we “too much are constrained by prejudices dating all the way from the renaissance”.[14]

Without prejudices, we should not have had a human culture. The roots of our prejudices are thousands of years old. They are the frame of our thoughts.

After Plato, they have needed an overhaul, in order that new knowledge should not be drowned in insufficient models. Husserl’s imprecise language is of no help, so much the less as the laming prejudices were 2200 years old when Husserl wrote.

It would have been possible to avoid gravitation as a collective model by stopping at the particular, saying that each body is “barogenic”. This does not seem far from the explaining of medical syndromes by “factors”, like urbanisation, a hypersensitive immune system, smoking, variations of blood pressure, *etc.*, as the single "factor" is ascribed an un-analysed influence not seen as related to specific functions, *cf.* ref. 29.

The consequence of the combined positivism and phenomenology is an uncritical use of empirics, not only in medicine, but in all connections where insight is exposed to being bogged down in data. From university circles I hear that scientific papers and treatises of today are mostly collections of data.

The strange in this is the general lack of models, as well as the acceptance of model-free information as the ultimate knowledge.

If we know the functions within a present structure, we can imagine or calculate the functions leading to the present. Rocks show their structure, their chemistry, and parts of their history. After Darwin and Mendel, the same is possible for animals.

As it is possible to find the conditions of the present, its consequences should be found..

Darwin did less argue for his model in his main work[39] than against the un-functional and un-biological arguments of the religious community.

Darwin's great contribution to science was a body of concepts and arguments useful for understanding a dynamical system working on the basis of physical and social conditions and within autochthonous functions.

The conditions of the material and biological system itself were seen as the sufficient conditions of change, even of the development into more complex forms.

No force from space was introduced, no *deus ex machina* required for procuring the changes seen within the combined material and biodynamical systems of the Earth.

It is not sure that we should have today the right concepts, or mathematics, for describing the relations and functions missing between the particle-models and wave-models of matter and their related forces. The accepted physics still include forces of imprecise nature and unknown provenience, *e.g.* magnetism and gravitation.

Maybe we can reach a new physics without paradoxes, *cf.* gravity, *ch.* 3 and water, *ch.* 7.

A little part of light ends its activity in our eyes. What happened to it before it arrived? Where did it start, and what were the properties making its way possible? What were the conditions of those properties? Is there an answer in optics?

The strangest part of light is that we can see it. This is not a part of light, but of life.

General models are rather abstract. Combined with descriptions of phenomena they leave a void where we expected to find a function. The description of functions, with or without mathematics, should be supposed to leading to understanding.

The current use of mathematics seems to have as its partial purpose the concealment of a deficiency of the descriptive part of the model, while the efficiency of its calculating part is well cared for. Exactitude of calculation may be taken as a sign of quality of description, probably because it is more easily evaluated than can be the accuracy of correspondence with its theme.

The model seems to be evaluated according to its scope and easiness of use, rather than to its completeness or exactitude of description.

A limitation to phenomena is a limit to the food for our understanding. A possibility of understanding lies in the phenomena. If we find out the production of phenomena, it may be easier to understand their nature. That will presume the understanding of the functions involved. We could start by learning the difference between phenomena and functions.

The beginning of a theory could be to find, or to postulate, the physical functions involved. They could be the foundation of a model. Mathematics may come as a second step. This seems to have been the method of Copernicus.

The model of the sun-centred planetary system was in the air at the end of the 15th century. Copernicus formulated the sun-centred planetary system; but he relied upon the mathematical model of Ptolemy, of the 2nd century A.D. This choice of mathematical description held back the common accept of his model for nearly one hundred years.

Classical physics is said to believe in a continuity of Nature and in the possibility of describing it as such, while modern physics is based on the discontinuity existing between the separate units of matter and forces.

This is disputable. The discontinuity postulated by Max Planck (A.D. 1900) was not followed by a description leaving aside the continuity of waves in the constitution of matter or in the transmission of light and forces.

Trying to combine these with the modern discontinuity has led to a discrepancy between the model of waves and the discontinuity of matter, or, maybe there exists in matter a continuity not described?

The distinction projected outwards on reality between a world of complete continuity and one of a least unit is a property of the models. It is an instance of blaming the world for the model's insufficiency; and it does not seem to be a fruitful approach.

The double description has led to a lack of understanding and to a reversion to Newton's phenomenological description, now in Einstein's version. The tradition of phenomena has not been left for functions.

The purpose of a mathematical model in physics is not the deduction of mathematics. A model of physics is useful only for finding the physical consequences of the functions described. These should not be excluded by the abstraction level of the mathematics.

A part of this is that the mathematical consequences are internal parts of the model and not necessarily those parts of it which deliver an adequate description of its theme.

It seems probable that the world will be best understood as a product of as few principles or functions as possible, *cf.* Ockham's razor.

The opposite course of thought is to ascribe autonomous functions to its parts. This is followed by the belief in phenomena being sufficient conditions of understanding, as the single observation is taken as independent.

It seems that ascribing autonomy to nearly every phenomenon, like heat, light, gravitation, medical symptom, *etc.*, has been our culture's way of understanding the surroundings. Our picture of physics has been a mosaic of phenomena imagined as autonomous.

This juxtaposition of phenomena has held our attention away from the connecting functions and has impeded the understanding of Nature.

Postulating continuity between phenomena and a limited number of functions could bring a coherent understanding into what has hitherto been seen as autonomous phenomena.

These common functions of matter would refer to a limited number of properties of matter and to its two partners in the one fundamental potential, which is that between positive and negative charges.

The continuity of waves seems to be a property of the model not always followed by analogous properties of matter. It therefore seems justified to propose particles as the principal form of the primary matter.

This will lead to fewer internal inconsistencies of the model; and it will point to the need for an understanding of the forces uniting the particles, if not by amalgamation, then in a common movement, the dance of the forces.

Physical conditions.

The un-exotic particles of matter are protons and electrons. Their charges are equal of size and opposite of kind. The field belonging to a single particle has an apparently short range, perhaps several diameters of the particle.

The charges have a special property of function, as the sums of fields of positive and negative charges are effective within a space significantly greater than the sum volume of the particles or of the body they constitute. This is seen in gravity, where the distances between bodies of one gravitational system are many times their size.

Dynamic fields have an orientation by their movement at high velocity or by being influenced by other dynamic fields. This is shown by magnets' capacity of transmitting magnetism to some other metals.

The fields of the proton and the electron of hydrogen reach far enough for their forming a monomer of water with oxygen and another atom of hydrogen.

Static sum-fields of protons and electrons can fill great spaces. The sums of the two charges of two bodies produce gravity over vast distances. The variable distance from the sun to Pluto is maximum $5{\cdot}9.\ 10^{9}$ km. This is nearly forty times the distance between the Earth and the sun.

The sun contains *c.* 10^{54} electrons and at least that number of protons. The sum of the sun fields reach far enough for holding Pluto in orbit by its fields. The density of the sum-fields (or the flux density $\boldsymbol{D}$) of the sun is around $3{\cdot}6\ .\ 10^{17}\ C_{(+\,\&\,-)}\ m^{-2}$ at the distance of Pluto. This corresponds to less than one part in a million of one mole *per* square metre.

Avogadro's number was not intended for the counting of fields. It is, though, possible to indicate the density of fields by means of the measure of density of substance, upon which it depends.

With its own fields, Pluto cooperates with those of the sun. The amount of substance and its accompanying field forces could provide a successor to Newton's gravitational constant, $G = 6{\cdot}072\ .\ 10^{-11}\ N\ m^{2}\ kg^{-2}$.

The constant does not include physical forces, as it is the phenomenological measure of the inertial momentum produced as a reaction to the intermaterial forces, which are not parts of the Newtonian model.

The force of gravity is proportional to the sum of charges over the projected area of each of the bodies involved and inversely proportional to the square of their distance:

$$\Sigma\,[A_2\, C_{(+\,\&\,-)\,1} / m_{(-\,\&\,+)2}\, A_1\, C_{(-\,\&\,+)\,2} / m_{(+\,\&\,-)1}] \,/\, D^2 = F_{g\,(1\text{-}2\,\&\,2\text{-}1)}$$

Gauss' gravitational constant is empirical like that of Newton.

The condensation of the planetary system could have taken millions of years. The field forces could hardly have been spread faster than the velocity of light. The question of the velocity of spreading of the fields of its particles is therefore without any instrumental significance for that situation.

A field is the extension of the property of a particle. This extension is greater than that of the particle.

The field is the transmitter of the property of a particle, thus of its part of a potential or its force.

A field will move with the particle to which it belongs. A moving field is still a field. As it moves with the particle, it cannot leave it, and it does not spontaneously lose its property.

Two particles of opposite charges forming a structure of moving particles conserve their fields and their potentials even when moving within this permanent relation.

A certain reservation is needed concerning negatively charged particles at high velocity, *e.g.* light.

The production of light, like in the sun, takes place in the same way as the production of a dynamic magnetic field, by the rapid change of direction of movement of the negative charge, *cf.* the transformer.

In the sun, electrons are broken down by their collisions; and the velocity of their parts rise stepwise to that of light.

As was seen above, the field of light is coherent, keeping its direction as it travels in narrow bundles, which do not expand.

In contrast to this, the sum-fields of gravity contain both charges and fill the space in which they are spreading. The planets are within the sun's gravitational field regardless of their direction from it.

A question arises from this condition. Would the gravitational field of the sun be strong enough for holding a great planet like Jupiter in an orbit the radius of Pluto?

A split particle does not lose its part of the charge of the whole particle.

Magnetism is a product of parallel charges. In a solenoid, the charges are made to move in parallel; thus, the magnetic effect lasts as long as the current is on. In a more or less permanent magnet, the molecular domains of (+ and -) are kept in the same direction.

In the sun, its negative charges are broken down to femto- or atto-particles through a series of high-velocity collisions. They are emitted as light. At a hit, light delivers its magnetic force.

A field is the extension of the property of a static charge. The concept 'field' is also used less precisely for other properties presumed to have an effect at a distance.

A wave is known as the movement of a potential between static loads. The model of the concept is also used, with a low degree of precision, for other relations between real or presumed potentials.

The concept 'wave' is inappropriate for the understanding of light as a physical function. Its magnetic function is produced by the field of the particle at a high velocity. This does not imply any lateral or longitudinal movement interpretable as a wave. The relation to atoms will be an interaction between photons and electrons.

If the photons do not meet the electron, they can pass at short distances, perhaps 10^{-11} m (0·1 Å); and they will then influence the direction of each other's motion.

The lateral magnetic effect of a photon is a vector transient not well described as a wave. The concepts 'wave' and 'field' are not adequately applied outside the realm of mechanical phenomena.

At meeting specific atoms, the photons will be given some directions rather than others; and they will therefore produce bands of light between dark bands. These deviations are produced by the solenoids of the electronic orbits having a v/r above a certain value, thus producing a magnetic field.

The dark and light bands discovered by Young could not have been products of light waves. The electrical charges of atoms and the magnetic force of moving charges were known to James Clerk Maxwell. He published his model in 1873[8]; and it offered an interpretation of light that could have kept its model within a physical, not self-contradictory frame.

The concept of 'field' and its use in the description of light and magnetism has led to a blurring of the difference between the mechanical and dynamical functions of physics.

One instance of this is light's role in thunder, where the unclear form of the model has brought a low understanding of the process.

There seems to be a reason for grading the size of fields between those of photons and those of lightning. There is not necessarily a great scale of sizes of single fields, as they seem to operate singly as well as at high concentrations.

When the concentration of charges is unknown, it is impossible to draw conclusions about the potential of the single particle carrying a charge. This is relevant to the relation between light's attributed wave length, or frequency, and the energy delivered by each photon.

As wave-length and frequency are phenomena produced by and in matter, at the interaction between light and the matter of measuring instruments, they are not primary properties of light, but mechanical categories projected into our interpretation of light. The correct measure of light would be potential *per* photon.

Light is not only a phenomenon visible as a colour, a reflection, or daylight. The properties of light are presumed to be exposed by the effects of its passage through lenses, prisms, and measuring instruments.

What are the properties of light as such? What are the properties added to or removed from the light on its passage through the instruments? What are the properties of the instruments?

Our prime source of light is the sun, which contains primary substance and its products. They are made as elements and their ions.

The properties of matter are all within the conditions under which particles of substance have cooperated at temperatures between those in the sun and those on Earth today.

As the moving field has an extension outside the particle to which it belongs, there is a certain room for interpreting as waves the interaction between light and Young's slits.

This interpretation should, however, not have survived the discovery of the electron, its charge, and field.

All interaction between light and matter can be interpreted as meetings between charges, either directly or *en passant*. Waves are not an active or passive part of the interaction.

In the case of close passing, the photonic charge is not delivered, but it will influence the solenoid or an electron by its dynamic potential.

The photoelectric effect depends upon the photons' magnetism and the magnetic field of the atom's solenoid.

Light, as a magnetic radiation, has no lateral field effect, except in a magnetic field. One ray of light is not broadened, but bent in that field; thus the light of a star is seen as a point and in its direction only.

Olbers' paradox, the dark night sky, confirms the two systems of energy.

When two light rays meet at an angle, the weakest of the photons will be beaten out of course. This produces the redshift from far stars and the background radiation at 2·7 K.

Empirics, conditions, and interpretation.

Atoms consist of protons and electrons, of opposite charges. Some of them are combined into neutrons, whose interaction is a compound of movement.

The electrons are too small for observation in action.

Their known electrical properties indicate that they have to move perpetually in order not to fall into the nuclei of the atoms.

Neutrons should therefore be small, high-potential versions of hydrogen atoms. Outside the nucleus of an atom, they are disintegrated because of the absence of an outside field.

The electrons cannot stand still. Seen from one side, the sum-fields of positive and negative charges are of different values depending upon the momentary place, velocity, and direction of the electron.

The magnetic field of the Earth is a force field coordinating the polarity of molecules, probably in most atoms, *cf.* the spectrum of the window. A variable sum-field may be interpreted as a wave; or it may be defined as a wave. If this should be an applied definition of the concept 'wave', it should be made explicit.

The concept 'wave', though implying an aspect of periodic change, does not communicate an adequate understanding of the changes taking place in the atom. On the sea, waves are sums of movements of particles under a sum of gravity, viscosity, and wind.

Models for waves as kinematic phenomena are on a par with other compounds of distributive phenomena: they impart no information about dynamic functions, their variables, their parameters, or the properties of their constituents.

They offer an abstract description, a simile of a model, while avoiding the functions of the physics that should have been described.

The physical functions of light and gravity are produced by the variables, their properties, their dynamic functions, and their parameters.

Light and matter are not inconsistent. Nature is consistent. Its parts work together, even when we do not understand how.

We see Nature as inconsistent, or double, when we see it through incoherent models. Nature is consistent and has no double nature.

If we believe anything to have a double nature, it is because we do not understand its real nature. Taking a calculation model as the ultimate truth about the properties or phenomena is too easy.

Our problem is that this will block the development of a better model, as it is difficult to leave the accepted knowledge.

This reflects shows that acceptance is not a product of a model's accord with reality, but of an agreement between the guardians of learning.

The universities will not accept anything they have not accepted already; and the Catholic Church rescinded its verdict against Galileo after 359 years.

One more unlucky reason for believing in an inconsistent Nature is our scientific tradition of accepting paradoxes and inconsistencies in models. Since our tradition includes the projection of models on reality, we believe the world to consist of incompatible parts.

This is an overbearing, nearly paranoic tradition, without which we should do very well.

It is possible to evaluate a model from its degree of consistency with the constitution of the technical equipment used for its establishing. This should, though, not be the ultimate criterion for the correctness of the model, *cf.* the theory of light's constitution based on Young's experiment.

Evaluating the physical presuppositions and mechanisms of light and other material derivatives is possible when the role of the properties of the equipment is considered.

We would like to have the control of our perceiving interactions by contact separately from interactions by fields, which are part electrostatic, part electro-dynamic.

In general, we would like to know that we perceive and measure what we want to measure, not a dominating interaction with the instrument for experiment or measuring.

The existence of atoms had not been confirmed in 1807 (*cf.* ref. 11), when Thomas Young sent light through slits and concluded from their interference figures that light should consist of waves.

As the slits are material, their edges consist of atoms; and the interaction between their electrons and the photons will be a lively exchange of forces between electromagnetic nano-fields and charged particles at the velocity of light.

This is also valid for the interpretation of light's composition of colours as autonomous units, which is not possible.

The moving electrons will interact with the fields of charged particles entering the atom. The periodicity of the electrons will be communicated to the photons.

Periodicity is not a sufficient characteristic of waves. Waves are parts of mechanics and should not be taken as a property of light. They are induced as periodicity by its interaction with matter.

Periodicity is not either a characteristic of all interactions of light, *cf.* the star visible during the solar eclipse of 1919.

As a calculation model for one of its manifestations at interaction, not a model of a physical function as such, the wave model of light is misleading. It does not contain its function or structure. Like other models accepted by their use, it is a hindrance to searching for a better model.

Periodicity or waves are interpretations or phenomena. They are not the primary products of physical functions.

What is a physical function?

At sea, a wave is a mechanical function of gravity, seawater's density and viscosity, wind's velocity pressure and the Bernoulli effect lifting the sea by $\Delta p = - \frac{1}{2} \rho v^2$.

Light is the dynamical product of a physical function. It does not have the wave form, though it meets matter whose parts produce periodicity.

In general, a function is the sum of a product and the conditions producing it. The product of a physical function, as well as its conditions, should be physical, thus not appearances only.

Still, appearances are products of physical functions, though less material. A photograph is material; and its picture can show a real happening. No general limit can be drawn between the physical function and the apparent.

Like in light, the functional constraints can be severe. In the case of the composing of proteins the constraints include many parts and specific conditions of pressure, temperature and presence of water, perhaps in a specific polymer combination, in addition to a specific enzyme.

Each amino acid of the protein is programmed in the DNA. This is a *post hoc*-phenomenon, as amino acids must have existed prior to DNA.

In some connections, "wave" is an imprecise word used undefined for explaining phenomena so as to escape understanding.

I have never understood what Schrödinger might have meant by the concept 'wave'. This does not underlie his wave mechanics, which is summed up as "…the world is based on wave phenomena, while particles are mere epiphenomena." [18]

Maybe, but in that case, what material or other functions are producing the wave phenomena? If it should be possible to communicate anything, the communication's concepts, be they in mathematical or literary form, would have to refer to something, abstract or concrete. If a wave exists, it should preferably consist of something other than a mathematical description.

The key functions can be mentioned by the concepts 'reference' and 'relevance'.

The Platonic abstraction removes any concrete significance from each case by subsuming it under a general class at a Godly level. Schrödinger's approach to description seems to be the same as that of Plato.

I can imagine Gauss' answer to the question of what his mathematics should describe: "Describe? They describe relations between numbers, nothing more."

The posterity of Plato and Schrödinger is confronted with a purpose whose properties are not disclosed.

A "reverse epistemology" has entered the discussion if we should mean that war is a reality, existing in the documents of war declaration only, while bullets, atomic bombs, and corpses are mere epiphenomena.

In Nature, we see waves where several forces work together on a number of material particles in an aggregate of particles of partly unknown form, potential, and function.

A question of principle is whether the world could have consisted of phenomena. Observable phenomena are not the primary class of existing entities. Lots of secondary happenings and qualities catch the eye.

Definitions of our concepts of reality will establish distinction and correspondence between the world's details and our concepts of them.

Periodicity or other distribution is not a model of physical functions. Regardless of a refined mathematical treatment of periodicity, this and other phenomena are products of interaction between physical functions. As they show themselves dependent upon charges, forces, and movements, these and their functions should be objects of science.

We may define the concept 'wave' in several ways, mostly as an observed secondary phenomenon of interaction between particles of substance or aggregates of matter by contact or by fields.

The observed phenomenon, or the postulated mathematical connection subsumable under the concept 'wave', does not disclose the nature of interaction; and it does not include the properties, energies or potentials of the interacting parts of matter, since the waves are sum-phenomena. In order to produce a transversal wave, three forces are required. In cylinder coordinates, the directions of the forces are + r, - r, and z.

Seen as a function of fluid dynamics, the wind | produces a pressure against the wave as soon as the differential function of the Bernoulli effect ($\Delta p = - \frac{1}{2} \rho v^2$) has lifted the water surface marginally over a small area. A small wave is lifted to become higher by the Bernoulli effect on the curve of the wave, and it gets stronger and faster by the wind pressure.

A registered frequency at the hit of, *e.g.*, a photon, does not imply that a "wave" in any meaning should have been effective in the light before the interaction.

Interactions by potentials between attometre-sized particles and electrons in an atom will lead

to a change in the system kept in dynamic equilibrium by the movement of the electrons relative to the nucleus.

Mathematical models seem to having been chosen because they are possible models and carry high prestige, not because they should offer adequate descriptions.

Since wave mechanics is a model of periodicity, it is at hand for describing a periodicity seen in matter and at light's meeting matter.

It seems more than strange that, in the case of light, this periodicity should be ascribed to light alone. The model does not describe matter's interaction with light, or how the periodicity of matter's electrons should be transmitted to the light.

The first place to search for the source of periodicity should be the substance and potentials of the matter meeting the light.

The find will be the coincidence between the periodicity of the electrons of the substance interacting with light, and the following periodicity of the light. The source of the frequency will be the atoms of a measuring instrument.

It seems that waves and wave mathematics have been used for pushing an unsolved problem out of the frame of reality and into a realm of untouchable abstracts or postulates.

If a wave model of light is chosen because light then is defined out of the material world, this could be seen as a fear of the concrete, *cf.* Newton. If light is postulated as not quite real, the scientist will have relieved himself of finding light's way of influencing matter, or of finding a place for it in physics.

A wave model of something material is a kind of abstract art, *cf.* Plato's systematic abstractions, in which the concrete, the properties of matter included, are no longer of interest.

Empirics is the knowledge of phenomena. It has been modern for 2200 years, since Aristotle. It has been strengthened at intervals, among others by Ptolemy and Newton. Its theme has been the immediately perceptible. Its intention and method is the description by any means considered adequate, from drawing or photography to refined mathematics.

Newton as well as Ptolemy avoided the real under the phenomena. This intended avoidance of reality is not a general characteristic of empirics, whose relation to the real should therefore be found in each case.

One instance is the fall to Earth. Galileo Galilei measured its acceleration. Johannes Kepler thought there must be a force operating between the planets and the sun; and he described the planetary trajectories.

Newton combined the acceleration with the movement of the planets around the sun and calculated the constant giving a measure of the observations of the movements of suns and planets.

This was the apotheosis of empirics. Empirics have dominated science since the death, *c.* 200 B.C., of the last Pythagorean, Aristarchus.

An alternative to empirics exists. This is the search for functions. Seen from today, Bernoulli and Lavoisier took up the thread of Pythagoras and Kepler.

Newton's method consisted in finding relations between phenomena. The post- and pre-modern method of the 18th century had been used in the 13th century by Peter Peregrinus in his description of magnets.[45]

This was an episode, as Europe had turned its back on Nature. 1500 years earlier, Plato gained the ears of the priests and princes of Europe for his simplified model, in which reality, life and society included, were without value compared to the abstractions of eternity.

The 18th century saw the beginning of accept for the study of Nature.

After all, it is possible to say: "I do not want to limit my search to the apparent. I know that there is some function behind it. It is not necessarily deep hidden. It will tell me more than I can see from the apparent. In the case of gravitation, there may be a force somewhere behind it."

It is even possible to continue: "It is unlikely that the visible and measurable phenomena of fall to Earth and orbits of planets should be the whole of what takes place between bodies and planets.

Since these phenomena take place without any obvious third part, it is possible to postulate a physical function at work between the bodies and planets. This function could be performed by the properties of matter itself. These properties are known to be matter, charge, extension, and movement."

This reasoning led to the theory of, *inter alia*, gravity described above.

It seems proven that matter consists of particular substance producing intra- and inter-material forces by the complementary charges of its particles.

Because of these charges and the size of the particles, these parts of atoms cannot stand still relative to each other, but will have to maintain their forces and keep their relative potentials by relative movements.

Standing still requires energy for stopping; and when the momentum of a moving part is overcome, the potential between it and an opposite charge will make them coalesce.

The phenomenological empirics of light may be described by a comprehensive model implying transport and distribution. The function of light resides, though, in its physics, which is neither described nor understood within models of transport, distribution, statistics or waves.

A mathematical model on a high level of abstraction does not describe the underlying functions, regardless of its having incorporated an abstract of them.

Atoms consist of protons and electrons, of opposite charges; and some of them are combined into neutrons, whose nature is defined by their parts in relative movement.

On their way, the electrons add their fields to that of the nucleus. Seen from one side, the sum-fields are of different values depending upon the momentary place and direction of the electron, *cf.* the spectrum from the window.

A variable sum-field may be interpreted as a wave; or it may be defined as a wave. If this should be the definition of the concept 'wave', it should be made explicit.

On the sea, waves are sums of movements of particles under a sum of gravity, viscosity, and wind. Models for waves as kinematic phenomena are on a par with those for other compounds of distributive phenomena. They impart no information about dynamic functions, their variables, their parameters, or the physical properties of their constituents.

The power of sea waves is a function of their amplitude and wavelength. It is possible to postulate a wave producing a high energy by its high frequency, though it will hardly be found in Nature, as matter and its constituent particles of substance have limits to their energetic performances relative to inertia.

The limit of the significance of inertia was passed before reaching the velocity of light, which is therefore the vehicle of dynamical force only. Its physical function is that of a magnetic radiation of particles; and this has no static or inertial part of its potential.

Light constitutes its own, one-dimensional, magneto-dynamical system of energy.

The high frequency of light is not a quality existing in the light ray on its way, as it is induced by the periodicity of the electrons of the receiving matter. In a measuring instrument, these moving electrons are the substance receiving the photons and therefore deciding the frequency of their arrival.

This is not equally valid for all atoms, since the smallest do not produce this magnetic effect, thus do not interact with light and are invisible, like air.

The arriving photons have one quality, which is a force produced by their charge and velocity. They have no inertia. Their potential is measurable as electricity transmitted as heat or free electrons.

The heat is an induced augmentation of the potential between the electrons and protons of the receiving atom. A measuring instrument will interpret the impact by the reactions of its own atoms.

As neutrinoes are without any charge they do not interact with matter. They go right through our bodies, unless they hit an atomic nucleus.

Ultra-violet (UV) and hard X-rays penetrate living matter to a certain depth, not because of their presumed high energy, but because of their low potential and their ensuing low capacity of delivering energy or interacting with matter.

The low energy of UV keeps them from penetrating the melanin of the skin. Individuals without a certain capacity of this layer will have the cells of the lower layers of their skin, by their resonance, exposed to the energy of the UV. The metabolism of these cells is disturbed, and a malign melanoma can follow. White horses die from malign melanoma.

Schrödinger's opinion of the electron as a wave or a sum of waves is a blind alley insofar as this calculation model for a distributive aspect of the atom has been taken to be a proposition about the physical constitution of the atom, or a model of its constitution.

This calculation model has added to the belief in "the double nature of matter" as particle and wave. It illustrates that the calculation of a phenomenon is not the same as the description of a function.

A calculation model is not a theory of the constitution of the physics presumed to be concerned, *cf.* Newton's letter[10] to Bentley and his avoidance of theories concerning the phenomena calculated. A description of dimensions of dynamic interactions is not the same as a description of the functions producing the interactions.

Light and matter are not inconsistent; but the existing models are incoherent. We see Nature as inconsistent when we see it through incoherent models. Matter has no double nature.

If we believe anything to have a double nature, it is because we do not understand its real nature. It is too easy to take a calculation model as the ultimate truth about the properties calculated. This will block the development of a better model.

We have no model describing the physical presuppositions or functions of matter.

Besides, we do not have any control of our registering contact-interactions separately from field-interactions, which are part electrostatic, part electro-dynamic.

In most cases we do not have the control of registering or measuring what we want to measure. The exception is JCM's laws.

A dominating interaction of the instrument for experiment is of no interest.

It is insufficient to interpret an effect of light as a particle or wave when we have sent it through an apparatus in which the potentials of the materials interfere with the energy we want to measure or with the functional form we want to identify.

The existence of atoms had not been confirmed in 1807, when Thomas Young sent light through slits and interpreted the interference lines as produced by waves.

This raises questions. How should light waves have been produced? How should light waves have been perceived?

If we agree that the physical light will consist of particles, after the way it is produced, its reception as particles will be understood without paradoxes or unexplained interactions.

As Newton's and Young's slits were material, their edges consisted of atoms; and the interaction between their electrons and the photons was a lively exchange of forces between electromagnetic fields of solenoids and charged particles at very high velocity.

The moving electrons will interact with the momenta or the fields of charged particles entering the atom or the sphere of its fields.

The periodicity of the electrons will be communicated to the photons as they are reflected or absorbed. Periodicity is not a sufficient characteristic of waves. Waves should not be taken as properties of light, as they are an interpretation of light's interaction with matter, thus do not pertain to light alone.

Light's double nature is unprofessionally undoubted within the profession of physics; *cf.* «The duality of the model is an adequate expression of the nature of light»[9]

By being a calculation model for one of its manifestations at interaction, not a model of the physical function, the wave model of light is misleading and a hindrance to searching for better models.

The empirics of light may be described by a comprehensive model implying transport and distribution; but the function of light lies in its physics, which is neither described nor understood within a model of statistics or waves.

A mathematical model on a high level of abstraction does not describe the underlying functions, regardless of its having incorporated an abstract of them.

"Wave" is an imprecise word used undefined for explaining phenomena so as to escape understanding. We see waves where several forces work together on a number of material particles in some form and function.

We may define the concept 'wave' in several ways, mostly as an observed secondary phenomenon of interaction between particles of substance or aggregates of matter by contact or by fields. The phenomenon does not disclose the properties of the interacting parts of matter, since the waves are sum-phenomena.

A registered frequency at the hit of, *e.g.*, a photon does not imply that a "wave" in any meaning should have been a part of it.

Any interaction between electrons in an atom and energy-carrying attometre-sized particles will lead to changes in the system kept in a dynamic equilibrium by the movement of the electrons relative to the nucleus.

Periodicity or distribution is not a model of physical functions. Regardless of a refined mathematical treatment of periodicity, this and other interaction phenomena are products of physical functions. As they are seen to be dependent upon charges and potentials, these should be objects of science.

The distribution of phenomena in time is a separate question, but not a probable independent variable of a possible function.

The different distributions are not necessarily connected:

$$y = f_1(\Delta t) \neq x = f_2(\Delta t)$$

This separate question should be separately treated. Its implication is that periodicity is not a sufficient argument in a specific relation.

Mathematical models seem to be chosen because they are possible models and carry high prestige by their high abstraction level, not because they should be adequate descriptions on a level of relevant function.

In this, there is also a part of the heritage from the Platonic abstraction, which is so complete as to remove the possibility of a picture of the reality behind the abstraction.

Some physicists, among them Einstein, have expressed a predilection for "beauty and simplicity" in their formulae. Further criteria may be asked for.

The relation between electrons and nucleus is stable as long as the electrons keep a distance and a velocity relative to the nucleus.[48]

The electrons' periodicity in atoms is seen in the absorption spectra. The periodicity of the reflected light is the frequency of orbiting of the electrons of the matter reflecting light.

The periodicity is thus not a property of light, but a part of the description of the matter performing the periodicity.

How correct, or abstract?

A wave model of something material is a kind of abstract art, where the properties of matter are no longer of interest, thus they are left for the abstract formula or picture.

Thereafter, it can take an immeasurable time to discuss the abstract model's meaning and its consequence for the understanding of that object of abstract or mathematical art. This is Plato's method. In his dialogues, he ascribed it to Socrates.

Psychologically, this is a method of avoidance, an abstract consolation in a world of unsolvable concrete problems, one of the functions of religion and philosophy.

The modern art of physics seems to be the abstraction beyond significance, belonging to the domain (*e.g.* space?) where beauty and simplicity reside untouched by earthly, dirty reality, the domain too far removed from the problems of description for being challenged by the base relation to reality.

What should be the social or political purpose aimed at by pretending physics by means of abstractions in conflict with reality?

What were the social or psychological advantages to Newton, Ptolemy, Plato, and Einstein?

Perhaps mathematics is regarded, by mathematicians, as that higher form of reality to which humans' reality should be subordinate?

This will, in case, be a modern version of Plato's world of ideas, where the world's concretes, life included, are impediments to the attainment of truth, whereas the ideas are eternal, so, truth and insight in the really existent are obtainable in death only, *cf.* ref. 17.

Mathematics could then, perhaps, be a consolation for those who, with Plato, would be inclined to exchanging insight for life.

The current models of light and gravity are instances of the dominance of Platonic thought.

The ensuing problem for the scientific community is the outsider's naïve quest for meaning and for correspondence with reality.

If light should be a wave, how could it communicate vision?

Plato's, Ptolemy's, Newton's, and Einstein's references to a God can be partially understood if their God is taken to be a symbol of society as a union and collective thought. This does not seem to coincide with Kepler's God, who was the creator and guardian of the world, even of those parts of it believed by some believers not to be in conformity with their conception of God's design of the world.

It took Europe 1500 years to remove the formal picture of epicycles from the sky and another 359 years to remove the formal consequences of the Catholic Church's allegiance to the teaching of the Earth as the centre of the World, *viz.* the judgment of Galileo in 1633 and its rescission in 1992.

This opens a perspective on our schizoid culture, in which the abstraction gains a higher value than any reality.
That is not a safe means of relating to reality, as is seen from those theories concerning reality which were not used for hundreds of years, *cf.* Newton's third law, *"ut actio, sic reactio"* and the rockets of

professor Goddard, as well as Bernoulli's equation[2] and its consequences, among which are sailing by the wind, and propulsion in fluids.

The accepted circulation model is purely mathematical. It is used for describing the lift of aeroplane wings; and it is insufficient for that purpose. Bernoulli's model is adequate.

This might be taken as unimportant; though seen in the perspective between Plato, Ptolemy, and Newton it is disquieting that our culture has invested so many human and institutional resources in keeping the world at arm's length.

Western society's intellectual and cultural models are paranoic and circumscribed rather than simple and naïve. Plato and Ptolemy are still on the top of waves of common understanding.

A characteristic of European society after Ptolemy has been that these paranoic traits have been parts of accepted science as well as of artistic expression.

Even Kepler, who kept his feet on Earth while carrying his head in heaven, has been pushed aside by Galileo Galilei, whose polemics and boasts, *cf.* ref. 20, overshadowed the deeds of Don Quixote, his imaginary contemporary.

Galileo had a toe on Earth, as he discovered and measured the phenomenon of acceleration, and he discovered Jupiter's four moons; but he got wrong the periods of the tides and overlooked through his last thirty years Kepler's model of the planetary system.[20]

After four hundred years, this model is still the one accepted.

The social and political gain from a closed learning is that of the shaman, the communicator between ordinary man, on the part of his defective intellect, on the one hand, and the Godly principles on the other.

If the shaman should teach anything without contradictions, he would give out the means of his social position. This is a sociological interpretation of Plato's, Ptolemy's, Newton's, and Einstein's references to their Gods.

There is an unsympathetic logic in this. Galileo obtained the historical position as the great scientist of the first half of the seventeenth century. He discovered and measured the phenomenon of acceleration. He discovered Jupiter's four moons. He got the tides wrong. His insight could not support his words. His polemics are boasting. He exploited Kepler's support and, when asked, gave nothing in return.

He is vaguely remembered as the martyr of science, though he was rather the martyr of his ego. His mechanics was, together with Kepler's, generalized by Newton.

Kepler calculated the physics of the Copernican system. He worked himself through the appearances of the planetary movements and found the three laws of their orbits. His model is un-esoteric and consistent; and it is the one valid today.

Newton made it a part of his system. Kepler's science is more developed than Galileo's, thus more valuable.

This interpretation and its logic lead to exposition of society's high evaluation of the shaman, who is a part of the power directed against the mind of the citizens.

The method is old-fashioned, as society has survived the spreading of insight. Society has gained from understanding the world, not from keeping a perspective closed or forbidden.

Understanding by means of abstractions in conflict with reality brings a limited advantage. The psychological and social advantages to Plato, Ptolemy, Newton, and Einstein were probably great. The costs were paid by the societies, whose gains were of a limited value.

Pythagoras founded a religious brotherhood, perhaps more religious than scientific; but he also founded a science close to reality.

Plato avoided reality. His purpose was political. Since we can think only that for which we have concepts, his model for the abstract is not useful as a model for the concrete of the external world or of society.

Plato seems to have been thinking like the shamans of ancient times and of our days: it is the idea, the concept, which rules the concrete. The method of the shaman is to influence the concrete by appealing to the concepts, the names or other symbols of the efficient.

This method, derived from magic, has an efficiency limited to society. It shows our societies' distance between thought and reality, in extreme cases named schizophrenia.

Following Plato, and stretching the method to the extreme, it will imply the introduction of abstract concepts to the degree of not being referable to any reality. It will be a description bereft of any relation to the described, but perhaps not to the describer or to the society in which it may have a function.

This method may even have an advantage over that of Plato: It is nearly free from formal social connotations; but if it is given a meaning, a denotation, this can be held outside the everyday life of society and most of its members. The method may furnish a simile of a means of communication; and every reference to it from an outsider may be repelled.

The political gain from an abstract art used as mathematics in a way dwarfing Plato as an esoteric, is the monopoly of steering the most important part of the universities' realms of power. The tactical gain is that of getting right by definition, as the interpretation of the very abstract is controlled by the professionals, who belong to the institutions. This was the useful method of the Church until after Galileo.

A separate question is that of correspondence with reality. Seen from a presumed point of view of a theoretical physicist, he could say that "the paradoxes of our teaching are necessary parts of it; and we cannot leave them out. We do not exclude the possibility of a body of physics free from paradoxes, in the future. We are glad that we, unlike you, are able to grasp the understanding of light and matter as having the double nature of waves and particles."

I leave the place, interpreting the answer as "if reality does not correspond to our model of physics (composed through history by the best physicists possible), so much the worse for reality. As to you, you are not part of our considerations."

As a religion without inconsistencies is not an efficient means of keeping peoples' attention bound to a theme, an idea, and a real or imagined political leader, the political gain of paradoxes and inconsistent theories is too great also for the universities, which then do not succumb to demands from the lay society.

Thomas Browne (1605-82) saw this from the point of view of a relatively independent man: "Methinks there be not impossibilities enough in Religion for an active faith."

Four hundred years earlier, the absurd of Christianity had been sufficient for St. Thomas' creed.[44]

We may pity Sir Thomas for not living today, since quantum mechanics and the theory of relativity offer enough inconsistencies for most scientists. These teachings seem to unite the greatest community of believers in the world.

It seems that Plato tried to convince himself that the world was really a nice and peaceful place, and that his surroundings of war and political dissolution should be a mirage.

Plato's imagining a good and harmonious world was not sufficient for creating it. If his picture of the world was a consolation for him, it would also be a kind of narcotic reducing his faculty of adapting to the world.

Social and psychological advantages to Ptolemy, Newton, Einstein, and many others, were their gains from a world picture in discord with the world, though rational to them.

Josiah Willard Gibbs (1839-1903) became the father of modern chemistry by introducing thermodynamics as a liminal condition. He is cited for saying that "A mathematician may say anything he pleases, but a physicist must be at least partially sane."[21]

Mathematics is an abstract science, whose themes and methods are strongly attractive to a minority, as it was to Carl Friedrich Gauss and Niels Henrik Abel. Mathematics is applicable to macro- and micro-descriptions of physics.

It seems that consequences of the mathematical model have been projected on reality in more than one case.

That major case was the model of Ptolemy, whose epicycles were for 1500 years taken to be *the* model of the planets' movements. Ptolemy was not in good faith, but wanted to hide God's use of elliptic planetary orbits[23], though Plato had defined the circle as God's perfect figure.[16]

It took the good observations of Tycho Brahe and seven years' work of a recalcitrant mathematician like Johannes Kepler to retrieve the ellipses.[20]

In modern Platonic physics, the mathematical consequences of models seem to be taken as indications or proofs of the forms and functions of reality, *cf.* the use of N 2.

According to Einstein, his God did not approve of dicing. Einstein's universe has a structure implying the transmission of the force of gravity from space to matter. In this, he surpasses Ptolemy in his own profession, the architecture of the heavens. In other connections, space has no other property than extension.

One advantage to Newton was that he put up his three laws as a defence against reality, *cf.* his *"hypotheses non fingo"*[10] As long as he treated phenomena only, he did not tread on his God's toes by imagining theories about reality.

In his approach there could be a harking back to the arguments of the case against Galileo, less than forty years before Newton started work on his physics. One of the arguments of the Vatican was that of "saving the appearances". This was an ambiguous criterion, which came to mean that the apparent should be part of the described.[20]

Newton's commitment was that of staying at phenomena, the symptoms of something happening. This non-committing statement relative to his God and to Nature has held physics back from consistency between initiating forces and the produced effects.

Newton was a cleverer mathematician than most of his contemporaries. He must have known that the parts of his second law were defined only by their relation in the equation.

His description must have been intended as a breaking of the connection between reality and his statement. The description should have been made in order to produce a simile of calculation of physics.

In this way, he succeeded in his scheme of not committing himself in the affairs of his God. This attitude is seen in his letter to Bentley[10] *v.s.*
He succeeded as well in not describing the real functions, the physical happenings, at which his God could have taken offence.

By his authority and prestige he also succeeded in making posterity believe in the correctness of his second law and of its sufficiency for its referred purpose.

Newton could possibly have been ignorant of the forces of substance and their effects not shown by the measurements of differences of inertia.

I find this improbable.

Newton calculated relations between phenomena, thus he knew that he had avoided the essential function of mechanics by his interdependent definitions of the three parts of his second law.

He was a consequent scientist in letting his religion dominate his science; and when he had written *"hypotheses non fingo",* he probably meant it: "I do not imagine theories".

His second law is a part of his use of phenomena instead of the forces involved. He knew the relations he had formulated himself; and he must have known that he was cheating.
Ptolemy disclosed his own cheating in separate comments, *cf.* ref. 20 and 43.

Curiously, Newton's second law is still taken at face value.

Back to matter ?

The world after Maxwell has learnt the effects of the fields of the particles of matter.

The forces of matter lie in the field charges of its substance, while its inertia can transmit the secondary force of a moving body. The field forces perform the functions of matter, while inertia is used for the calculations of Newton's second law and of the postulated $E = m \cdot c^2$.

As is seen at high velocities, matter's potentials or inertia are not conserved at high energies.

What are the personal or social advantages of a schizoid science?

If you are of the right kind and invest your life in it, you have a chance in a million of being remembered in the pertinent circles. Newton got the advantage of admiring surroundings having a high tolerance for his rage. Plato was a revered teacher.

Semmelweis (1818-1865) was thrown into an asylum for disclosing the septic reality of childbirth and surgery, thus disturbing the image of the medical profession.

Einstein was a shrewd scientist; still he did not employ Maxwell's results on sunlight. His apparent understanding of the solar eclipse of 1919 was misleading, as he presumed gravitation to be an autonomous force, thus his prediction of its influence on light to be confirmed by the displaced observation of a star during the eclipse.

The effect on the light was the electro-dynamic force between the magnetic field of the outer parts of the sun and the magnetic photons.

Einstein's gravitation in space made gravitation on Earth less credible.

What could have been the personal or social advantage to Newton, Ptolemy, Plato, and Einstein in avoiding consistent theories? What could have been their purpose?

The reference to a God is a reference to the common understanding of any society. This creed in the common understanding includes factual relations without relevance to society.

It seems that the mentality is the same today, though the sanctions are less fatal than were the *acts of faith* of a few hundred years ago, when they were real *autos-da-fé.*

The symbolic relief of Plato by his removal of reality from the objects of thought was probably shared by Newton, whose mental equilibrium was defective and easily shaken.

His occupation with religion combined with his physics of phenomena could indicate a fright of the concrete. His *"...hypotheses non fingo..."*[10] is a conscious avoidance of the reality he imagined and feared.

How could Plato become an ideal of science? It could have been because his recourse to a God was taken by the later Church as a sign of his reliability, and because his scientific model was abstract and totalitarian enough for the Church.

The continuity between Plato's time and ours is seen in form, political relations, and in political connotations of scientific abstractions.

The first possibility is that of neglecting concretes in one's own life or in the general conditions of society. The next is that of using the abstractions of science as themes of a part of religion, which is also a picture of society.

The picture used is not intended to be a verifiable description, but an impenetrable symbol of the powers and ways included in the political management of society.

This could have been socially efficient if society had kept the level dominated by shamans and sorcerers. Since society has been developed to manipulating nearly as many functions as are discovered, it hurts man's relation to life's reality as well as his understanding of society. Our understanding of world, physics, life, and medicine is defective in fundamental parts.

The scope of concepts is wider than their immediate significance. This is shown in music, which is a symbolic expression of the psychology of society.

Chinese music is built on a scale of five notes to the octave. This music cannot be raised to the contrasts which are parts of European music. Contrast is a part of society which can furnish political means.

Chinese music does not produce contrasts of melody, tonality, or harmony implanting the concepts 'contrast' and 'disharmony' in Everyman's thought the way it has happened in Europe. The music expresses Chinese society as harmonious; and it is a part of the realization of this model, as the idea of the common interest is supposed to pervade everybody.

Belief or knowledge ?

Our thoughts are parts of the world. Perhaps it is a part of a fundamental picture of the world that all its parts influence each other?

Perhaps it is man's schizoid relation to the world and himself that prevents him from distinguishing between the concrete world outside the individual and his conception of it.

In this lies a possible reason for the shaman's feigning control over the concrete by means of concepts and formulae, and for the idea of psychosomatic illness.

This is a part of the conditions of religion as a belief and of its frame of social actions, like prayers and rituals. These actions have no meaning except as an expression of a belief in the symbol as something more than a part of experience and knowledge.

This "something more" is an imagined part of a concept or a theory, which thereby is believed to influence reality.

This function as a relation between the world and our model of it, or religion, is a part of the human personality and should be more strongly expressed in some persons and societies.

In them, there is no division line between religious activity and other activities. By tradition, knowledge is a fruit of society's belief. Knowledge still seems to be accepted as long as it is taken to correspond to the belief.

The relation between knowledge and its object does not seem to be of any importance to the religious society. This is, though, the aspect of knowledge and science which is relevant to the members of society, regardless of their religion.

Probably because of the possibility of discord, the themes of science are seen as possible objects of religion, thus as possible parts of its power, *cf.* the Church and Ptolemy.

A part of religion is its function as an image of the world and society. A picture of the world produced by a projection of society can be used as a reason for the existent society, which is then seen as conforming to the order of the world.

The picture of the world can be used as a reason for the powers in society, *e.g.* polytheism in a clan society and monotheism in a kingdom.

The uniting of Norway to one kingdom was supported by the idea of the one and sovereign God, *cf.* the royal sagas.[63]

That taken as science at any time is a continuation of religion. Its formulation is more specific; but its characteristics are astonishingly similar to those of religion. Its principles can be so general or vague that they are hardly referable to earthly reality.

References to principles of religion are also used as a condition of a scientific model or theory, *cf.* Ptolemy, Newton, and Einstein. Ptolemy referred his cheating to the need for hiding God's shame, his unGodly, elliptic planetary orbits. Newton would not imagine theories; and Einstein refused the possibility of outcome by probability.

Johannes Kepler was probably the first and doubtless one of the few who went against his belief, or against the commonly supposed identity between creed and science.

250 years earlier the later bishop Nicole Oresme had protested, not against the teachings of the Church, but against a part of a coming university dogma, Aristotle's model of heaven and Earth.

Kepler was excommunicated from his Lutheran Church a few years before he died, for disputing a point of teaching later left by that Church.[20] Kepler built on Copernicus' model of the planetary system, but left the Ptolemaic calculation model used by Copernicus.

Kepler calculated the planets' movements according to the model he had developed. His three laws of the planetary orbits (1609 and 1619) are those accepted today.

The universities were founded as supplements to the Catholic Church. As late as the 18th century, their teachers should be unmarried. They are still institutions for producing a foundation of belief supporting society.

Rationality is not an ideal, not even utopian, for science, but a threat. At first, it will be taken as directed against the content and truth of science. If it concerns important themes, to which the institutions attach a high prestige, the universities will feel at a loss; and this will lead to retaliation.

In an extreme situation, the belief in the foundation of society may subside; and the guardians of knowledge feel the responsibility for propping up its ideology.

The support from scientific activity to the religious foundation of society implies that all mental activity or model-forming should be cleansed of concepts, models, and theories which could describe the world, society, or man, in ways making it possible to imagine any doubt about the existing society as the best possible, included the professionals of the universities.

For the political purpose of supporting religion and society through science, a description is more efficient than a political program. It is easier to point to the character of the world, to which one must relate and adapt.

Gravity understood as a weak force, a differential of the inner microforces of the substance of matter, lowly matter, does not comprise a heavenly force, dominated by God. Gravity is a heavier argument when it is postulated as an autonomous and irresistible force coming from space or heaven.

It is possible that the Church felt stronger after adding the Ptolemaic system to its teachings, if not to its *Credo*.

The loss suffered after the cheap victory over Galileo, in 1633, was swallowed in 1992, when the judgment on Galileo was retracted. The loss of prestige was felt in the heart of the Church, but probably not in its members.

More important is the loss for knowledge. I shall never know to what degree a confessant Roman Catholic before 1992 would have been reproached for not sharing his Church's belief in the Ptolemaic system.

The Church taking sides in questions of knowledge is a lasting bias. The resistance to new insight is not rational relative to knowledge.

It could be seen as a waiting for an authoritative permission to think a new thought. Its rationality is social, as it implies subordination to the presumed preferences of the social group of which the person is a real or imagined member.

On this background, my own experience is understandable. When I was a teacher in secondary school fifty years ago, I aired the idea of instituting a "think-yourself-week". There was no positive response.

My interpretation was that nobody would imagine the creation of individual thoughts. This has been confirmed by scientific results suppressed by their authors, *cf.* ref. 6 & 19.

For some irrational, *i.e.* religious, reason, the corporeal forces are seen as the lowest of all. Though they are the foundation of life, the smallest and innermost parts of matter are what kings have in common with beggars; and that is not talked about.

This is not so far from the world picture implied in the Ptolemaic model, in which Earth was the centre of the universe and its most lowly part, *cf.* also the geometry of Dante Alighieri's *Divina Commedia,* A.D. 1313-1321.

If insight into the world as it is should be the purpose of knowledge, it would be necessary to abandon the apparent learning imposed through conventional teaching.

Darwin understood this. His *"On the Origin of Species…"* [39] is not mainly an argument for the development of species on their own conditions, but a series of arguments against their development on the conditions of religion.

The arguments developed and underpinned during the 150 years since its publication have not moved the world's opinion on Darwin's theory. Perhaps five *per cent* of the World's population will accept it today?

Is science limited to political statements and political method, or does it comprise a dash of reality or statements about reality? On the other hand, we can ask whether scientific statements have stronger effects when postulated as reality than promoted as political theses.

It is possible to move the question one step backwards in the direction of our blackest past of shamanism. There we meet Newton as the executor and symbol of the dominance and curbing of thought relative to reality. He knew what he was doing; and he did it in spite of its detrimental effect to his work and to posterity.

We may doubt that Plato could have imagined the spread and duration of his own teaching, and that Ptolemy would have believed the credulity of scientists until Copernicus and Kepler.

Newton's cheating was cruder, as he did not leave his readers any choice. It transpires from Plato's, Newton's and other's work that they saw themselves as the guardians of society through their teachings.

How is knowledge then developed and renewed? By being taken as an apparent truth or temporary description only and removed in due time, or by being denounced as politics? Neither seems efficient.

The Ptolemy case will probably not be the last. It lasted for 1500 years and was ousted by Kepler, probably the only European mathematician who was both competent for the task and independent of universities, the Catholic Church and his own Lutheran Church.

The latest offers from the university side of knowledge are gravity from heaven (untouched by earthly matter), black holes for all sinners, and a waving light as inscrutable as the Almighty.

Theology is the science of the unknowable. It starts with "God is unknowable, therefore we can know about God that He is…and has the following properties…"

It seems that physicists regard the world as unknowable in principle and feel free to imagine anything. Could this be a reason for the ascription of physical forces to the heavens?

As long as they stay at phenomena and symptoms, physicists will avoid feeling the guilt at infringing God's domain which they could have had if they proposed theories about the principles of physics after ascribing them to a heavenly provenience.

Newton formulated this, *cf.* his *"hypotheses non fingo"*[10] written in the same letter as his argument about the unimaginable in a force working through empty space. We see Newton's religion dominating his intellect.

One question of principle remains unanswered. How do believers know what their God means or intends? The answer is a new question. What is the benefit to society from paranoid or non-verifiable ideas?

Bohr said that physics' theme is what we can *say* about physics.

This, as well as Newton's standpoint, is a way of eschewing the task and problem of science, which is how the object of science should be described in order to communicate its essence.

Ptolemy's explicit argument was another one, probably related to Newton's half-formulated. Ptolemy let his religion overrule God's planetary orbits, since God had let the planets wander in Godless ellipses.

Plato had known better than God what God might permit himself.

Ptolemy followed Plato in ascribing circular motion to the planets; and he saw it as the astronomer's task to conceal the irregular movement of the planets in "…uniform circular motions, because only such motions are appropriate to their divine nature…"[23]

Ptolemy cheated, even relative to his own program, by combining circles (deferents and epicycles) in describing ellipses. The planetary trajectories were not passed at uniform velocity, the way he had required, or promised. Copernicus felt deceived on this point.

In his dialogue *Timaeus*[16] (33 B-34 B) Plato had postulated the circle as God's perfect form, thus as the planetary orbit.

Following this tradition of asking God[46] or Plato first and, perhaps, reality afterwards, Einstein found gravity in the form and asymmetry of space itself. This reminds of the theory of Aristotle, who said that bodies seek back to the centre of the universe, which is the Earth.

I have problems at seeing how it should be possible to ascribe "form and asymmetry" to space, which has been supposed to be the nothingness between stars and planets.

The forces of stars and planets extended into space are found, though not as properties of space. They are found as light from stars, magnetic fields and gravity fields from stars and planets. They are operating through space, aided by its lack of properties.

Should we define our presence in a room as a function of that room?

Newton was, to my knowledge, the last who delivered an explicit argument for avoiding theories of reality for a fancy of the properties of the unreal and its postulated influence on reality.

He has given instances of the consequences of this principle of knowledge. His second law is a relation between phenomena defined by each other through this relation only.

They are thus not related to their referred theme, which was the relations of forces between physical bodies.

In his prism experiment, the colours are presumed to be disclosed by an instrument, the prism, as the true content of the light. In spite of his own theory of light as consisting of particles, he apparently did not consider the possible ways of particles through the prism, which is the edge of a great magnifying lens.

The role of the slit is an instance of the reality of the concrete world dominating the phenomena left for us to perceive, *cf.* the colours.

Should we see an irony in this retaliation from the physical world upon man's interpretation of that into which he had invested his bright mind in order to avert its understanding?

Physicists after Newton have apparently not seen any need to argue for their avoiding reality. It seems that the tradition of physics permits the introduction of an external mover at need.

Planck's constant seems to have been one of those. As it is the invariable energy part, Js, of the model, this does not permit the production of energy by the process itself.

His model seems to having been the means for formalizing the ascribed relation between frequency and energy, the relation between short wavelength and high energy. This is, though, impossible, *cf.* the low-energetic, high-penetrating, short wave ultra-violet and the un-energetic, all-penetrating neutrinoes.

The sequel should be a formula showing the proportionality between light's wavelength (which is an indirect phenomenon produced by a measuring instrument) and its delivered energy.

The concept 'energy' was coined by Thomas Young. His slit experiment was taken to exclude Newton's theory of light as particles.

His slits produced interference lines, taken to be products of waves. That was a hasty inference, now lasting for two hundred years.

Today, enough should be known about atoms and electrons for understanding the ways of light in relation to matter.

The wave theory of light is seen as supported by Young's experiment. This opinion could have part of its origin in the lack of a physically possible theory of light.

The imagined foundation of physics of the 19th century has been removed; and that imagined as hard matter is replaced by something that may be particles or waves, if it is not a complex of mathematics.

It is a system of abstractions not easily applied to everyday physics.

Principles of physics ?

We need a description of reality as it is, and as it works. We want to understand its ways and forces; and we need the means for their correct calculation.

Some description of reality is needed in order that we know what we are talking about. Still, we cannot be sure that the form of our description should be the same as that of reality or its working. As long as we are critical to our own definition of reality and to its description, we have a chance of reaching a useful model.

The description of the world seems to be conceived out of different intentions. The religious aspect is prevalent. Its intention is to describe the world so as to consolidate the power of society where it is.

The technical aspect is an adaptation to the practical needs of society. An instance of this is Galileo's identification and measuring of acceleration by experiment.

The lack of connection between these aspects is shown in the lacking unity in the development of sailing and hydrodynamics, the lack of understanding of substance's charges in mechanics or dynamics of matter, and the lack of consistency making it possible to conceive parts of physics as peculiar and autonomous.

When the accepted description is rather abstract, it is difficult to associate it with any physical reality. Any compound description, whether mathematical, statistical, or in a few words, is general, and not always significant for the single case.

For this reason, it is difficult to find the physical functions in descriptions of more than a low degree of abstraction. The descriptions of phenomena and their periodicity are not unconditionally referable to ascribed functions.

Schrödinger postulated waves as the real content or form of matter, while particles should be their appearances, epiphenomena[18]. This seems to be at quite some distance from reality.

It reminds me of the introduction to a novel by Boris Pasternak, where the branches of the trees work heavily and whip up the winds. I closed the book and forgot its title.

Is there a criterion for estimating models' closeness to reality? It is possible to describe dynamical relations in a system containing interaction of forces.

Absolute or relative differences of temperature in the atmosphere or in a living body can be identified and related in a mathematical model.

Beautiful mathematics may result, but will it convey anything of interest to the breathing body? Does the form add to the information?

The means for relating to our world begins with some knowledge of the properties of matter and life. Our images of the details and properties should have a degree of correspondence with reality permitting us to communicate about, and, at need, manipulating the external world with enough understanding for producing a wanted outcome.

At the outset, the images and concepts of phenomena are insufficient for our relating to the world; and we should know the functions.

In this is included the distinction between the concepts 'phenomenon' and 'function', the distinction between the apparent and the real, and the insight into the workings of functions.

The image of reality, interpreted from the model of Ptolemy, was that the planets describe epicycles in the sky. This is even apparent to the Earthly public, though it was beyond Ptolemy's declared intention, that of hiding the planets' elliptic orbits.

Newton's second law was not defined by physics, but by phenomena. It was extended by Einstein to $E = m \,.\, c^2$, which is identically equal to $F = m \,.\, a$.

The difference between them is that the first is the second multiplied by metre on both sides. Both of them concern phenomena, or appearances.

Their distance from reality is indicated by the second being an insufficient description of mechanical force, while the first is a misleading subsumption of magneto-dynamic functions under the insufficient description of mechanics.

An instance of these problems is the prism, which shows us the different colours of the light.

Where are these colours produced? Newton and his posterity have contended that the colours are produced by the division of light as it passes through the prism.

This does not conform to the physical conditions of light and the atoms of the slit through which light passes before entering the prism, so the theory of light should be revised.

A beginning could be to find the relative energies coming into play in the interaction between the light and the atoms of the slit.

We could be further enlightened by seeing the prism as a part of a magnifying glass.

It is even possible to look through it at the edges of a window frame and see the two halves of the spectrum separated.

Matter and energy.

Einstein read more out of Newton's second law than was built into it. It is a relation between phenomena defined by this relation.

Einstein postulated that N 2 should be valid also for the velocity of light. It could not have been intended for that region, as it was made as a description of phenomena of mechanics, *i.e.* for homely velocities on Earth.

It is not clear whether Einstein intended his conclusions to be valid for reality or for phenomena.

At the outset, the law's foundation on phenomena deprives it of validity as a description of functions of reality.

As N 2 is a relation between phenomena defined by this relation only, it has no significance as a description of the relation between the functions underlying the phenomena described as relative to each other.

Thus its relativity is the product of its lack of any description of a functional relation to a part of reality external to the parts of N 2. In addition, its themes are phenomena of mechanics, not functions of dynamics.

Its use as a postulated description of an external system of relativity is a projection of its internal relations and their lack of definitions referring to reality.

Einstein's prediction (*cf.* Lorentz-FitzGerald) about change of form at high velocity was possible only because the dimension of the intramaterial forces could not have been considered.

Matter is held together by potentials on a lower level than the energy needed for accelerating a body to the velocity of light. The acceleration will dissolve a body by the added energy needed for acceleration.

This is seen in the dissolution of matter and particles in the sun. In inner parts of the sun, some ions are conserved under high pressure. Protons and electrons do not constitute matter at temperatures above 5800 K.

Protons are not broken down in the sun, even at higher temperatures. Electrons are broken down to photons only after being broken down to small particles and further accelerated and collided.

It is helpful to find the necessary conditions of that which is known, to find the intermediate functions and parts involved in the necessary functions taking place, and to identify its necessary consequences.

A measure of potential in matter is the ionization energy of the first electron of an element. This energy is needed for releasing an electron from the atom, thus, it is the first step in dissolving substance.

In molecules or more complex matter, inter- and intra-molecular potentials should first be overcome.

In most elements, the ionization energy of the first electron is between five and ten eV. ($8\text{-}16.10^{-19}$ J) Helium is the strongest, at 25 eV.

In an atom at a velocity approaching that of light, the moving fields of its charged particles will add electro-dynamic potentials to their static fields.

As dynamic potentials are greater than static potentials, *cf.* Maxwell's third equation, a greater energy is needed in order to produce them.

Therefore, there is not a linear consumption of energy as the velocity rises.

The energetic product of acceleration changes from the presumed inertial $m.\mathrm{v}^2$ to the electro-dynamic $4\ \pi\ \rho\ c^2$ at the velocity of light, where ρ indicates the charge of the particle.

As shown above, light is produced in the sun by the breaking down of electrons and accelerating their parts to the velocity of light. The acceleration of particles of substance to the velocity of light is not indicated. These particles are protons and electrons.

This implies that atoms will start dissolving at velocities well below that of light.

The static potential of a particle disappears as the velocity rises. The static potential is that holding atoms and particles together. It is responsible for gravity and is effective as long as it is not overrun by a dynamic force. This is seen in light's particles, which are outside matter.

The imagined corollaries of the relativity theory, the Lorentz-FitzGerald predictions, are not possible, as matter will be dissolved; and its single particles will not reach the velocity of light, *cf.* tests at CERN.

A condition of light is the energy needed for surpassing matter's or particles' bonding. As it is produced at the complete transition from static to dynamic force of the charges of substance, there is no return possible to the bonds of matter from its limit of dissolution crossed at a velocity lower than that of light.

Light returns energy from primary substance to matter when it is re-united with it. Light transmits energy to plants and through them to the climate, making life the domain of negative entropy.

Particles, even subatomic, do not reach the velocity of light. The light shining on our way consists of small parts of electrons. In October 2011, high-energy tests at CERN moved neutrinoes to the velocity of light.

Thus, CERN energy proves that the inertia of charges keeps particles from reaching the velocity of light.

Contemporary descriptions of physics seem to have certain characteristics in common:

1. The descriptions are concentrated around phenomena, not functions.

As objects of description, the easily measurable phenomena, like the parts of Newton's second law, are preferred to physical functions.

2. The descriptions are made in consideration of their mathematical form rather than their correspondence with the objects of description.

Einstein's "beauty and simplicity" of mathematics is in disagreement with, *e.g.*, the reality of the physics described as gravity at the solar eclipse in 1919. Neither beauty nor simplicity is a relevant quality of a description. Relative to its purpose, the reference to beauty and simplicity is an avoidance manœuvre.

3. The theme of description is not always clear.

Is gravity on Earth understood to be the same function as gravity in space?

Or is the answering of this question refused since gravity is taken as two systems of autonomous phenomena?

Or is the belief in gravity as autonomous seen as preventing any involvement between its two postulated varieties?

Through analysis of what happens, and of its conditions, it should be possible to find the functions underlying phenomena. In the case of light, the form of interaction with the measuring instrument makes impossible a correct interpretation of the measurements.

The frequency of light is not a property of light or a quality existing in the light ray on its way, but is induced in a number of photons by the electrons of the receiving matter.

In a measuring instrument, its electrons are its parts receiving the arriving photons. These have one possible movement through space; and, as long as their electro-dynamic field is not influenced by magnetic fields from stars, planets, or instruments, this is a straight line.

Since instruments show the same values for several seconds or minutes, we may presume the light ray to be stable over a short time.

Redshift from far stars is commonly taken to be a case of Doppler-Fizeau-effect, augmenting as the distance. A part of relativity theory concerns the velocity of light relative to a moving observer. This velocity is presumed to be the same regardless of the observer's movement.

This may be correct, though for another reason than that presumed by Einstein, as the different systems of energy preclude the influence of static charges upon the electro-dynamic light.

Since the mechanical phenomenon of differential velocity is not a possibility in light, the Doppler-Fizeau-effect cannot exist there. This effect was presumed to be the production of an altered wavelength of light by the higher velocity of far stars.

Redshift will be understood by considering the loss of photons carrying the lowest energy, *i.e.* the blue part of the spectrum. The space between the stars is filled with light. There is no probability of one light ray travelling for years without crossing some other light ray.

The probability of photons extinguishing each other at meeting in space is above zero. The low-energy photons will be those first extinct. The surviving photons will be the most energetic. These are the red and infra-red.

This is in conformity with other energetic reactions to light, *e.g.* its penetration into human skin unprotected by melanin. The lower energy of the smallest photons keeps them from interacting with the atoms of the skin, *cf.* neutrinoes' penetration of matter.

The hurting photons are those of the direct sunshine, not of ordinary artificial light. The ordinary glass of window panes and light bulbs is not penetrable to UV radiation, which is that part of solar radiation provoking cancer by delivering its low energy on a level below the surface of the skin.

Sun-tanning lamps are made of quartz-glass, which lets through the UV-radiation.

Another mechanism of interaction adds to the different ways of light. Light is not deviated by the static fields of the atoms, but by the magnetic fields of the electronic solenoids *cf.* above.

Light-coloured skin reflects much of the sunshine by means of the magnetic fields of the electronic orbits of many elements, though not all. These fields are effective on a local scale, in the interaction between light and some of the smaller atoms, thus electro-dynamic.

The most common of these small-radius solenoids will be water. Light interacts with particles and atoms having electromagnetic potentials *cf.* above. Water-containing matter will reflect more light than dry matter.

Society or innovation ?

In spite of the upgrading, after the Middle Ages, of the status of the study of Nature, the tradition of telling Nature how it is, still seems to be the living spirit of Science.

Technology has been developed in spite of being impeded by science. Sadi Carnot[25] wrote about the force of heat for the advantage of French industry and science, more than one hundred years after 1712, when Thomas Newcomen built his steam-engine. Carnot had seen that British industry had been developed by the use of energy from coal; and he wanted to develop French industry.

Sailing by the wind was not, until the 1920ies, seen as a function of lowered pressure in the direction of ninety degrees from the wind. The function of aeroplane wings is described as "circulation", a mathematical model nearly as un-physical as gravitation in curved space.

The near-perfection of Aristotle's society, in his eyes,[20] is also seen in later societies. They believe themselves to be so near perfection that nothing can make them better, except more of the same.

Novelties are refused, like the rockets of Professor Goddard or the propulsion method based upon Bernoulli's publication of 1738, *cf.* above. They are, at best, frowned at and suppressed.

This "more of the same" is what brings the downfall of civilizations, *cf.* ref. 4, 5, & 47.

There is a period of slackened power in the cycle of societies, when the former powerful no longer find other peoples' resources worth exploiting.

Poor peoples' initiative and inventive imagination create a period of cultural growth before society anew binds itself to considering its own rule of power more important than everything else.[47]
During ninety *per cent* of the period of development and downfall of a resource-rich country, innovation is not brooked.

If the program of concealing, *cf.* Ptolemy, has not been successful, this can explain modern science's new evasion of adequate models, *e.g.* of light and gravity.

Energy, as we see its first step in fire or electricity, is a sum of transients, which each is the transfer of one photon or one electron.

Neutrinoes penetrate matter of all kinds. Their lack of charge implies lack of potential relative to any matter, thus they are not capable of interacting with particles of substance. This interaction would have taken place by the fields of charged particles.

When the charge of a particle is small, its potential is low, and the possible interaction is weak, thus it produces a small transient.

As photons are produced by an undifferentiating process, they have different charges, giving them different potentials; thus they release different energies at meeting matter.

A greater charge will have a greater potential relative to the charges of other substance. A photon of great charge will not pass through a layer of molecules before interacting with an atom.

The production of light in the sun gives photons of many sizes. They produce a scale of energies at meeting the electrons of substance. The calibration of this scale will depend upon the potentials of the electrons met and the vectors of their meeting. Another factor is the impact of light on the atoms of the slit before the prism, seen as colours.

The great development of twentieth century technology was built on the semiconductor. It seems that its technical development has progressed without being hampered by its scientific understanding. The development of hydrodynamic technology and rocketry has, on the other hand, been impeded by the limited perspective of scientists involved, *cf.* ref. 22.

The beginning of an answer to the problem of concealing, *cf.* Ptolemy's words, could be that the acceptance of a physical theory is not a question of its correspondence with reality, but of its accept in the right social group. If this group is shown to harbour inconsistencies of teaching, it acquires a position closer to God.

It seems that physics will continue to produce paradoxes and continue proving by defective models that Nature is inconsistent, if not in reality, at least in the way it is described, which is taken to be the way we can understand it.

This could be a residuum of religion in science, as God's perfection, by somebody's decision, should be hidden to man. If ghosts were to be invoked, we could look for Sir Isaac's spirit covering the view to reality.

It also seems that scientists will defend themselves against new theories and new insight, *cf.* the letter[22] from the Norwegian Technical-Scientific University defending itself against a new technology. This is in conformity with the dictum of the great Lord Kelvin: "Flying machines heavier than air are an impossibility." (1895) He was President of the Royal Society of London. The brothers Wright had probably not heard of this.

This could also be an aspect of religion, since most scientists, when questioned, declare themselves as believers. This would imply that they accept the given insight in its given form; but they neither accept any new insight nor any new form of the old one, *cf.* Newton.

An aspect of the same is that religion and its parts, science included, are seen as one, thus its teaching should not be changed, nor its theme extended.

The references to a God or to the absolute impossibility are heard when scientists are confronted with problems outside their perspective. They seem to believe that the reference to a God will add to their credibility.

The Catholic Church said its good-bye to the Ptolemaic model of the planetary system in A.D.

1992, as it had made it a part of its creed and had to retract it formally in order to rescind its verdict on Galileo.

This could indicate that a general study of science should be performed as a study of theology and sociology.

The Ptolemaic episode of European astronomy lasted *c.* A.D. 170-1640. The present episode of science was started by Newton in 1687[7]; and Einstein was his disciple.

Turning one's head a few degrees to the left makes the neck less stiff and lets one see new sides of the world. This gives a new orientation and a varied insight. New perspectives show themselves from the side of the world where the control is less persistent. The left side of the perspective is evaluated by the right half of the brain, which is its creative part.

It is possible to establish a scale of energy of light from its charge and velocity. The scale could be from $4\pi\rho c^2.10^{-3}$ C m^2 s^{-2}, sinking to $4\pi\rho c^2.10^{-6}$ C m^2 s^{-2}, if the conjectural distribution of the charges of the parts of the electrons is approximately correct. The charge ρ here denotes the elementary charge, that of the entire electron before it is broken down.

The physical constraints on waves (thus not on light) are the limits of energy of their producing functions and the potential relations between their material parts. If the potential lasts for a short time, it cannot build up a great energy, since $E = f(\Delta p \,.\, \Delta t)$.

Light is now measured by its interaction with matter, whose properties are ascribed to light through the instruments. The short-wave blue light belongs to the lower end of the energy scale.

Redshift is the loss of the low-energy part of the stellar radiation, which will produce the highest frequencies at interaction. The colours of least energy show the shortest wavelengths in the measuring instrument. They are violet and blue.

Behind relativity.

As long as the variables of N 2 are mainly phenomena, there is no probability of using it for calculating physical functions. Distance is the only physical measure involved.

The consequence of using N 2 for calculating the moving forces of bodies has been that inertia has been taken as the whole of forces involved in the movement. This has not only been a lack of approximate correctness, but one instance of many denying any inherent potential or force to man or matter.

This consequence of an authoritarian religion pervades all societies of some size and centralization. The link to the belonging model of science is described by Newton, *cf.* above.

The lack of a standpoint in the question of gravity is probably the only flaw in Newton's religious armour. Newton argued about science; but he did not argue from a scientific point of view.

His cause was religion. He subordinated his scientific perspective, called "philosophical" at his time, to his religion. If the "absurdity" should be accepted as correct, that would have implied a defect in his God's total power over man and matter. This very thought would have been a sin which Newton was not prepared to commit.

His arguments from religion were dominant, as all powers, for him, were from God and Heaven, not from the inner, lower parts of man or matter. Einstein's gravity from space is on a par with that of Newton.

It seems that Newton gave priority to the contact with his God ahead of contact with reality. It is astonishing that the fervent believer Isaac Newton could believe that his almighty God should not be capable of producing effects by means which the mortal Sir Isaac could not imagine, *cf.* ref. 10.

Seen from the outside, this is also a case of the theologian-philosopher-scientist knowing better than his God. In dictating his God what He might permit himself, Newton followed Ptolemy, who had followed Plato.

The argument is not new: "Man and his thoughts are imperfect, thus his judgment is unreliable in science as well as in religion. Therefore, science is correctly understood as a dependency of religion."

This unreliable reasoning of Platonic-Ptolemaic-Newtonian provenience seems to have been used against the thoughts of the religious school itself. The religious ownership of science has proved its insufficiency since Plato. We can pity science for what has happened and not happened, but we should use a part of our consciousness in order to understand it.

In 1687, *cf.* ref. 7, a force working at a distance had been known in Europe for four hundred years, since Petrus Peregrinus published his book on magnets.[45] William Gilbert had published his experiments[62] in 1600 and introduced the concept 'electric', which made him the first physicist in this field. It seems improbable that Newton should not have known these works when he wrote his letter (ref. 10) to Bentley.

The imagined effects of relativity at velocities approaching that of light are projections of the presumed properties of the variables of N 2, *i.e.* an instance of believing the forms and relations of the model to be normative for the world.

Relativity is built into the model by its parts being relations between parts defined by each other. Their variability at high velocity was, at the outset, not looked for.

When the relativity, or indetermination, of the model, is projected into the predictions made, these are postulated as parts of high-velocity mechanics. Those presumed parts of mechanics are a closed set of postulates without connection to the real world.

The properties of its presumed subject are therefore not correctly described, *cf.* dynamics.

If matter at some velocity, high or low, falls on something, it will exert a pressure, which it will also at rest. Is this what is meant by "converting energy to mass"? If so, this is rather an instance of reverting to a less differentiated language. Maybe the word "mass" is given different meanings according to the situation, without warning?

Matter is not converted to energy, nor energy to matter. The equation $E = m \cdot c^2$ does not describe "the energy content of matter", as it postulates the energy transmitted by a measure of inertia at the velocity of light.

No inertial matter, however, can be accelerated to the velocity of light.

Matter's composing parts of substance have relative potentials, which are used for maintaining its—above 0 K—ever moving internal structure. For liberating these potentials an amount of energy is needed; and this energy is greater than that sufficient for dissolving the quantity of matter in question.

The differences between real particles and presumed bodies moving seem great and not accordant with the theory of relativity. This discord could be solved within a mechanics based on physical functions.

A first trial could be to accelerate atoms to a very high velocity and register their cohesion. The Lorentz-FitzGerald contraction postulate is not consistent with the dimension of the potentials of matter and their relation to the energy needed for accelerating particles of substance to velocities near that of light. Particles do not reach that velocity.

The necessary moving force will be a relation between some external charge and the charges of the body itself, relative to its inertia, *cf.* gravity. This force is not a part of Newton's second law, nor is it introduced into Einstein's version.

In a world of matter composed of un-charged substance, moving bodies would have been the only sources of moving forces. This is described in N 2; and it was taken over by Einstein, together with Newton's presumed autonomous force of gravitation.

Since the energy uptake of charged particles and bodies is not a function of inertia and velocity, *cf.* Maxwell, the function of moving charges should be taken into account.

Gravity is a compound force produced by the charges of substance. Fire, a product of charges, has been used for three centuries as the energy source for the prime moving force of Europe.

Fire's use as the source of light was challenged by the light-emitting diode, LED, a few decades ago. Edison's controlled fire in the evacuated glass bulb came in the 19^{th} century.

The energy E calculated will have been used for accelerating to the velocity v some quantity of matter having the inertia *m*. Its moment is convertible to a potential or to energy, depending upon the conditions of conversion.

A potential is not unconditionally convertible to energy. $E = m.\ c^2$ does not imply that energy should be "converted to mass" or to matter.

Energy is a product of moving matter, or of a released potential. It is measured as a difference of moment, momentum, or temperature.

If matter could have been accelerated to the velocity of light, it would have carried a potential proportional to the square of that velocity.

Matter cannot stay intact at very high velocities, as the energy for acceleration will surpass the internal potentials of matter.

'Mass' is the name of the measure of inertia, not of the quantity of matter, nor of matter. The property inertia is not convertible. Within the limit of moderate velocities, a body can transmit a momentum by its inertia, provided it has been accelerated by an external force.

At high velocities, the charges of a body's substance will gain electro-dynamic qualities at the cost of their static forces and an amount of energy produced by released potentials.

The structure of matter is not compatible with electro-dynamics above a level seen in electron's movements and in some molecular bonds, *e.g.* the monomers of water.

The structure of substance is not a static, permanent trestle-work, but a near permanent grid-like system of particles held in relative movement by the potentials of their charges.

A differentiation of terminology is useful. Should we say that the fallen rain has been converted to millimetres or inches? We should distinguish between, *e.g.*, measure and identity.
At the velocity of light, the energy taken up in a quantity of matter has been used for its acceleration and its dissolution; to atomic substance, to subatomic particles of substance, and to sub-particular photons.

Looking to the physics of the sun and its two main activities, emission of light and emission of protons, it is seen that electrons are broken down to photons and distribute energy, while protons are emitted whole in showers and counteract energy by their positive charges.

This is seen in the sun-"storms", which affect the fields of the Earth, the technical use of electromagnetic fields, and the photonic energy of negative charges.

Magnetic fields are produced by moving charges. Their polarity depends upon the polarity of the charges, and of their direction.

Uncharged particles do not affect normal matter. Interactions involving transmission of potentials take place by the charges of the particles, not by their inertia.

These interactions are not included in that which can be described by Newton's second law. This law is limited to inertia as the representative of the qualities of the substance involved.

The description by charges and the forces of their potentials is needed when atoms or their particles are involved, and when light is involved.

This arises from light's magnetic constitution, which makes it impervious to material forces.

When particles of light are aggregated to the matter hit, their potential is taken up by this matter, *cf.* heating of matter under the sun. When the particles are reflected, a part of their potential is left with the reflecting matter, depending upon the angle of reflection.

Calculation of interaction between particles or between particles and light should comprise the qualities as well as the forces of the particles. The forces are produced by the potentials between charges of the different particles.

The qualities can be classified as positive and negative charges, and the lack of charges. Added to them are the photons and their specific electro-dynamic force.

It will be seen that uncharged particles have no influence upon the forces produced in the interaction, though upon the inertia of a particular system.

The velocity of light is not an option for a body. The potential needed for reaching c will dissolve any matter. Small parts of particles will exist, but no body to be accelerated.

Einstein's equation $E = m.\ c^2$ is built upon Newton's, which was a conscious avoidance of reality. Einstein's equation is not valid for any purpose.

The physical functions of mechanics are not known well enough for having been placed in their correct relation to the empirics of physics; and these do not represent the physical functions of physics.

N 2 does not permit a description of the qualities of the particles, potentials, or forces involved in the interaction between matter and light or other radiation.

When we see something taking place in space, we do not have any reason to presume that what happens should be a property of space or a product of space.

As long as everything takes place in space, we may presume that the property producing a differential of force should be a property of the bodies or particles involved, rather than a property of space.

Light, as an electro-dynamic radiation, passes through the fields of static charges without interaction. This is the reason for the lack of measurable differences of velocity between light from different directions relative to the onlooker.

The possible interaction is in the direction from light to matter. This is seen in the photoelectric effect and in the heating and visibility of matter. These are not field interactions, but particles meeting.

Reflection and refraction take place by interaction between light and the electrons orbiting the atoms as their parts. Their fields are small, and their forces are weak compared to those of light.

Light has practically no lateral extension of its field, thus the interaction will take place at direct or very close encounters.

The smallest atoms do not reflect light, thus the dry atmosphere is nearly invisible. Water is intermediate, as the two bonds of its monomer are magnetic solenoids and strong. Its surface reflects light; and its deep absorbs it.

Together, the electrons of the solenoid of an atom will carry the field of its magnetism; and this should cooperate with the photons of light.

Each species of atom has a specific reaction to the received light, *cf.* the absorption spectra of the elements.

Weight.

Instead of thinking that the world is the way the model says, we could rather think that any approximate model gives a picture of an aspect of the world. A picture is not the world itself. It is always incomplete; and it may be misleading.

We should always feel exhorted to make our understanding better by revising our models.

Drawing conclusions about reality from the model's form or properties is an activity of low relevance to reality. Conclusions should be made from the content of the model, not from its form or grammar. This is also valid for mathematical models.

Mathematical consequences of a model are not necessary parts of the reality described in the model, though they are not by necessity excluded from it.

The weighing of a body is performed in order to measure its amount of constitutive matter.

The force between bodies is an extension of the intra-material forces, those effective between matter's primary particles, its substance. The forces relative to the Earth are supposed to give the correct measures of the quantity of matter constituting the bodies weighed. As far as it has been controllable, it has given correct results.

The same reasoning seems to lie under the technology for determining the size of the substance of particles constituting matter. The results are not consistent, as the weighing of substance has not given the same results as the weighing of matter.

Consistency may be reached after considering that substance is kept from interaction with other substance when it does not form a part of average matter.

The current understanding of gravity is empirical; and its belonging calculations are phenomenological. In not accounting for its physical conditions, our present model of substance and gravity is not valid for uncharged or singly charged particles.

For practical purposes within macro-mechanics, mass is mass as measured.

If a body of matter is weighed, its technical relation to gravity is established. This should be understood as a phenomenological relation, as it is not established on functional conditions.

When «energy of matter» or gravity is concerned as a physical function, the matter is different. Since, until now, a functional theory of gravity has been lacking, there are defects in our understanding of matter, its composing substance, and its interactions.

When particles form atoms, there is no necessary exchange of energy. An electron can establish a potential and an orbit relative to a nucleus or a proton. When this happens, a potential is substituted for a momentum.

An electron and a proton will meet and form a neutron or an atom. Their reciprocal potential used for approaching is converted to momenta and to their relative potential, expressed in their charge, inertia, radius of orbit and period of orbiting.

Energy is a sum of transients. It is not reversible. It seems that the concept 'energy' is used for transmissions producing recognizable changes of matter, *e.g.* heat or movement.

Different levels of momentum continue as levels of potentials; and, as protons and electrons have opposite charges, the potential of their relation is a quadratic, inverted product of the radius of the electronic orbit.

Neutrons are correctly weighed because they conform to our preconception of the nature of matter, which has directed our measuring techniques and measures.

This raises the question of our definition of matter: should we define normal matter as that containing not more than a certain percentage of singly-charged particles?

Within the model of matter understood as consisting of positively and negatively charged particles, the neutron consists of one proton and one electron.

The weight of of the neutron is given as the weight of the proton plus 2·5 times the weight of the electron.

This paradox has been possible because the weighing of singly-charged particles has been based on the belief in gravity as an autonomous force of matter. As this cannot be the case, *cf. ch.* 3, a new understanding of weighing is needed.

As weighing is performed for establishing the force, relative to the Earth, of a quantity of matter, with the purpose of using that force as a measure of this quantity of matter, we have to consider the method of weighing.

As the force of weighing is a product of the properties of the body's substance as well as of those of the Earth's substance, both should be taken into account at the measuring of the force.
'Mass' is the name of the size of inertia, which is one of the qualities performing the phenomena described in Newton's second law.

When the movement of a body relative to some other body, or the velocity of its movement, is not the theme, mass is not relevant for consideration.

The physical functions of matter are performed by the charges of its substance. Gravity is the function by which the weight is produced and measured.

An exact measuring of the forces depends upon the velocity of the charges. This is not needed for everyday weighing.

Mass is not a part of the question, since inertia is not involved.

The method has been taken to yield correct results for particles of substance, since gravity was postulated as a force belonging to matter as such, regardless of its constitution.

When, though, matter's constituting particles are seen to produce the function of gravity by the specific properties of their charges, regard should be had to these properties and their influence upon the measurement.

Gravity, *cf. ch.* 3, can be taken to produce correct measurements of weight as long as the substance of the weighed matter is composed of an equal number of electrons and protons.

A neutron should therefore be correctly weighed.

Since gravity is a function of charges in a body in their relation to the charges of the Earth, this will indicate that the single electron or proton is not correctly weighed.

The correct measurements should be seen from the sum of attraction and repulsion of each particle from the negative and positive charges of the Earth, with due regard to the interaction between the positive and negative particles of the matter weighed.

We have to decide whether we want to know

1. the weight of the particles of substance as single particles, or

2. their weight in their function as parts of matter composed of equal numbers of electrons and protons.

The weight of the particles in their function is their manifestation in the physics of everyday.
In a body, electrons and protons, $e^- \leftrightarrow p^+$ are bound to each other.

This intra-molecular bond ↔ gives each of them a part in the other particle's attraction to Earth.

The particles of substance, electrons and protons, attract ↔ each other:

$$e^- \quad \leftrightarrow \quad p^+$$

$$\downarrow\uparrow \qquad\qquad \uparrow\downarrow$$

They are attracted ↓ and repelled ↑

$$+\,- \qquad\qquad +\,-$$

by the unlike and like charges

of the particles of the Earth.

When two unlike particles are parts of a body, they attract each other; and both of them will also be the objects of a stronger attraction to the Earth than they are as separate particles.

The reason for this is that each of them also receives ↔ a part of the attraction of the other particle to the Earth.

This attraction cannot be separately measured. It makes the neutron heavier than the sum of the weights of its parts when these are weighed as single particles.
The opposite description could seem more adequate:
Single particles of negative or positive charge are ascribed a lower weight than their functional weight as parts of atoms or neutrons.

Their part in the combined attraction of two or several particles is the condition of their functional weight as parts of atoms of a body.
The positive and negative fields exert their influence independently of each other, though in the same space. Because of this, singly-charged particles are exposed to the repelling forces of the like charges of the other body as well as to the attracting forces of the opposite charges of that body.

They are, though, not exposed to any of those complementary forces which their absent companion particles would have received.

Though the relation between charge and the single particles of substance is defined, the

quantitative relation between charge and composite matter has not been defined.
Although inertia and gravity are exerted by matter defined by its constituent substance, the material, inter-substantial forces producing these functions are those between the charges.

These charges are unequally distributed within matter, even to the point of wrecking our measurements.

With the exception of extra-luminous radiation from the sun (the misnamed “solar activity”), single protons and electrons are technical artefacts without any original significance in earthly physics.

It seems that the production of sunlight is the sun’s main activity, for which it uses 5 million tonnes of its substance *per* second.

Our technical electricity has probably not reached a volume noticeable in the physics of the Earth, though its energy concentration and frequencies most probably have an impact upon life in urban regions.

Neutrons and atoms.

Neutrons seem to show a measure of magnetism corresponding to that of an electron orbiting a proton. The dissolution of free neutrons, after a half-life of seventeen minutes, leaves after each of them a proton, an electron, and an antineutrino, of which the last seems to have neither mass nor charge. It could be a residuum of the energy released at the meeting of the electron and the proton.

Their original condensation should have happened under energetic conditions maybe like those of the sun today: a hot place with a certain density of particles and a high pressure. If the antineutrino is an opposite of the neutrino in most respects, it should, like the neutrino, have a very small inertia.

Release of energy is perhaps not the adequate model of what took place at the formation of neutrons. Condensation is a situation of external energy in which several particles, *in casu* electron and proton, will meet and hold together long enough for the surroundings’ reaching a stable situation including the new, greater particles.

Condensation could then be seen as the product of specific conditions, and, because of the changing conditions, not reversible. The condensation will be produced by removal of a potential, in the form of pressure, temperature, and other specific variables needed for sustaining the specific situation between single particles.

The remaining energy is that converted to the potential of a bond and no longer at the disposition of further processes in the same range of energy as before condensation.

A possible part of the process could be a magnetic field, perhaps transient. By catching the electrons and protons, it would keep them close together without coalescing. A temperature of, perhaps, several thousand K would keep their momenta from being exhausted.

In the hot interior of the sun, elements are broken down *cf.* the highly ionized elements, like Fe^{14+}, ref. 12.

The interesting question will then be how this and other elements were first made. Were they made in the sun and then half-way destroyed? Are they residua of elements existing in matter from which the sun was made? Or are they accidentally produced by specific conditions?

The current theory seems to presume that the heavy elements were made in the stars and spread to planets by supernova explosions. Were they also spread to other stars?

Iron is found on Earth mostly in metallic or oxide form. Has our sun been a part of a supernova explosion? As far as is known, our sun is not old enough for that process; and it does not seem probable that the matter left after the explosion could have any structure.

Was Big Bang a local happening in the Milky Way?

If the ions of iron are half-way produced iron atoms, they can be seen as atoms in their condensation process, where the nucleus was first condensed, and free electrons of the sun added as the energy level was sinking.

The presumed parts of the early world would leave open the possibility that neutrons could be the products of the hot scenario at the common forming of sun and planets.

One possible sequel of this could be that the conditions at the forming of sun and planets made possible other potentials than those imagined today; and that the successive levels of potentials were the specific conditions at the forming of specific bonds.
Condensation should have been the process of forming of compounds whose origins are not now objects of study.

The dissolution of free neutrons shows that they are not constituted by an amalgamation of their two particles, but by a reversible relation between them.

It seems probable that the two constitute a small, atom-like system produced by a proton and an electron nearly meeting under energy so high as to give them a reciprocal potential higher than that of the ^{1}H-atom.

They will therefore constitute an atom-like system with a radius smaller than that of the atom of hydrogen.

Such a system will, by its solenoid structure and fast-moving electron, constitute a magnet, like the first coil of the transformer.

Magnets between the protons of the nucleus will be the necessary and sufficient mechanism for neutralizing the reciprocal repulsion between the protons.

The dissolution of the neutron indicates that it was formed under a higher potential than that of, *e.g.*, the monomers of water, thus a strong thermal and magnetic potential.

The potential could have been that of the production and dissolution of proteins, 360 kPa and 140 ºC.

The neutron's conservation depends upon the use of a part of its field force for a purpose external to the atom-like structure itself.

Systems of energy.

The separation into two systems of energy is seen in the different forces engaged in the interactions of matter and those of light.

Magnetic fields are not influenced by fields of static or low-velocity charges, which also make impossible their acceleration to the velocity of light.

Light is produced in the sun by the collisions between electrons and the acceleration of their parts. The process removes the static charges.

Its products are photons, which are very small parts of electrons, their very high velocity, and their electro-dynamic charge, seen as light.

The particles have two characteristics, which are charge and the velocity of light.

These produce magnetism. The transition to magnetism begins at *c.* eight *per cent* of the velocity of light.

In matter, the high velocity is produced by charges as a Δ v of the charged particles. Small atoms will have high velocities in their electrons and produce a break of their field twice *per* revolution, followed by a stronger magnetism.

This effect is exploited in transformers, where a Δ v is produced in its first coil by the current's reversal twice *per* revolution.

In water's monomer, consisting of one oxygen atom and two hydrogen atoms, the change of direction of the electron of the H-atom is faster than in any other atom.

Thus, water should be the molecule which, among our everyday molecules, is the strongest producer of magnetism.

It will be seen that the interrupted stream of electrons produces the difference between the magnetic varieties of movement and the varieties that carry the mechanical forces.

This can explain the forces of the atomic nucleus. Its number of neutrons is equal to, or greater than, that of its protons, except in ^{1}H.

Because of their smaller number, the protons in nuclei are without mutual contact; and the magnetic fields of the neutrons, which belong to the system of dynamic energy, are impervious to the fields of the static charges of the protons.

The protons stay in the spaces between the neutrons. This intercalation keeps the protons away from mutual contact.

Their fields extend, however, far enough for keeping the electrons in place and holding the atom together.

This nuclear structure and mechanism will explain the maximum size of atoms. The forces between protons and neutrons will not extend far enough for maintaining nuclei greater than those existing as natural elements today. This further explains the low stability of greater nuclei and their ensuing short half-lives.

The greater transuranian elements existed under a stronger terrestrial magnetism, but are now known from artificial production only.

The difference between ^{1}H and neutrons will be that these have the higher internal potential, thus the smaller radius.

Together with their stronger magnetic fields, the necessary high energy of formation of the neutrons lets us understand their function and their dissolution after a singleton half-life of seventeen minutes.

The dissolution takes place at their removal from the potential of the nucleus. Their dissolution shows that there was no energy gain from their formation by condensation.

If there had been any energy gain, some added energy would have been needed for their dissolution.

The nuclear forces, Nº 1, weak, and Nº 2, strong, can then be understood as

1. Weak. The absence of any reciprocally repelling force between the protons, as the field potentials of the protons are not taken up by the neutrons, which by their electro-dynamic fields are impervious to the static fields of the protons' charges,

cf. the properties of the systems of energy; and

2. Strong. This consists in the magnetic forces of the neutrons' fields, which keep the protons away from mutual contact by retaining them in the spaces between the neutrons.

This also indicates that the protons are aligned, so as to have a spatial orientation.

This could be a product of the polarity of the neutrons, *cf.* the right hand rule. The neutrons will be coordinated by their magnetic fields, so that the South pole of one neutron will be placed in succession to the North pole of the other.

This will have consequences also for the polarity of the atom as a whole, together with the solenoid of the electrons leading to a polarization of atoms in the magnetic field of the Earth.

This will even lead to restrictions on the possible orbitals of the atoms, as there will be limits, by their magnetic fields, to the movements of electrons relative to the magnetic fields of the atomic nuclei.

Light belongs to the magnetic fields, as is demonstrated by its production in the sun.

Not phenomena only.

The hydrodynamic effect was published in 1738[2]. Nearly two hundred years later, sailors began to understand that there was something in it for them. They sailed close to the wind and discovered that they could get more force and velocity out of it than by plain sailing. Aeroplane engineers applied their versions on wings.

It is the phenomenon of the effect that has fascinated sailors and engineers. The function has not yet been published, as far as I know.

There will have to be a function of matter hidden in the stream of air or water.

The charges of matter are moving with the wind and the stream; and they will by necessity use their potentials relative to the fluid at rest or low velocity on the other side of the sail.

The physical side of the method is the same as in other means of exploiting potentials: the charges of air or water will establish a relation, a molecular bond and let the sailor keep his relative position to the stream while he moves relative to the sea.

The only condition he should fulfil, is keeping a good relation to the useful stream of water or wind.

Extended magnetism.

Since the inner parts of the Earth are made of a plastic material, their atoms should be oriented in a succession of changing magnetic poles, thus making one great magnet.

This would have happened even if the core of the Earth were not made of magnetic matter.

Since the currents producing magnetism do so by the same movement as in a spool, *cf.* the transformer, the solenoid movement of the electrons of the atoms of the Earth's core is a possible source of Earth's magnetism. Their alignment is automatic by their fields.

The probable water in the core could be monomeric. As water, by its hydrogen solenoids, is a strong magnetic molecule, it could explain the softness of the magma, which should be a factor in the rapid changes of strength of the geomagnetic field seen during the 20th century, together with the movement of the magnetic poles.

It could also be a factor in the reversal of the magnetic field, every 700 000 years on the average. Water is the most probable source of Earth's magnetism.

Light seen through a prism is divided into colours, provided it is let into the prism through a slit parallel to its axis, or crossing an edge in the same position, *e.g.* a window frame.

The photons of light are slightly deviated by the magnetic forces of the electronic solenoids of the two edges of the slits. The degree of deviation is decided by the magnetic momenta of the photons.

The photons are coordinated by their magnetic fields, which are aligned with the magnetic field of the Earth.

This function between light and matter is a magnetic, or electro-dynamic, interaction. It is seen in the coordination between the atoms of the edges of the slits, which, by the dynamic fields of their electrons, separate the photons according to potential.

A prism is the edge of a magnifying glass with r = ∞. It does not separate the parts of light according to their different magnetic potentials; but, when this is done by the electro-dynamic interaction with the electrons of the atoms of the slits, it makes the separation conspicuous by its magnifying.

The slit is not instrumental as a valve for the light. Its function lies in the relation between the electro-dynamic scale of potentials of the light and the potentials of the electrons of the atoms of the edges of the slit.

The resulting scale of energy is enlarged, in one dimension, by the prism.

Looking at a window through the prism makes visible one half of the spectrum at each inner edge of the window frame. This shows these edges, or those of the slit, to be the instrumental parts of light separation, not the prism.

A further consequence is that the magnetic fields of the solenoid orbits of the electrons in the material of the slits are seen to influence the light in opposite ways.

The inner edge of each side of the window frame shows one half of the spectrum; and it seems that the two halves produce light of different energy.

In the magnetic field of the Earth, the solenoids of the atoms will be oriented in parallel. Light falling on one edge of a slit will meet the electrons in the direction of their orbiting; while light falling on the other edge will follow the electrons in their movement.

This implies that the momenta of the two halves of the spectrum will be different, as the first will be exposed to a deduction, the second to an addition of momentum.

This is possible when the movement in the atomic solenoids is fast enough for producing magnetic fields, thus influencing the light, *cf.* the invisibility of air, whose moving electrons are too weak for that interaction.

The spectrum thus shows a sum of magnetic and mechanical interaction between photons and electrons. The apparatus could perhaps be used for finding properties of different materials from their use in the slits and cooperation with light.

The properties would be relative; and a common measure would be needed for establishing absolute values.

Singly charged particles respond to external electrical fields by their single charges. Gravity presupposes both charges; and mass is defined by bodies having both.

Thus, the ascribed “defect of mass” is due to a lack of understanding of what has been measured, combined with believing the current method of measuring to be adequate.

Weighing singly-charged particles is an instance of taking gravitation as an autonomous property. The method used is mistaken as the provider of adequate information.

We understand the world by our models, even when the world does not correspond to them. In order to relating adequately to it, we should rather find models corresponding to reality.

A first step could be to find the functions and properties of the world. These will lead us away from the deficiencies of the old models.

For practical purposes within macro-mechanics, mass is mass as measured. If a body of matter is weighed, its technical relation to gravity is established.

When it comes to utterings about «energy of matter», or about gravitation as such, the matter is different.

The use of phenomena for describing gravitation has impeded our understanding of gravity as well as hindered the search for its physical function.

The absence of a model of the physical function of gravity was combined with defects in our understanding of matter and the interactions of its internal substance. The common understanding of gravitation today is empirical; and its calculation is phenomenological.

In not accounting for its physical conditions, our model of matter and mechanics is not valid for uncharged or singly-charged particles. Nor is it valid for magneto-dynamic particles or their interactions.

Because of the lacking correspondence between the amounts of charge and of substance, we have gravity. If the relation between charge and substance had been the same in all particles, we could not have had gravity, nor matter as we know it. In that case, there would not have been any attraction between atoms; and these could not have existed in their present form.

Trying to measure the mass of protons and electrons, and discovering a deficit, this has been taken to be a property of the objects weighed.

It is, though, due to the inadequate model. We may arrive at a better method of measuring by understanding the physics of its objects.

The neutron should be correctly weighed.

The difference between the definitions of the concept ‘mass’ will probably not lead to its unequivocal use.

The interpretation or definition permitting the more precise use is that of letting the concept ‘mass’ denote “the measure of inertia of matter”.

The “mass defect” does not indicate a defect of substance or energy, but arises from a lacking correspondence between the model of interaction between bodies which was formulated by Newton as $F = m \cdot a$, on the one hand, and the relation between substance and charge on the other.

This relation is not the same in all matter. When hydrogen is weighed, it is related to the empirical constant $g = 9{\cdot}81$ N kg^{-1} regardless of its internal electrostatic functions being others than those of the matter of the Earth.

The presumed mass defect of ^{1}H will be due to the lack of a neutron in its nucleus. It is exposed to the repelling force from other nuclei, but not to any attracting force from earthly neutrons.

Newton would not see gravity as a function at a distance, but he included gravitation as a phenomenon in his model of mechanics. He chose a model for macro-mechanics which, by its limitation to phenomena, has led to an inconsistent model of nano-mechanics as well as of dynamics of high velocities.

We have not considered the primary properties of substance as the conditions of the properties of matter.

The properties of substance are constraints on the properties of matter, as well in their functions as in the way we perceive them.

The elementary properties of substance are not accidental accessories, but the conditions of the phenomena registered at a first glance and of the functions seen at a closer scrutiny.

Newton also reduced his considered material phenomena or functions to one only, which is inertia. Even if Newton is blameworthy for what he did and did not, his posterity is equally blameworthy for not mending his omission.

As was seen above, conclusions about high-velocity dynamics should not be drawn on the conditions formulated by Newton.

Sacrificing mass for energy, or for a potential, means exchanging one function of substance for another. From this does not follow a loss of a quantity of substance. The misunderstanding of the 20^{th} century follows from the unclear meaning of the word “mass”.

Neutrinoes are known as nearly massless particles without any charge. Because of their lack of any possibility of electrical interaction with the matter of the Earth, they pass right through it unless they hit an atomic nucleus.

As particles, they consist of something, which we may call ‘substance’. As they interact with atomic nuclei, their substance is confirmed. As they do not interact in general, they will have to be without any charge.

The interaction between charge and matter in general is that particles without charges, like neutrinoes, go through all matter.

Particles of small charges go through a thicker layer of matter than do particles having greater charges. Photons of small charges release little energy when they interact with the electrons of atoms. They are hard X-ray and ultraviolet light.

This illuminates the mechanism of light’s reflection: photons are reflected when they are repelled by the like charges and the electro-dynamic force of the electrons of the atoms of the surface of matter.

Hard X-ray and UV are less energetic than visible or infrared light. It is thus important to distinguish between “energy from light” and “energy from a photon”.

Light is not reflected from the small atoms of light gases, which is why the air is invisible.

One consequence of this is that the world is visible because its matter does not absorb all light, but reflects parts of it. Blue light and UV are absorbed because of their low energy.

The sunset is red because the weakest part of the light is absorbed in the atmosphere by its dissolved water and by small amounts of heavier gases, not by the air itself.

This instance of redshift is more important than refraction at sunset, which is also a magnetic function of water.

The two solenoid bonds of the monomer of water will contribute to the greenhouse effect as well as to the production of the Earth's magnetism.

Substance, charge, and energy.

In Ψ / m, the relation between charge and inertia, the mass m is not well defined for the purpose, as it indicates mass as we think of it in a model of mechanics, where movement is considered in a purely empirical model or as a product of presumed non-electrical forces. The mass of singly-charged particles can, though, not be defined within those models.

Therefore, there could have been an advantage in using the concept 'electrical mass'. One reason for this is that singly-charged particles do not show the same measure of mass as particles of both charges.

One other reason is that the electrostatic and electromechanical effects of singly-charged substance are so much stronger than their mechanical effect. Thus, it could be important to use the electrical mass in connections where it is prevalent.

One reason for not establishing this as a routine for all cases is that all inter-particular forces are products of the charges of the particles.

Mass defect is now defined as the mass whose energy is used for binding the nucleus (or holding the atom together).[15] The definition seems to be based on a physical interpretation of $E = m \cdot c^2$, implying a conversion of mass to energy, combined with 'mass' not understood as the name of the measure of inertia, but apparently as a quantity of matter. This physical interpretation is not well founded.

A fundamental property of N 2 is that it does not contain any reference to a physical force. Its force, the product of mass and acceleration, is a calculation unit, as there is no functional foundation for the relations of N 2.

Mass is conceived as the measure of inertia, which is the passive product of a moved body. This interpretation gives a measure of meaning to Newton's second law, though only as a description of phenomena.

Acceleration is the measure of the change of velocity. Newton's concept of force is the phenomenological relation between two qualities of moving bodies.

These qualities seem to be abstracted from the bodily functions believed to be active, though they are not parts of the functions.

Newton's concept of 'force' is thus rather abstract, as it is the product of two relations. Both of them are, in real physics and in life, produced through physical functions; and both of them are deprived of the functions before they are regarded as abstracts. In their state, as abstracts or phenomena, they cannot deliver statements about physical functions.

At low velocities, the products of N 2 are taken as true by definition. This is not founded.

At high velocities and the velocity of light, the products of the 20^{th} century variety of N 2 are wrong. Neither the physical conditions of high velocities nor their products are regarded, *cf.* the loss of coherence of bodies at the energy input thought to be needed for reaching high velocities.

This indicates that the consequences ascribed to the physics described are, at the outset, consequences of the model. This seems to have been the method of Einstein. I see no reason for recommending it.

All forces are produced by the intra-material potentials between positively and negatively charged particles. The static forces dominate through low velocities. At high velocities, the electro-dynamic forces are dominant.

According to JCM 3, 4 π is the relation between the electro-dynamic force at the velocity of light and the electrostatic force at velocity zero. This difference is technically known as distinguishing the transformable AC and the non-transformable DC.

The decisive difference between them is the Δv of the alternating current, since the unidirectional velocity of the direct current is insufficient for inducing the electro-dynamic fields in the soft iron core of the transformer *cf.* the formation of light in the sun.

This also removes permanent relations by the rapid change of direction. The production of light in the sun consists of the breaking down electrons, the acceleration of their parts, and their rapid change of direction. These could all be decisive factors in the transition from static charges to electro-dynamic fields and their high velocity.

Photons are not connected, but form a stream in which they are free from each other to the point of not interacting, only streaming side by side in a narrow ray.

The velocity of a charge gives it the function of a vector, thus the Δ v of a solenoid or an electron

in an atom is higher when produced at a smaller radius.
The physics of light as an electro-dynamic force begins with separating electrons from protons.

From our picture of forces, which includes technical transformation of potentials, we can infer that the charged particles of light have an effect comparable to that of a high-voltage current at a low level of power.

There is another side to this. When a function produces a phenomenon, do we then have the option of choosing the phenomenon as the cause of the function?

Distinguishing between phenomena and their conditions may demand some perspective.

The deviation of a star's apparent position during the solar eclipse in 1919 was predicted by Einstein and ascribed to solar gravitation by its presumed curving the light's trajectory.[26]

This could not have been the case. Light and gravity do not interact, as light is impervious to the forces of the static fields producing gravity. It could not have been the electrostatic force of gravity which attracted the electro-dynamic force of photons from the star.

Light reacts to magnetic fields. The magnetic field of the sun is its outer part, produced by fast-moving electrons as they are broken down.
The sun's magnetic field would have produced the curved trajectory of the star's light.

The production of light in the outer parts of the sun indicates that the luminosity of a star is a product of the strength of the star's magnetic field. The proportionality of these two could be seen as a law of physics.

The question of principle concerning N 2 is whether it is useful with its shortcomings. Bernoulli[2] and Maxwell[8] pointed to two new roads.

Bernoulli described the indirect stream function without knowing the electro-potentials of matter or the mathematical model of vectors.

Empirically, Bernoulli's indirect stream force can be seen as a vector function. Its physics is mentioned above, this chapter.

Maxwell apparently saw electricity and magnetism as one of several forces of matter. Amalgamating the models of Maxwell and Bernoulli could let us understand the potentials producing the forces of matter, and of their ways of working, *e.g.* seeing the dynamic pressure component Δ p = - ½ ρ v^2 as a vector product of moving charges, while Bernoulli had seen the pressure difference produced by a moving fluid.

It does not seem that Maxwell's insight has been understood or used in its full scope, or that Bernoulli's approximate application of Maxwell's third equation, 135 years before its publication, has got an adequate place in the technology of fluids.

This un-knowing seems to have been spread by the ever greater learning's ever stricter limits of accept. The un-niceness consists in saying something unexpected or unwanted.

It seems that the finder of the unexpected, relative to known science, prefers to keep his mouth shut; and that his reason is fear of losing status by showing disagreement.

Instances of passing over own results of research are the references 6 and 19. In both cases, the results were important by pointing to new perspectives, *cf.* ref. 29.

1930 was the year of publication of the method of electrophoresis, which brought its inventor, Arne W. K. Tiselius, the Nobel prize in chemistry in 1948. More important than a method of the medical laboratory is the principle of the method. It proves that biology's functions are performed by the charges of the bodily molecules and atoms.

This is not yet understood by medicine or biology, which, staying at symptoms, have not reached the understanding of functions. This understanding is the condition of the application of a science.

Gravity shows that forces are products of the charges of matter. The static forces are gradually overtaken by the dynamic forces from *c.* eight *per cent* of the velocity of light.

The usefulness of N 2 is limited to cases where inertia is the relevant variable, and velocity is not above those of everyday. This is the case when an object is thrown. The force needed is relative to the gravitation and to inertia. In all other cases, the religion of Newton prevails.

When the initiating force of a body's movement is a part of what takes place, it should be entered into the calculation. A case of this is the free fall to Earth.

The use of N 2 at high velocities gives unfounded results.

Dangers at uncritical use are to forget the need for a more precise calculation tool, and the disregarding of the dynamical functions of high velocities.

Light relations.

Reflected light carries a lower energy than the incoming light. If it were not to be thus, the light would have taken energy from the reflecting matter for its reflection. Likewise, light loses some energy by passing through a transparent medium, like water or air.

Since light is an electro-dynamic radiation, it is not influenced by static fields on its course. It passes through the static fields of gravity, but it is deviated or reflected by the moving electrons of atoms, except the smallest. This effect accounts for refraction and reflection, for the spectrum, and for the visibility of most matter.

Magnetic fields make light curve around a magnetic body, like the sun or the Earth, *cf.* the solar eclipse of 1919. It is seen at sunrise and sunset in the apparent higher position of the sun over the horizon.

Light's constitution as an electro-dynamic radiation keeps it outside the influence of gravitation and low-energy radiation. Light is a sum of electro-dynamic fields; and it is influenced by other fields of the same system of energy, which include magnetism from stars and planets, technical installations, sunlight, starlight, and artificial light. It reacts to electrons above a certain velocity, since they produce solenoids and therefore magnetic fields, *cf.* the transformer.

There is a conspicuous similarity between light's reflection from the electrons of a surface and the field effect of magnetism. The uninfluenced passage of light through a gravitational field is outside the scale, while the curving of light around a star is within it.

Since these influences are variable, it is, in principle, impossible to determine one velocity of light. The velocities measured should be referred to the actual conditions, *e.g. in vacuo*.

None of these extraneous functions is due to light itself, but to the conditions of the environment. Light is a part of what happens between its emission from a star and its observation, minutes or millions of years later. Redshift is used for estimating time and distance from its source. Its calibration is insecure.

Light is influenced by other electromagnetic radiation and by magnetic fields. In two light rays meeting at any angle, the photons of highest energy in each ray will take most of the potential out of the meeting low-energy photons.
They will use some of their own potential for this. They will extinguish the weakest of the photons crossing their way. In the long run, the most energetic photons will survive and show their red light at interaction.

After a long time of crossing light, the light from a source will have lost its weakest photons.

These photons would have delivered light from the UV and short-wavelength end of the spectrum; and the light from these sources will now be redshifted.

This is a necessary result of light's passage through space. The loss of the weakest photons at interaction in space is a sufficient function for explaining the redshift.

The weakest photons will survive as a low-energy radiation. As long as light from different sources is crossing space, the weakest photons will be most weakened, since space is not quite empty. The results are redshift and a weak background radiation.

This is no proof against Big Bang, but the indication of a source of the background radiation at 2·7 K close to our time. It could be calibrated from the probability of the meeting of photons from different sources and of the extinguishing of the weakest.

The presumed cause of the redshift of the light from far stars, the Doppler-Fizeau effect, is seen as compatible with the higher velocity of farther stars, as they are moving away from the Earth by the accelerating expansion of the universe.

This is a strange postulate, as the light left the stars a very long time ago. The expansion of the universe can hardly mean the expansion of space itself, as this would have produced relative velocities higher than that of light.

If the intended meaning should be that of augmenting distances between stars, this would not have any influence on the velocity or quality of light emitted a long time before the stars reached their present relative distances and velocities.

Another question is that of energy. The acceleration of solar systems and galaxies will require great energies.

The differential of forces producing gravity will draw bodies closer to each other, or keep them in permanent orbits. This is efficient within the dimension of each planetary system and apparently also within each galaxy. The forces are produced by the differentials of potentials of the atoms of the planets and stars.
The presumed expansion of the universe could be due to insecure measurement.

The probability of light from a star not crossing the light from another star on its way is nil. A part of the mechanism of redshift of the light from far stars could be a loss of the weakest radiation, the non-red, at absorption by the small quantity of matter in space.

The theory of a residual radiation from Big Bang, at 2·7 K, should be revalued in this light.

Redshift is a physical function whose debris will have to exist, as the mechanism of its production is a necessary consequence of known conditions of light and its distribution.

Big Bang is still a postulate, while the background radiation can be referred to the lost energy from everyday crossing photons. This lost energy and the redshift are compatible data, not independent postulates.

Redshift implies that infrared will carry the highest energy of the radiation; and ultraviolet will carry the lowest energy. This is consistent with the known radiation, *i.e.* matter-penetrating neutrinoes, the UV's cancer-producing in deeper layers of the skin, hard X-ray, and the loss in space of the lowest energies of the spectrum, which are the UV.

The physics of redshift is simple, as it consists in the loss of the least energetic parts of the light, which are the blue, violet, and UV.

Its calibration is not obvious. As stars are not equally distributed, the calibration could be based upon their density in the sky.

Light is influenced by electro-dynamic fields, like that of a cloud of very cold Na^+-ions (a Bose-Einstein condensate), in which its velocity was lowered to 17 km s^{-1}.[30] This also demonstrates light's energy, which is carried by its negative charges, while the positively charged ions carry negative energy.

The redshift is now ascribed to the Doppler-Fizeau effect. Like any periodic phenomenon ascribed to light, it is produced by interaction.

The wave model of light, a loan from mechanics, is sustained by the measuring instruments and their periodicity.

They are ascribed to light, though they are products of its interaction with the atoms of the measuring instruments.

The wave theory of light does not explain the production of light as waves. A physically probable model of the light waves' travel through space has not been proposed.

A physical indication of the energy differences between light of different colours does not seem to exist, though it should be needed for explaining the production of different frequencies in the measuring instruments.

Some conditions are seen behind the empirics and necessary interactions:

Light is not produced as waves.
Light does not travel as waves.
Light is not taken up in matter as waves.
Light's periodicity is produced in the atoms receiving it.
Light's measured frequencies are the orbiting frequencies of the electrons of the atoms of the receiving matter, *e.g.* the measuring instruments. This function is produced by atomic solenoids of more than a minimal size.
Infrared waves and "long-wave-length radio" need great effects for their production.
Blue light is produced by a low-energy source.
Light, as electro-dynamic particles, interacts with those parts of matter where electrons produce electro-dynamic fields by their high v/θ.
Light is produced and travels as particles.
The greenhouse effect is produced by molecules held together by electro-dynamic bonds. This is the case of the monomer of water, though not of the inter-monomer bonds of its polymer.

A postulate of relativity theory says that light's velocity relative to an observer is independent of the velocity or relative direction of the observer's motion. This is compatible with the systems of energy, *v.s.*, but not with the Doppler-Fizeau effect.

Light's electro-dynamic function will require its measuring by magnetic instruments. This is so because it is impervious to static potentials.

It seems that light is best measured by indirect means. Ole Rømer (1676) could have asked "Where was the light before we could see it?" and "When was that?"

The energy of radiation should be ascribed to the single photon. A light ray of high energy can be technically produced regardless of its measured frequency.

The measures show the potential of light as it is manifested at interaction, without reference to its primary qualities. These should not be referred to the apparent properties of light.

Light's appearances, shown by and through the measuring instruments, are frequency and wavelength. These are products of interaction with the instruments apparently confirming the wave interpretation of Young's experiment. They conceal light's physical qualities.

One of these qualities is seen as colours at light's interaction with matter. Their distinctive property is the potential of the single photon.

They are seen or otherwise registered only by their interaction with matter; and it is not obvious how this interaction decides the qualities of the light we perceive.

Colours are not primary qualities of light, but products of light's interaction with substance, as is seen in the effect of the slits. Colours are also produced by surface molecules of matter.

Separation of light will have to take place through its interaction with some electro-dynamic device. Separation will produce some energy taken up at interaction.

The form in which this energy is delivered will decide the quality of our perception. The separation into colours will have to take place by the specific energies of electronic orbits. This could be verified by letting specific atoms be met by light of specific energy.

The dark matter of space will absorb radiation. Light not falling on Earth, though not very dense, is in the way of light reaching us. It is not equally distributed, as dark clouds are seen in the night sky. The light not falling on Earth will damp the crossing light that we see.

As light does not belong to the system of static forces, it is not influenced by gravity.

The opposite is the case, as light will add energy to matter by delivering its electro-dynamic potentials to the electrons of matter and thereby augmenting their potentials relative to the nucleus. We feel the warmth under the sun, and the warming of a hand under a light bulb.

When photons are reflected into the atom and reach the nucleus, they will lower the potential between the electrons and the nucleus, but lift the energy level of the atom.

Some phenomena of light and matter can be described as waves, as long as we are content with describing phenomena, *e.g.* periodicity.

This, however, is no guaranty that the mathematical waves should be a picture of any wave-like reality. (The fact that Jonathan Swift (1667-1745) could write *Gulliver's Travels* is no indication of the tale's truth.)

Thomas Young saw the interference between light from different slits in 1807. His interpretation was that light should consist of waves. This was before atoms were known.

Looking into the atom, we see the electrons orbiting the atoms in a range of periodicity; and we see that light waves carry the measures made with instruments made of atoms.

Thus the periodicity ascribed to light is that of the electrons of the atoms met by the light.

The properties of the measuring apparatus do not permit us to inferring that light should consist of waves.

The periodicity measured is currently ascribed to light, though it is a product of the periodicity of the electrons of the atoms of the measuring apparatus.

Interpreting this as a wave-property of light itself is a short circuit which has led to misunderstandings concerning light's properties and its relation to matter.

On the other hand, the theory of light as particles is consistent with the known physics of the outer parts of the sun.

Protons are exposed to a low level of acceleration. They are not broken down in the sun. Thus there is no positive magnetic monopole.

The consistent model is reached by seeing light as photons moving in straight trajectories.

Planck's model was intended as a description of the connection between light's wavelength and the radiated energy from a blackbody.

This raises the question of the role of energy as a function of radiation. If the wave property of light is an artefact of measuring, which it seems to be, and the Planck energy factor h should be bound to the presumed wave function, then there will be a need for reinterpreting the relation between radiation and energy.

The need disappears, since the material photons are produced by a lack of precision, which gives them a series of charges and potentials, *cf.* the light's production in the sun.

Waves of light are secondary phenomena, produced by the interaction between bundles of light and the atoms of measuring instruments.

It seems that the use of waves as the main picture or model of light, as well after as before interaction, is a loan from the model of mechanical phenomena.

Waves at sea are parts of the mechanics of gravity.

Ascribing waves to light is an application of a known picture of movement under mechanical forces, used without evaluating the specific, non-mechanical conditions of light.

This perspective has led to an automatic presumption of movement of light similar to the movement of matter, which includes waves.

This could also include a residue of the belief in the continuity of physics (or physics' phenomena) which seems to have been ascribed to classical physics.

The recognition of light as a separate kind of moving force has not been encouraged by its automatic and misunderstood inclusion in the category of moving particles and waves.

Beside this use of a known model, the mental distance from light to radiation has perhaps been longer than the distance from light to waves.

Thus the model of waves has been taken as the model for a greater number of phenomena than now seems adequate.

Is there a continuity ?

The discontinuity of physics seems to have been a postulated reason for the autonomy of parts of physics not understood.

The particles of substance are separate entities; and their fields are linking their potentials and producing their structure of cooperation.

Seen in a structural picture, they are a disjoined continuum of particles; though, seen as a sum of functions, they are a well-structured continuum of moving particles, their fields, and the potentials between them.

The physical foundation of the seen and measured is the discontinuity of the particles of substance, *e.g.* in the sun, where, in its outer part, the particles of negative charge of different sizes become dynamic light; and in its inner part gravity of bodies is produced by the differentials between the charges of particles of substance, partly taken from former material bodies.

It seems that modern physics has not left the purportedly disgracing belief in the material continuity of matter and its functions.

But as long as matter is material, its interaction will have to be exerted between its material parts or by the extensions of the property of its constituting particles of substance, which is their field forces of positive and negative charges.

The potentials between field forces account for the continuity and strength of matter. When this intra-material structure is treated mathematically as a distribution function, its decisive potentials are slipping between the phenomenological equations.

Continuity or discontinuity is an insufficient criterion of quality. The use of this distinction is a distraction from a relevant model.

A more differentiated model can let us see the world as continuous, in some way, and according to some definition of continuity.

Through the theory expounded here, it is seen that the continuity, rather than directly material, since matter is divided into bodies and particles, is inter-material by the fields of charges of substance.

The continuity is not complete, as the functions are performed on different levels. As a product of the two systems of energy they are only partially and one-way continuous.

Two kinds of potentials.

The electro-dynamic forces of photons are implanted as energy into relations of static charges, while the opposite is not the case.

The static charges are transformed when exposed to high levels of Δ v, as in a solenoid, or in the sun.

The transition from static charge to dynamic force is described by δ^2 v / δ t^2, which takes place in the alternating current of a transformer, between electrons in the outer parts of the sun, and in the electronic solenoids of atoms above a minimum size and potential.

It seems predefined that the energy of light should be proportionate to frequency. The constant of proportionality in blackbody-radiation is Planck's constant h.

If it should be valid for blackbody-radiation only, this would be placed in a particular and untenable position.

It is therefore presumed that Planck's constant is intended as a property of light, where the presumed energy of the single photon is expressed as $J = h \cdot \nu$.

This expression has two properties which do not seem compatible with the character of light. The energy of a quantity of light, or of the single photon, cannot be seen as proportional to the frequency ν of the light; and it seems unfounded that the energy part of the expression, h, should be independent of the properties of light.

The reasons for this are that, if light should be interpreted as a wave,

1) its potential would be proportional to its wavelength; and

2) calculation of its potentials would have to be done not from phenomena, but from a physical function.

Like the relativity of Einstein, h can be referred to properties of the model. The consequences are of no concern to the objects of description.

Seen from the outside of the house of learning, high-frequency radiation starts from neutrinoes, which are without wavelength or frequency.

They penetrate matter because they, as neutral particles, do not interact with it. Their lack of charge impedes their interaction with atoms.

Since their interaction with some atomic nuclei is registered, *e.g.* in the chlorine of perchlorine ethylene, the neutrino is seen to be physically active; thus it is not a chimera.

The radiation whose properties are closest to those of neutrinoes, are hard X-rays and ultra-violet light. Their penetration of living tissue is due to their low levels of potential relative to the substance of matter. From this property follows a low capacity of interacting with substance.

Their interaction begins at a certain depth. UV is stopped when it is absorbed by melanin in one of the deeper layers of the skin.

Europeans have lost much of this layer, apparently for the need of producing vitamin D in a weaker sunshine than that of Africa.

The current interpretation of these phenomena is that the high frequencies and short wavelengths are ascribed to a higher level of energy of the radiation.

This could be the result of a mixing up the understanding of the technical level of energy needed for the production of, *e.g.*, hard X-ray, and the energy level of one photon.

In order to produce blue light, a small level of energy is needed, like that from a match, whereas the production of a strong radiation demands much energy, regardless of the energy of each of its composing photons.

Since light is a dynamical radiation, its measure should not be built on wave mechanics, but on particle dynamics.

The particles of lowest energy will penetrate matter; and they produce the shortest wavelengths and highest frequencies at interaction with the solenoids of measuring instruments.

The slits and the colours.

There seems to be a common understanding of colours as the parts of white light. This is built upon Newton's prism experiment, which showed a distribution of colours from red to violet. The common knowledge is that the colours were separated by the prism. Newton let the sunlight into the prism through a narrow hole.

Looking at the light from a window through a prism, we see one half of the spectrum at each side of the window frame. Something relevant to the spectrum has happened at the window frame.

I did not see the green at either side. Violet and blue were at one side, yellow and red at the other. Thus the prism did not split the light into colours. The separating of the colours took place at the edges of the window frame. The green is visible where other colours meet.

The prism is equal to the edge of a magnifying glass with $r = \infty$. Its magnifying takes place in one plane only; at ninety degrees from the edge of the prism.

There seems to be one possible mechanism in the production of the spectrum. This is the electro-dynamic function of the electrons of the atoms of the edges of the slits or the window frame.

This function makes the electrons of each atom into a small solenoid and makes it take an orientation in the magnetic field of the Earth.

Photons reflected from the electrons of one side of the slit are thrown along in the direction in which they have hit the atoms of the edge.

The atoms of the other side of the slit have their electrons orbiting in the same direction; which is against the light falling in through this side of the window.

The photons reflected from this side have lost a part of their potential, thus they produce the colours of lowest energy; violet and blue.

The energetic distinction between the colours as they are seen is thus greater than the difference between the momenta of the arriving photons.

To their physical differences will correspond differences of potential.

Their energetic outcome will be a sum of the photons' momenta at meeting the atoms of the edge of the slit, and the momenta they receive from the electrons of those atoms.

A diffraction grating is working as an enlargement of the atoms of the edge of the slit, where the separation of colours takes place. Both separate the light according to its angle of reflection. In the series of atoms along the edge of the slit there should be the same differentiation of angles as in the grating.

The angle of reflection is varied across a grating or a line of atoms, and according to the material of the slits.

The variation of angles between different surfaces is decisive for the differentiation of the colours. The gradient of colour and energy will be as the $\Delta \sin \varphi$ of the angle between the incoming light and the periphery of the electronic orbit or as the angle between the light and the grating.

The interaction will be by contact, not by fields, as the photons do not have fields.

Within the small dimensions of photons, atoms, and electrons, it is possible to imagine that photons will be met by electrons at slightly different points of their orbit. Their angles of reflection will be different.

To their different angles will correspond small differences of momentum after reflection. The electro-dynamic force will vary with the potential of the photon, *cf.* the lack of precision in the production of light in the sun.

The exit energy is decisive for the colour. The red will be the part of radiation having lost the least part of its energy in the meeting.

It seems that the colours of the spectrum are produced by the introduction of periodicity into the light reflected from the atoms of the slits or the grating; and that the reflection is specific according to the electrons' velocity, charge, and angle relative to the photons.

A grating shows that the degree of specificity is high, as small differences of angle produce different colours.

This gives a physical explanation of the difference between cool and warm colours. The red and yellow has received some energy from the matter of the surface producing them; and the blue has lost some energy to its part of the reflecting surface.

This should imply that light's periodicity is introduced at its meeting with matter; and that its colours are a scale of induced potentials.

One part of the potential is provided by the photons, and the other part by the electrons of the atoms of the slits or the reflecting surface.

The first part of this scale of potential was present in the photons from their production in the sun. As their size is variable within an estimated range of $10^{-9} - 10^{-6}$ of one electron, this should imply a scale of energy from the smallest to the greatest of the photons:

$$4 \pi \rho_1 c^2 \quad \text{to} \quad 4 \pi \rho_2 c^2, \text{ or from}$$

$$1{\cdot}6 \,.\, 10^{-19} \,.\, 10^{-9} \,.\, 4 \pi \,.\, c^2; \text{ giving}$$

$$1{\cdot}8 \,.\, 10^{-11} \text{ C m}^2 \text{ s}^{-2} \text{ to } 1{\cdot}8 \,.\, 10^{-8} \text{ C m}^2 \text{ s}^{-2}.$$

The colours are different because the photons produce different levels of energy. The optical additive mixing of yellow and blue, making green of the spectrum from a narrow slit, in this case gives the same result as the subtractive colour produced by the mixing of pigments. The green is also seen as reflected from the grating.

The separation of colours is stronger than the scale of potentials of light not passing through a slit or not crossing the edges of the window frame. This is produced by the push or resistance from the atoms of the edges.

The potentials and the produced colours are thus partly due to light's energy and properties before interaction, partly products of interaction between the photons and the electrons of the substance they have met.

The reflection of photons and their number of specific colours is not a sum of accidental field interactions, but of a series of specific meetings.

Photons and electrons in the slits collide as particles of specific potentials within the two scales of electrons' and photons' charges.

The specificity is seen in the absorption spectra, which are so specific as to characterizing the elements.

The sorting of photons by the electronic reflection is a process of interaction between two functions, one of electro-dynamic momentum of light and one of electro-dynamic potential of electronic solenoids.

Its product is therefore not a product of light's momentum alone, nor of the electrons of the reflecting matter.

The direction of orbiting of the electrons of atoms will have to be a product of the magnetic field of Earth.

This renders a consistent theory of light, its electro-dynamic potential and its specific interaction with matter and its fields.

Quantum dynamics.

Photons do not interact by inertia, thus their part of interaction is not adequately described by a model built upon mass, like N 2 or its derivative. Photons interact by their magneto-dynamic momentum $4 \pi \rho c^2$.

Their charges are varying, *cf.* the production of light in the sun. Waves are ascribed to light as an inadequate interpretation of electrons' periodicity induced by measuring instruments.

Photons belong to dynamics, the energy system 2. They are impervious to mechanical forces, but react to electrons of substance when these move in solenoids at changes of direction of velocity fast enough for producing magnetic fields. This makes most matter visible and produces the periodicity ascribed to light.

The interactions involving photons comprise their charges and velocity, but not inertia or weight, which they do not have.

Quantum dynamics should be understood as a realm outside mechanics. Its interactions are not described by N 2, nor by its derivative $E = m \cdot c^2$.

The fundament of the interactions is the relation between the charge and velocity of the electron, ρv^2, and those of the photon, $4 \pi \rho c^2$.

The dynamical forces are directed against the particles of energy system 1. These produce life and its negative entropy, visible in the necessity of a varied life for the sustenance of climate.

Time is a part of the mechanical system 1. Time is not a part of the dynamical system 2; thus there is no dimension of time in the observations made within it. Time can be measured within system 1 when it is influenced by system 2.

The moment of influence can be determined, *e.g.* the moment of arrival of light.

Planck's model contains the postulate that the potential of light, and its released energy, should be proportional to ν, its measured frequency.

The frequency is, though, not a property of light, but a quality induced by its measuring.

The model of light's physics should be revised, including the dynamics of its interaction with the particles of substance.

At high velocities, the potentials of atomic particles are independent of their inertia; and the mass forces of the parts of atoms are vanishing.

Insight into the systemic difference between the mechanics of matter and the dynamics of light should also lead to a better understanding of the functions now tucked away in the phenomenological principle of uncertainty.

The particle form of atoms and light indicates that a wave description will be indirect and imprecise, leaving out the dynamical functions performed through the particle interactions excluded from the current model.

Is the universe expanding ?

The energy needed and used for the presumed expansion of the universe has not been identified.

It seems to have been more or less accepted that it should be a part of the energy expended in the stars' radiation.

If, though, the star's radiation should have produced this energy, it should also have led to an expansion of each planetary system.

On the other hand: light belongs to the energy system 2. As it does not deliver any mechanical force, light can neither move its planets nor a neighbouring star.

If it could, each planetary system would have been continually expanding.

The Moon is receding 37 mm *per* year from the Earth because its gravitational force is depleted by the changing tides.

On this background, there is no indication of the necessary force for moving the stars away from each other.

8. TIME.

The SI-definition of time is the atomic second, which is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the hyperfine structure levels in the ground state of the caesium (^{133}Cs) nuclide.[42]

We may presume that this second is stable at temperatures around 300 K and at low external velocities. The energy needed for heating or for acceleration to high velocities will change the dynamics of the atom, *v.i.*

We do not know how the functional products time, velocity, and energy will be influenced by the physics of the velocity of light.

Time is defined as the relation between different movements. The SI-definition of the second is the heir of monuments measuring the positions of the sun and of clocks measuring parts of the day. Our second is the *hora minuta secunda,* the second time diminished hour.

The measure of time has been present from antiquity; and this has made us forget that we need a stable definition of time.

If the measure of time, as modern physics says, is not permanent, but altered according to the conditions, *e.g.* by the velocity of moving bodies, what should then be the general definition of time?

If time is dependent upon velocity, in what does this dependency consist? Is there a method for correcting time-readings according to a comprehensive definition? If empirics is all, how should it be interpreted?

If time should be made a useful variable at high velocities, it would be necessary to find an undisputable physical foundation of it that could also define and measure high velocities.

A related problem is that of finding the limiting conditions of conserving bodies' potentials. This is also the limit of time, since time is part of the measure of potentials at relative movements of particles.

When they approach the velocity of light, the moving particles defining time have lost their mechanical momenta and their atomic relation.

There is therefore no foundation of relative movement that could define time at high velocities.

At the outset, time is the measure of relative movement, or, perhaps better, the relation between different movements. If all matter were moving at the same velocity and in the same direction, no time would have been measurable.

If all matter were collected into one body without internal movement, no time could have existed.

The condition of the existence of time is relative movement. Without relative movement, no time would have existed. We know what has been defined as the object of measuring; but we do not know the influence on its measurements from those parts of movement in which the small parts of moving substance are engaged.

A general definition of time is not immediately given from the systems of energy, since the static forces are produced by potentials at low velocities; and the dynamic forces by light and other high velocities.

Since the reciprocal forces of substance are only partially known, and the relations between its changing forces and potentials are not thoroughly studied, as pointed to in ref. 48, no foundation of a definition of time exists.

In the changing relation between velocity and time, energy plays a role. This could be a clue to understanding time.

Velocity is equal to distance divided by time; but time is a function of difference of velocity.

Thus $v = s / t$, but $t = f(\Delta v)$.

The distance s is equal to the product of velocity and time: $s = v \cdot t$.

This seems reasonable as regards astronomical observations. The difficulty is that

the variables are unknown. We get no help from the variant $t = s / v$, time is distance divided by velocity.

The momentary $v = \delta s / \delta t$

The corresponding $t = \delta s / \delta v$; and

the acceleration $a = \delta v / \delta t$;

thus $t = v / a$.

At the velocity of light, acceleration is not possible. Time will be $t_c = c / 0 \text{ m s}^{-2}$.

This operation is not a part of arithmetic; though, as v approaches the velocity of light, acceleration approaches zero; and time approaches infinity. The near infinity of time will be a permitted value within the model.

This is valid, however, only if we accept either that the model should prevail over reality, or that we should have arrived at a description offering an undisputable model of reality's property on this point.

Since we have got a time and its foundation in mechanics, the present problem consists in finding the definition of another function than the time of mechanics.

The velocities of dynamics are not today defined within its own system; and that which we know about the relations between mechanics and dynamics does not offer any clue to a definition of time within dynamics. We therefore have no foundation of dynamical time.

The velocity of light is a physical fact; and if any time at all could exist at that velocity, its value would be infinity. This is an extension of the foundation of mechanical time.

There may be a need for dynamical time. Its foundation will hardly be found in mechanics, the accepted mechanical time included.

This is a necessary consequence of the present time being defined within the mechanical system of movement and force. Our time is a relation between moving bodies.

The possible communication between bodies is performed by their fields or by the sum-fields of their positive and negative charges. This communication is seen in gravitation.

Their relative movement will also be understood as a relation between sum-fields, like a Δ g. This could hardly be calculated as a differential relative to time.

Time is a function of the interaction between the static or mechanical fields of matter. This function is no longer performed when its parts approach the velocity of light.

The fast small parts of electrons no longer cooperate with substance beyond being absorbed or reflected by electrons in atoms. There is no possibility of communicating a force from matter's potentials to light; and light is not capable of receiving any force or communication from the static or mechanical fields of substance or matter.

This should be seen in its connection with light's origin in the negative charges of the sun particles after their separation from the positively charged particles.

The result is that light is outside matter. It has no weight; and it cannot perform gravity.

Its movement is outside time.

Time happens to the physical world and to the beings in it. An un-physical time is not possible and hardly interesting. We can wish that the limits of time should not be very far from the limits of our world. It would be nice if the conditions of time would coincide with those of the world and its forces.

This seems to be the case.

Its lower limit is that of matter's movement equal to zero. If relative movement between parts of matter does not exist, no time exists.

At the velocity of light, time is no longer measurable relative to the movement of physical bodies or particles, since the limit to mechanical phenomena is their properties' ending at velocities well below that of light.

If we should want to define mechanics no longer from phenomena, but from functions, we could start from $F = \Psi \cdot v^2$, which is the charge of a body times its velocity squared. In units, this force will be $\text{C m}^2 \text{ s}^{-2}$. The active charge of a body in a greater field will be its sum-field of positive and negative charges, as in gravity.

Time is defined by the velocity of matter. The velocity of light has transcended the limits of velocity of matter. This implies that there is no connection between light and time. There will be no road to time of high velocity *via* the charges of matter, since these describe the relation between force and the moved matter at the velocities of mechanics.

Time is defined as a relation of mechanics. Our model of mechanics is not independent of internal, interdependent definitions, *v.s.*, thus the model, in correspondence with reality, excludes the possibility of defining time as an independent factor.

Any definition is the formalizing of a dependency. There is hardly any reason for defining time out of physics. There is reason for seeing time as a part of physics.

There is no bridge to the physics of light *via* the units describing the functions of mechanics.

All matter depends upon its inner potentials for maintaining its function of inner movement and structure. Its substance consists of protons and electrons. Their functions within matter are limited by their potentials. The limits lie somewhere between everyday conditions on Earth and those of the sun.

It is not impossible to grasp the difference between the energetic consequences of the sun and those of our surroundings on Earth.

The energy needed for accelerating particles to the velocity of light exceeds the cohesive force of the particles already at a lower velocity. This is seen in the sun, where not even electrons reach the velocity of light. One thousandth is the estimated part of the electron small enough for reaching the velocity of light.

The over-proportional amount of energy needed for this is used for dividing electrons and converting their static charges to electro-dynamic potentials. This implies smaller charges and the reduction of fields to nearly nothing. Together, they dominate static charges and charges at low velocities.

Protons do not reach a velocity at which they are broken down. Thus the magnetism of light is a product of negative charges only.

Time is a function of the movement of matter. Light's electro-dynamic force does not take up forces, or any communication, from the mechanical fields of matter, as it is impervious to matter's fields and their potentials.

Before reaching the velocity of light, matter is dissolved into its substance; and substance is divided into protons and electrons. Only the small parts of electrons can reach the velocity of light.

Between this part of the process and the final reaching that maximum velocity, the electrons are broken down to photons. Then they have received a higher level of potential than that relative to which matter or substance can initiate a communication, since matter is dissolved at a certain input of energy.

One aspect of the cooperation is that matter consists of both parts of substance, which are electrons and protons. Matter's energetic interaction is a process between electrons and protons.

The potentials of light, in contrast to those of mechanics, are exclusively electro-dynamic and are performed by negative charges only.

In this lies the necessity of seeing time as belonging to the potentials of the interaction between electrons and protons. Time does not belong to the energy system of light and electro-dynamics. This system does not comprehend two parts between which time, as a relational function, could have taken place.

Light is an energy system to which, or in which, there is no counterpart. Light's character and function as magnetic monopole leaves no functional room for any physical perspective.

The absence of a functional counterpart likewise does not permit light to enter into the functional cooperation needed in order to establish a relation of equivalence.

A relation between equivalent parts is the characteristic of the physical function of time. Time is a relation between different and complementary movements performed by different actors of the same kind.

In the realm of light and other electro-dynamics, there is but one part, and no counterpart.

If we deprive the concept 'monophysitic' of religious connotations, it may be used in physics for light's, magnetism's, and high velocities' property making it impossible for them to interact with those potential-carrying complexes of substance whose relative movement is time and the measure of time.

Time is a part of the energy system of matter and substance. This excludes the possibility of measuring time at velocities where the electro-dynamic force is prevalent.

When $v = 0$, or when $v = c$, there is no time. In the first case, time will be infinite. In the second case, its measure will approach infinity.

These two cases are, though, not relevant for the identification of time within a system of dynamics like that of light.

These are physical consequences. Without movement, there is no relative movement, thus no time.

At the velocity of light, there is no structured matter left; and the particles moving have no relation to a complementary kind or force, thus nothing performs movements relative to light.

The velocity of light is the exclusive velocity of light and other very small particles, *e.g.*

neutrinoes. The production of light in the sun has shown that the particles lose their mechanical properties through the process.

Time is a relation between bodies moving within the system of static potentials, which is the system of mechanics. At the velocity of light, time is not only undecided; it is no longer a part of the physical functions. One part of this absence of cooperation between the systems of energy is that light is unipolar and has left the possibility of cooperation with the positive charges of the protons, thus bodies do not reach the velocity of light.

In the sun, the protons stay in magnetic fields until they break out at irregular intervals. In flames, they are spread with the smoke.

At the velocity of light, there is no cohesion between the particles of substance, which are left by magnetic fields to their separate compartments in the sun. Negatively charged particles are broken down to photons. Protons do not participate in the play of electrons and their breakdown to photons in the sun.

Matter or substance can neither inflict their forces upon light nor attain high velocities. The apparent exception from this is the reflection of light from the solenoids of electrons in atoms. This takes place because the particles of these solenoids are moving fast enough for producing magnetic fields.

As reality does not follow the models, it seems reasonable to dismiss time when the velocity of matter surpasses a value where the electro-dynamic forces surpass the potentials between positive and negative charges. It is possible to say that time is undecided between this velocity and the velocity of light; and it is well founded to say that time does not exist in the latter case.

The potentials between positive and negative charges disappear in the sun, when matter has been divided down to these particles; and their reciprocal attraction disappears as they are separated by magnetic fields into different compartments of the sun.

The magnetic fields are produced by the fast moving particles. The transition away from time begins with the surpassing of static forces by the electro-dynamic forces and their velocities.

When heartbeats or electronic movements do not exist, no time can be discovered. Time as a category as well as function and measure depends upon the movement of particles as long as they interact by means of the potentials between their charges.

How much one would wish to have an independent definition of time, it is impossible. Any definition determines a dependency.

Time is defined by relative movement. Measurements involving time at high velocities are not credible, since time is inconsistent at high velocities. Approaching c, time has no meaning.

The use of $E = m.c^2$ as a model for time- or velocity-dependent properties of matter at high velocities is not founded. The *m* of the equation represents mass, the measure of inertia, which is an impediment to reaching the velocity of light.

The variables of movement are distance, time, and velocity. The two last are reciprocally dependent by being defined by each other. It is therefore difficult to evaluate their representativeness or precision.

Time as a category as well as a function and measure depends upon the movement of particles as long as they interact by means of the potentials between their static charges. Light has no static potential. Its force is the movement of its high-velocity charge. This is the electro-dynamic category of forces.

When we, after all, use time as the foundation for measuring movement regardless of its velocity, the measurements escape any controllable precision. In marginal situations, external potentials will interfere in ways we cannot know. Instances of this are the effect of velocity on moving bodies and the relation between real and measured velocity. The last problem is not accessible to solution.

Calling this "relativity" moves the problem from a level of symptoms, or phenomena, to a level of secondary phenomena. "Relativity" is another name for the interdependence of the factors of N2. It augments the discouragement of searching for a rational description of the physics behind the appearances of mechanics.

Physics does not take place as phenomena, but as physical functions. We get no insight into what passes as long as we observe phenomena and limit ourselves to judging from them.

Relativity theory is an extension of Newton's phenomenology, which was an intended avoidance of real functions. His *"Hypotheses non fingo"*[10] was his declaration of building his work on phenomena and avoiding imagining or formulating theories about the real.

Relativity theory is an extension of Newton's second law: $F = m \cdot a$, to which $E = m \cdot c^2$ is identically equal. Einstein's formula is at least as phenomenological as Newton's, thus it does not enter reality more than Newton's did. Its postulated happenings at the velocity of light are physically impossible, *cf.* above.

$E = m \cdot c^2$ is misleading on several points:

1. The inertia-carrying matter cannot be accelerated to the velocity of light.

2. The energy delivered by the moving matter is only partially described by inertia. The description therefore has a correspondingly limited significance. Its energy-carrying capacity should be described by its charges.

3. The energy-producing potential is not a part of the model.

4. Light is accelerated to the velocity of light; but it does not have the bodily inertia which was the physical content of the inertia-function indicated by the concept 'mass'. The velocity of light and the bodily inertia are mutually excluding.

5. Its combination of incompatible properties, *cf.* 1, makes $E = m \cdot c^2$ useless for any purpose.

The use of N 2 by Einstein has therefore removed its significance one step further from reality. Building upon Newton's description of phenomena, Einstein extended the use of N 2 outside its intended validity within mechanics.

The limits of the realm of dynamics are not well defined. Its functions are not understood by descriptions taken from mechanics. A start for the needed differentiation could be the distinction between the two systems of energy. As it is shown above, *e.g.* gravity and time do not interfere with light or magnetism.

The present dynamics, the phenomena imagined at high velocities, are not functions postulated from the relevant physical conditions, but are projected consequences of the model of mechanics, *cf.* $E = m \cdot c^2$.

It is, though, possible to derive the dynamic functions from physical conditions.

The missing links between phenomena and functions are the consistent definitions of time and velocity. The three parts of Newton's second law are defined relative to each other, having acceleration as a phenomenological, half point of reference to the real world.

One problem is that time is defined from relations between movements, which are, at the same time, relations between potentials. This implies that potential or energy enters into all measuring units concerning movement, and in measurements done with velocity involved.

This is a part of time's belonging to the realm of matter and substance. When the parts of substance are divided, first in protons and electrons, then in parts of electrons, while the protons are left behind, time is no longer a part of the world. Time's world is surpassed by light and magnetism.

At the velocity of light, there is no physical reality left, in which time could have any function or meaning. The measuring of the velocity of light will therefore have to take place from the outside, *cf.* Ole Rømer.

This is also a part of the physics of Einstein's postulate of apparently equal velocities of light measured, independently of the relative movement of the observer. This is a phenomenological description, not functional.

The changes of velocities on the macro level produce changes in the micro- and nano-relations of substance, thus changing the measurements of time and velocity. This consequence of the electro-dynamic reaction of electrons to light will vary between different kinds of matter.

At velocities approaching that of light, we could take our time *cum grano salis* and use it for measuring with some low precision.

Though there will be a transition from a reliable time through acceleration to the loss of time at some high velocity, there seems to be no reference for describing this transition with credibility.

The potentials holding substance and matter together as structures are not permanent energy, which does not exist, but permanent and sub-permanent potentials and differences of potentials, Δ p. They hold matter together as long as they are not released as the transients we see as energy.

The measure of energy and potential is the same. Potentials are released on different conditions. Wood starts burning at a few hundred centigrades; but water molecules are stable to around 2500 K. Unstable atomic nuclei are decomposed by the high concentration of their composing particles.

Atoms are held together by the potentials between nucleus and moving electrons. The potentials are of different sizes. They are overstrained by higher potentials or energies.

At the outset, we presume that velocity is something happening to bodies, matter, or substance, like a gas or a particle. Flares from the sun contain subatomic substance, mainly protons, perhaps electrons. They use a few days on their way to Earth; as they move at a few hundred kilometres *per* second.

In order to accelerate a body or a particle to a high velocity, it will have to be exposed to a high potential. At a certain level, the potential added will surpass that of the body itself. Bodies and atoms will then be dissolved.

Electrons are not broken down outside the sun. Protons are not broken down under the conditions produced in the sun.

In the sun, protons seem to fill compartments below those of electrons, since the magnetic loops connected with proton outbursts are ending in dark regions, sunspots, presumed to indicate holes in the sun's uttermost layer.

The protons' velocity and ambient temperature are lower than those of electrons, *i.e. c.* 4000 K against 5780 K at the surface of the compartments of electrons.

Sunspots are less hot because the charges of the protons neutralize those of the electrons.

The temperature equivalent of one electron volt is 11 600 K. The temperature of the proton regions is around 4000 K, which will correspond to 0·35 eV or $5{\cdot}5 \,.\, 10^{-20}$ J of each particle.

We may then presume that matter has progressed into its dissolution at 4000 K or 0·35 eV *per* electron or proton. This is made probable by the fact that the regions of protons and electrons exist separately in the sun; and their particles do not coalesce into matter.

Energy consists in released potentials. At 4000 K, it will have overtaken the potentials holding matter or a body together. All elements have their melting points below 4000 ºC.

Time is defined as the measure of relative movements between particles of substance in their function as parts of matter, *cf.* the SI-definition of the second.

The parts of matter are called 'substance' as long as they are characterized by their charges only, not by being parts of atoms. Light is not material, as it does not consist of aggregated, positively and negatively charged particles of substance, together called 'matter', but is an electro-dynamical radiation of particles of negative charge.

Time is material by being the relative movement between bodies and parts of bodies which are constituted as systems of aggregated, positively and negatively charged particles of substance in relative movement.

As long as movement, velocity, matter, and time are described as phenomena only, aided by the visible relations between the phenomena, it will be impossible to perceive or imagine their physical functions.

There is no help from N 2 or from Einstein's theory of relativity. They avoid reality in the same way and therefore offer no credible description of the functions of mechanics.

Lene Hau retarded light to seventeen kilometres *per* second in a cloud of ionized sodium, close to absolute zero. Na^{+}-ions belong to the electro-dynamic system of energy and will interact with light. These positive ions will remove most of the energy of the light.

Correspondingly, the emission of protons can take place when energy is removed by a lower emission of photons.

Light lost at redshift should be found as a dispersed low-energy radiation, *e.g.* the 2·7 K radiation now ascribed to Big Bang.

Choosing between the two, the odds are for the redshift loss of low-potential light as the source of background radiation. This loss of low-energy radiation is not a possibility, but a known loss.

It does not disprove Big Bang (whose energy source is unknown); but points to a function of our time, and more probable. Correctly calibrated, it should correct the understanding of size and rate of dilatation of the universe.

The earlier proposed mechanism of redshift is the Doppler-Fizeau effect, which presumes an interaction between matter and light, in the direction from matter to light. This is not a possible interaction between the energy systems.

The background radiation at 2·7 K is compatible with the loss of potential from the weakest part of stellar radiation. Its strongest parts should be the visible, diffuse and redshifted light without a precise source.

Bodies are conserved and time is defined up to the velocity of transition from static charges to the electro-dynamic potential. The transition begins at *c.* eight *per cent* of the velocity of light.

The possibility of measuring the velocity of light does not imply that time will exist at that velocity. The velocity c is measured from the outside; but it will not be measurable from light itself.

9. LIFE.

Life is made of inorganic physics, which also appears as organic chemistry.

Life has its root in physics. This is seen where their functions share principles. It is possible to spot a connection when the connecting function of physics is known.

One of the functions is the bond to the magnetism of the world. It takes place through water, whose monomer is held together by two solenoids, H:O:H, thus in two magnetic bonds. These will react to the magnetic field of the Earth, keeping the water molecule in a permanent direction in the field. This magnetic field's constituent is water.

The function of our neurons is a nano-function of magnetic properties of water and single atoms, apparently pre-life, in canals between protein molecules. This function could be older than the formation of the multi-cellular animals, formed in the cool, calcium-rich sea around 550 My ago.

The sparse presence of continental drift before that time can be deduced from the low mineralization of life.

The Cambrian explosion of multicellular life took place in the sea when the new sea bottom volcanoes had filled the sea with calcium as carbonate, sulphate, and phosphate, in this succession, seen from the chemistry of fossils. It is followed by their rising complexity: mussels, crabs, and skeletal animals.

Beside their external or internal frame of minerals, the animals are distinguished by different kinds of metabolism.

The most important is that their calcium gave them a higher metabolism and a multicellular structure which, in turn, demanded an internal communication system of blood and nerves.

The molecular bonds of the water monomer are strong. Since they belong to the magnetic system of energy, they do not participate in chemistry. Water participates by its ions.

In the water ion, the inter-monomeric hydrogen-bond (H-bond) holds the ionic part H^+ or HO^- to the main part of the molecule. The water ions are extremely versatile and will carry nearly everything.

Life started as composites of simple and energy-rich molecules formed in the hot, wet, oxygen-free, and stinking atmosphere of the early Earth.

They were water, dihydrogen sulphide, methane, and ammonia. These are the trestles of life's structural and functional molecules.

We taste the three last of them as proteins, carbohydrates, and fats. Water's ions perform the bonding and communication. Seventy *per cent* of a grown-up human consists of water.

Water's molecules have a high magnetic susceptibility; and their bonds seem to be best understood as solenoids of a small number of atoms.

They could have brought an intense use of magnetism into the central molecules of life.

They explain life's susceptibility to magnetic fields and its water-dependency.

A push to a more intense physico-chemical activity of matter could have come from the water in the core of the Earth and its magnetism in the sea which was the only habitat of the mono-cellular animals and their descendants, the mono-cellular plants.

Magnetism follows water. It will have given a greater metabolic force to the molecules united by covalent bonds, which, looked at closely, are solenoids.

The solenoid bonds of life's central molecules (*cf.* the right hand rule) place life into the continuity of Earth's inorganic functions. Our neural function is inorganic. It can be seen as a part of the earthly frame of life.

Water and magnetism point to the connection between earthquakes, disturbed magnetic fields, and animals' sensitivity to earthquakes.

At an unknown number of hundreds of million years before the long Precambrian glacial period, some small, multicellular animals appeared, in addition to the mono-cellular bacteria and algae.

Our nerves work by means of an electro-dynamic function comprising one polymer of water and one metal atom. They are combined into one ion, which seems to have a permanent orientation. This direction will be due to the magnetic field of the Earth.

The ion is lifted out through the nerve membrane and back. The propagation of this movement of charges is the nerve signal. The energy for its production is believed to be delivered by protein bodies in the membrane.

It seems probable that a living being should depend upon the magnetic field of the Earth for the function of each of its cells, and especially for the nerve function.

Mono-cellular animals have room for a great number of functions within their diameter of a few micrometres.

Water pervades all functions of life and keeps an orientation relative to Earth's magnetic field.

The vital functions depend upon the size of the local magnetic field and its stability. Neural and metabolic functions are impaired in strong and variable magnetic fields, like the microwave oven. We probably need the strength of the unimpaired magnetic field of Earth.

We do not know the consequences of this constraint; nor do we know whether the magnetic fields produced by technical electricity will surpass the tolerance of our functions.

One possibility of useful coincidence exists. It has been discovered that some motors work better and need less fuel when this has run through tubes in magnetic fields. It is presumed that the magnets will coordinate the stream of fuel and its burning.

We can extrapolate this and guess that we will thrive in a homogeneous magnetic field of a minimum strength.

Changes of quantitative relations between the polymers of water produce changes of its energy functions. Organic reactions need different energies at different temperatures. This could be due to the polymer composition of the water involved and its different forces.

Alcohol changes the relation between the polymers. Energy is needed for the cleaving of water polymers, thus the lowered temperature at mixing alcohol and water will be a sign of the division of polymers and the forming of dimer water.

The presence of ethanol requires more energy for hydrolysis, presumably because a part of the polymers is broken down to dimers, which seem to be less cooperative, but stronger than trimers and tetramers, and physiologically dominant above 42 ºC.

Hydrolysis of a composite of nitro-benzaldehyde shows minima of energy at *c.* 22 and 37 ºC. Water's high frequency permittivity falls 20 *per cent* between 35 and 40 ºC. Enzymes show abrupt changes of energy uptake at differences of temperature, probably because of changes of water structure.[34]

Our chemistry has its lowest energy cost at 37 ºC. Hydrolysis is a main function of our metabolism. Added energy efficiency should follow the sinking high frequency permittivity of water, which should be a part of a rise in its magnetic susceptibility.

This implies a higher production of energy from the magnetic field of the Earth and other fields. The result could be a greater energy production, from the same amount of food, when the body temperature is raised to 40 ºC.

Magnetic induction also takes place on a nano level in neurons and synapses. The changes of transport of ions through the axon membrane take place during microseconds, thus MHz is the relevant scale of measurement.

Induction could also be a part of hydrolysis and synthesis, pointing to the reactions between the four elementary chemicals, *cf.* above.

The life of the late Precambrian was primitive; and it would have been so even in the eyes of a Cambrian scientist. Graptoliths are small, nearly triangular, flat bodies, a few millimetres long, linked by a thin thread.

The Cambrian period started as the opening of volcanoes in the sea bottom when the old megacontinent was broken up. Great amounts of lava were released from the sea-bottom volcanoes; and this lava changed life and its conditions. The long ice period ended; and the sea had its content of minerals extended.

Bacteria and small, wormlike animals were developed in the hot sea hundreds of million years earlier; and they had survived the long glacial period in the hot ocean springs.

The main form of life was bacteria, whose descendants make life difficult for us. Their origin in hot, mainly dimer water is not forgotten, so they thrive with our fever. They could even have the power of cleaving the water polymers, which would explain deadly fever at 42 ºC by removal of the cool water's tetramers, upon which our nerve function depends.

Some of them still live in hot springs of volcanic regions. *Pyrolobus fumarii* lives in oceanic fumaroles at 110 ºC. They point to the origin of life closer to the origin of the Earth than imagined from the earthly temperatures of post-Cambrian times.

It also points to the condensation of organic compounds as combinations of substance no longer present. The enigma of early life will be a combination of conditions not imagined.

The new calcium minerals were part of the reason for the new forms of life, and for their size, several hundred times their forerunners.

A possible help could have come from a change of magnetic effect in the sea. The metal content of the sea was augmented, mainly by calcium, but probably also by potassium and sodium. The new calcium salts fill the shells of Mollusca, the carapaces of Arthropoda and the bones of Vertebrata; containing carbonate, sulphate, and phosphate, respectively.

The new flow of magnetic materials in the late Precambrian, in combination with water, probably made the use of magnetism a general part of metabolism, not of the single cell only.

The transmission of potentials within each individual can explain the great and complex activity of cells and the great differentiation of functions in mono-cellular life. Each cell has its digestion as well as a differentiated metabolism.

In our multicellular bodies, digestion is cell-extern; and cells have specialized functions. Hormones, blood, and nerves provide an intense communication within the body.

A general teaching of evolution is that it was forced upon life by changes for which it was not prepared. Each of them lifted life to a higher level of complexity on the basis of potentials not earlier disclosed. None of them was planned or asked for, nor was the continuation of an existing line. Instances of this are the three lines of calcium-developed animals, represented by Mollusca, Arthropoda, and Vertebrata.

This will not last for ever; and we shall never know the end of our consciousness. A warning exists in the continuous development of existing properties, *e.g.* by heritage, leading to extinction.

The magnetic bonds of the water monomer will let the tri- and tetramers of water molecules and -ions take the upper hand over the dimers below a certain temperature. This could be 42 ºC, since this is the temperature above which the vital functions of mammals will collapse today.

This fact concerns the mainstream of life after the Cambrian, which is extremely complicated, compared to the hot-water life of one thousand million years ago.

This implies that the dissolving capacity of the dimers of hot water was replaced around 550 My B.P. by the new minerals' property of permitting great molecules and providing potentials for their permanence and interaction. The greater water molecules support the formation of complex animal tissue, which was not present in the Precambrian hot-water fauna.

One main condition of this is the differentiation of water ions at temperatures below 42 ºC. The next condition is the constraint and potential of the magnetic bonds between molecules of water and the few compounds which have become the pivot of life. Beside water, they are methane, CH_4, dihydrogen sulphide, H_2S, and trihydrogen nitride, ammonia, NH_3. They make the framework of sugars, fats, and proteins.

The high-temperature worms and bacteria of hot springs and ocean bottom springs are still living under the Precambrian conditions. They are characterized by the hot water life's soft tissue, and they do not have the complex matter produced at lower ambient potentials. This is seen in their low biochemical and physiological differentiation.

As is seen from the relation between bacteria and mammals in fever, the limit of mortality is 42 ºC, which was probably reached from above by a part of life around 600 My B.P. Outside the hot ocean springs, the main survivors from the Precambrian are bacteria; and they are fatal if the patients' high fever is not overcome.

The danger from fever could be not only the bacterial activity, but the presence of more than a small part of dimers in the water of the body. One property of dimers could be a specific advantage to the bacteria. Trimers and tetramers seem to be found in structures, while dimers are active in the dissolving of matter. It is even possible that the production of dimers is a part of the digestion of the hot-water bacteria.

The division of water polymers is also a product of an admixture with alcohol, *v.s.*, which reduces motorial and intellectual capacity. This shows that the function of mammalian nerves is not sustained by water consisting of more than a minimum of dimers. These therefore seem to be the cause of death at 42 ºC, *cf.* above.

This could open for the treatment of a high fever with infusions of cool water (30 ºC?) with a physiological salt content, 0·85 *per cent* NaCl. Combined with dialysis of the blood, or alone, body cooling to 32 ºC should be useful.

Animals and fish now living at temperatures below 42 ºC were developed at lower temperatures than were the small worms of the Precambrian sea. There seems to have been two conditions of their development during the Cambrian. They were the calcium salts in the sea and the greater proportion of trimers and tetramers of water at the lower temperatures.

The polymer water produced the condensation of biological matter below 42 ºC. This and the water's higher magnetic susceptibility gave life a long-term existence and a new complexity.

The possibilities must have been a shock to the animals exposed to them. We do not know the mechanisms by which they could survive while reforming their metabolism to living at temperatures 60-100 ºC lower than those to which they were adapted through more than one thousand million years; except a short life.

The calcium salts would have been the means of survival, useful as buffers in the metabolic production of energy. The high-temperature life should otherwise have been exposed to a paralysing lowering of metabolism.

Calcium will even play a role outside the bones today, by providing chemical buffers and maintaining nerves and metabolism at 37 ºC under the conditions to which we are adapted through the last 500 million years.

The necessary process of condensation of matter at transitions between conditions no longer existing could cast light on the need for helping substance in the production of organic matter in organisms.

Enzymes should be present at biological syntheses; but they are said not to participate in the reaction. This does not sound probable, as some participation will have to take place.

Condensation was the process between a high-pressure, hot gas, water, and a mixture of labile compounds. It could explain the need for enzymes. The residual matter would have been necessary in the process, though not brought into the end product at its condensation. That matter could be what we understand as enzymes.

This is consistent with our lack of enzymes for the breaking down of new organic matter in organisms. The new organic compounds, produced by genetic modification after 65 My B.P., do not seem to be metabolized, but to produce metabolic and neural disturbances.

These compounds are in the same class as the compounds, gluten and gliadine, of the grasses, with high contents of the amino acid glutamine. They are still new and alien to the metabolism of the animals feeding on grass, and to human metabolism, mostly fed by grain.

The staple food of most of humanity, our daily bread, is grain of the grass family (Poaceae). The metabolism of humans is the same as that of the first terrestrials more than 300 million years ago; and this metabolism had been developed by the third Cambrian group of animals, Vertebrata.

Humans and grass-feeding animals are victims to the proteins of the new grass family, produced by the toxic presence of iridium, element Nº 77, from the meteorite of 65 My B.P. The problem is not only that the new compounds are not metabolized, but that their presence is toxic, *i.e.* a profound disturbance of metabolic and neural processes, *cf.* ref. 29.

Their metabolism will depend upon specific enzymes, which we cannot produce. Those we have were made for the metabolism of the food prevailing in the period from the Cambrian until 65 My B.P.

Magnetism is the mechanism of our nerves. The function of our axons consists in leading neural signals; and these consist in water ions, each with an adsorbed atom of sodium or potassium. They move from the inside of the axon membrane to the outside and back. Each of them is linked to a polymer ion of water, which is a trimer or a tetramer. The membrane has 10^{11} passages *per* mm^2. The ions pass out through the fat axon membrane and back to its inner side.

The magnetic field produced by the moving ion is transmitted to the next ion and constitutes the nerve signal.

The energy for their movement is produced by protein bodies in the membrane.

The magnetic field of the Earth was probably not consolidated until a central body, a core, was formed from magnetic matter. Water's magnetic role was a possibility as soon as the sea existed. The water in the crust was discovered in the deep hole bored at The Kola Peninsula.

Consolidating an atmosphere of vapour into a magnetic field has a low probability. The magnetic field of the sea is probable; as are the magnetic fields of water streams in soil and in the fissures of a mountain.

The presence of water in the deep parts of the Earth makes possible that the Earth should have been condensed from a cloud consisting of water and molecules of minerals. A surplus of heavy minerals is thought to exist in its deeper layers.

The three atoms of the monomer of water are held together on a straight line by two magnetic bonds, each produced by the solenoid in each of the two bonds between the three atoms of H:O:H. These three atoms are coordinated by their solenoid bonds, which are magnetic.

A similar function within the hot mineral core of the Earth, will be the fields of water summed into the magnetic field of the Earth, *cf.* water's probable lacking of a Curie point, *v.s.*

The strength of magnetism in the bonds of the straight water molecule could be higher than in the bonds of the monomers angled by the H-bond to the next monomer, *cf.* ref. 34.

The combination of energy produced by proteins and its use within a magnetic field was possible since magnetism had permeated the sea and the water of all cells. The solenoid magnetic fields of water could have played a part in this organizing before the first organic molecules.

The high temperature of the sea would have limited the effect of the magnetic field on living organisms. This was due to the lower magnetic susceptibility of the hot-water ions.

Later, the lower temperature made possible an intra-cell and inter-cell communication not seen in earlier life. The Precambrian cold interlude of several hundred million years made it, though, for a long time impossible for life to exploit the possibilities of magnetism, since the physiology of life could not develop a great biochemical differentiation.

We may suppose that water below 42 ºC can better exploit the capacity of magnetism relative to the functions of life. This is seen in the complexity of metabolism in each cell of mono-cellular life.

Life began as the organized use of the magnetic potential in the primordial mass of small molecules at temperatures above 42 ºC, even approaching 140 ºC, *cf.* the dissolution of proteins.

This stage of organization was remade through the near-destruction of life during the long glacial period and given a new and unpredictable direction after *c.* 600 My B.P.

The greater magnetic forces of the tri- and tetramers of water were decisive for the forms of life at its transition from 140 ºC to below 40 ºC.

The proliferation of the new life forms during the Cambrian would have depended upon a far higher magnetic susceptibility of the cool water than that of the warm water.

This combination of water properties and neurons could have been decisive for the complexity and function of our nerves.

At the same time, the physical conditions of chemistry were extended by the new quantity of metallic ions, of which calcium was the most spectacular. Its activity at the volcanic outbreaks poured into the sea the new salts of biology: carbonate, sulphate, and phosphate.

The temperature of the hot life is deduced from the separation of amino acids in proteins at 140 ºC and 360 kPa, which once would have been the conditions of their condensation.

The form and degree of autonomous development through the generations is not clear, Darwin notwithstanding. Adaptation will have demanded greater biological changes than those included in the anatomical and physiological perspective of an age, hence the many ways of evolution.

The Cambrian was a forced development mostly in conflict with the conditions to which life was adapted during the long glacial period.

Because of the limited volcanism after the formation of the ocean bottom, the salts had been well hidden. This is shown by the low mineralization and soft bodies of the hot-water relict fauna of today's hot springs of ocean bottom and of volcanic regions.

The sudden biological significance of the three calcium salts, seen in the fossils, should indicate that the continental separation did not exist before 600 My B.P.

Three episodes of volcanism released calcium carbonate, calcium sulphate, and calcium phosphate, respectively. Their sequence is known from that of their fossils. Main groups are, in succession, Mollusca, Arthropoda, and Vertebrata.

The detailed role of magnetism in life's development is not clear, though the upwelling lava would have augmented the magnetic activity of the sea bottom, and perhaps also the magnetic susceptibility of the sea water.

Since the water monomer is held together by two magnetic bonds, it is probable that water and its magnetism played a part in the evolution of the new metabolism and the new body structures.

The three calcium salts could have had different biological effects due to their possible particular magnetic properties. This should be traceable in the physiology or the neural system of the three groups.

The role of water in the magnetic field of the Precambrian Earth is not clear. Was the polarity of the magnetic field of the Earth changing before 600 My B.P.? After that time it should have changed 800 times, if its periodicity was the same as that of more recent periods.

It would not be strange if a connection should be discovered between ions in water, whose monomers are magnetically bonded, and the magnetic effect of light. Water's principal role in the magnetic field of the Earth seems probable, *v.s.*, though its rapid changes of direction are unexplained.

A variation of magnetic fields could be a sufficient reason for the fluctuations of non-equilibrium thermodynamics observed by Lars Onsager (Nobel prize 1968) and Ilya Prigogine (Nobel prize 1977).

The role of water is pervading chemistry; and it should be seen as probable that small variations within a semi-permanent condition should have been released by a variable addition of unregistered energy produced by magnetic potential differences of water.

The enigmatic part of the condition consists in the not imagined possibility of a mechanism producing the variations.

Even another internal mechanism of water is possible, as the transition from one proportion of tetramers or trimers to another can take place at small differences of temperature, *e.g.* from evening to morning in the laboratory. Any transition will presuppose an uptake or liberation of energy.

Another moment of principle concerning description is that the thermodynamic models are imagined and understood as sufficient descriptions, analogously to gravity seen until recently as an autonomous force of Nature, and thus as an exclusive and prevailing force. Thermodynamics is, though, not autonomous, but a system of phenomena.

The problem following what is believed to be autonomous is that nobody will feel allowed to imagine any connection between its function and other functions. But though the potentials of substance are autonomous, no force concerning matter should be seen as autonomous. As the interaction possibilities are not infinite, there is a rational hope of finding the connecting functions. These are not phenomena, but primary functions of physics.

Black holes are imagined on the condition that gravity should be autonomous and, though weak, dominant relative to other forces. This presupposes that gravity should be independent of other physical functions; and excluding them. This is also part of the misunderstanding of the deviation of a star position in 1919, and of the belief in the possibility of influence of mechanics on light.

Gravity is, though, a function of static charges and does not influence light or other electromagnetic forces. As gravity does not override light or magnetism, the deviation of light should be understood as a magnetic interaction.

The empirical tradition of seeing functions or autonomous production of phenomena in every other observation is a heritage from the time of shamans. It is a lack of adaptation to reality in our perception.

Thermodynamics is an instance of this. Its realm of physics is taken at face value, as its measurements are taken as the sufficient insight into its nature, though they are phenomenological.

Life uses energy in its project of negative entropy. Life is produced by light's intervention, aided by other magnetism, in the physics of matter; and life is the carrier of negative entropy. As long as life conserves its functions and is fed by sunshine and water, it can defend a place against the entropic dispersion of energy.

Life is the interplay between specific physical functions and their domains, *cf.* the systems of energy, above. Their relations are the physics of light, water, and matter.

Matter has a variable capacity of taking up energy and conserving it. Life uses matter, which has the capacity of reacting quickly upon light, heat, and other photonic radiation. Sunshine is the energy transmission maintaining the negative entropy of life.

Water's role in life is, to a great extent, based on the opposite quality to that characterizing its principal form. There is no monomer water ion. The water monomer's two solenoid bonds H:O:H belong to the electromagnetic system of energy, together with light. These properties produce the physical properties and fundamentals of life.

Water's participation in chemistry depends upon its great capacity of ionizing, and upon the properties of its ions.

The two ionic parts, –H^+ and –HO^-, are bonded to the rest of the polymer by the hydrogen-bond, which is not electro-magnetic, but a weak bond.

This bond liberates the ionic part of the water polymer ion from the magnetic bond of the main part of the molecule.

This change of connection is the condition of water's ions' cooperation with nearly all kinds of molecules and ions.

The ions are water's connection to common chemistry; and they are its *passe-partout*, letting it carry nearly everything.

In our multicellular bodies and in our food, the two dimer ions should not be present in more than small proportions. After the hot-water period, our physiology was forcibly adapted to the tri- and tetramers of cooler water, *v.s.* These polymers will have lower external potentials than the dimers.

Consequences of this condition are the development of the human brain and the collapse of neural function and sudden death at a fever of 42 ºC, probably due to the too high proportion of dimers in the body water and the higher potential of the dimer of water.

Water can then no longer perform the carrying function in the transport of a metal-containing ion in the neural communication.

The higher potential of the dimer seems to impede the release of the metal atom after its passage through the neural membrane.

The loss of body heat at alcohol intoxication is most probably due to the same cause, which is the higher proportion of dimer ions in the body water. The final death in this condition is characterized by the loss of neural function.

Possible structure of a dimer cation, hydronium, $(H_5O_2)^+$ and a dimer anion, hydroxyl, $(H_3O_2)^-$:

Dimeric hydronium:

```
H       H
  O – H  O
H        \
          H+
```

Dimeric hydroxyl:

```
H
  O – H O-
H
```

The possible structure of the tetramer ions, hydronium, $(H_9O_4)^+$, and hydroxyl, (H_7O_4)- .
The proposed structure of the trimers will be the same, minus the first monomer to the left.

Tetrameric hydronium:

```
H       H
  O – H O        .
H       \
         H       H
           O – H O
         H       \
                  H+
```

Tetrameric hydroxyl:

```
H       H
   O – H  O
 H        \
           H
             O – H O-
           H
```

Dimers belong to the dissolving part of animal life. This part consists of the survivors of the Precambrian hot-water life, who still thrive above 42 ºC, when they have inflicted a deadly fever upon us.

Our lives depend upon the permanence and structure of the tetramers and trimers of water.

10. CLIMATE and HEALTH.

If we continue regarding the tropical forests as disposable ornaments to Earth, we shall be lost on a cold globe.

For the Earth, there was a transition 65 M years ago. The dinosaurs died out; and the 70 M years' period of the Cretaceous came to an end. It had been a green and fertile period. The climate had been damp and warm; and it had favoured the development of great reptiles. These, except the crocodiles, died out.

The good climate had been sustained by a high circulation of water and calcium in plants and animals. The chemical possibilities of calcium relative to life are much greater than those of acid-forming elements.

Thus, the total vitality of the living was greater before this cosmic accident than after. This was perhaps the most important factor of the higher circulation of energy before 65 My B.P.

Seen on the background of what has been conserved in human physiology, the pH of the environment must have been at least 7·4. Reminiscences of the marine microlife of the Cretaceous are chalk sediments of several hundred metre's depth. The white cliffs of Dover are a specimen of them.

The mammals had been developed, possibly as small varieties of reptiles, around 200 My B.P.

Walter Alvarez discovered a layer of reddish clay in Italy. It was the division line between the Cretaceous and the Tertiary. The layer was found all over the Earth; and the analyses showed it to contain relatively much iridium. [64]

This, element N° 77, is otherwise very rare on Earth. It belongs to the platinum group and is the second heaviest element; with a relative density of 22·42. It is believed that it sank to the core of the Earth early in its history. It was agreed that the iridium found in the clay had an extra-terrestrial origin. A crater of corresponding age was already known, situated at the northern coast of Yucatán. The days and years after the meteorite fall must have been dark and cold.

Iridium makes up a very small part of the Earth's crust, *c.* 10^{-9}. Much of it is found in the two inches clay layer between the Cretaceous and the Tertiary, which contains 6 g m^{-3}.

The chemical properties of iridium are much like those of element N° 80, mercury. Both of them will change the genes of the plants and animals which they invade.

An unknown number of species was extinct, among them the great reptiles, except the crocodiles. These could stay in the water, since their nostrils sit on the top of the snout.

As they are ectothermal, they do not need to breathe much as long as they do not move. They could avoid inhaling most of the sharp and poisonous mineral dust which had killed the other big animals. The crocodiles could live from fish and carcasses. Though they are the only group of surviving big reptiles, there is no enigma in their survival.

The mammals were small and mostly huddled in the trees, living from insects, fruits, and leaves. Some of them found insects and earth worms by digging.

The dust from the meteorite fall was breathed for years. The dust must have been a poison source for plants for thousands of years. For insects, animals and humans, the plants are still a source of poisons.

The changes of heredity are destructive. The first grasses grew some time, perhaps a few million years, after the meteorite fall. They were supposedly derived from the lily order (Liliales).

They conquered a cool world; and they are better adapted to cold climates than most other plants.

Their gene modification was not delivered on order; but we may suppose that it delivered plants which could support the new cold.

Their properties are also a defence against a change to a warmer climate.
The new families of grass (Poaceae), rush (Juncaceae), and sedge (Cyperaceae) do not use energy for permanent stems, which could be lost in a frosty night. They do not even produce summer stems, but let their leaves and flower stalks sprout from the top of the root.

Their thin leaves and flower stalks are carried by a relatively high content of cellulose. Bamboo (genus *Bambusa*) is special. Its stalks are semi-permanent and die after flowering.
The ectothermal reptiles of the Cretaceous had been integrated in an energy distribution and buffer function in common with the plants.
Reptiles need two to three *per cent* of the food energy needed by mammals of the same size.[70]
The extinct browsers had had the advantage of size, which made them need less food, as their great bodies could conserve their temperature with less variation. Even better than the present reptiles, they could rely upon the energy taken from the local climate, of which they were a part.
The new grasses were easily reached, so they favoured small plant eaters, which grew from the size of small dogs. The new climate was the great occasion for the further development of the endothermal animals, the mammals.
The grass eating, the small mass of the meagre grass, small flowers, small seed, and above all, its physiological adaptation to cool and cold climates, gave the grass family its great advantage. Furthermore, it spreads its seed with the faeces of the grazing animals.
The grasses offered a meagre food compared to the calcium-rich lignoses of the warm period, thus the new plant eaters, developed after 60 My B.P., use most of their time for eating, and many of them use much time for ruminating. By the help of bacteria, they are adapted to the low energy content of the food and its high content of cellulose, which is impervious to their own digestion.
The number of grazing species exploded with the spread of the grasses. These are also augmenting as they have taken over more woodland after its clearing. The first clearings came with fires and the shock of sinking temperature during the long and dark dust-fall. Temperature is kept low by the small plant mass and the low water content of the grass.
Though the grass eaters and their predators developed into great animals, like elephants and tigers, they are small compared to the extinct browsers, like *Brontosaurus*, and their predators, like *Tyrannosaurus*.
The development of new plants and animals after the catastrophe is one instance of the development of heredity after an offer that cannot be refused. A colder climate and a thoroughgoing new chemical environment forced animals to adapt to new externals, like feeding on new plants.
The fundamental conditions of animals' biochemistry and neurochemistry were not changed, in spite of the new chemistry of the still new food plants. Not only the plant eaters, but their predators, and we humans, are obliged to take our food from that offered; and our criteria for quality assessment have become deficient relative to the chemistry of our metabolism.
Therefore we eat the food offered; and we shall never be able to produce our own gene modification so as to be able to metabolize the new chemicals produced by the plants that are still new to life, 60 million years after life was urged to produce a new metabolism for its new food. It was in vain; and we are less capable of tackling the new climate with our old heredity.
Instead of repairing the symptoms of our deficient health without knowing precisely what produces food diseases, gene-modifying plants will be more efficient, making them produce proteins adapted to our metabolism.
There would have been an advantage to plants and climate when the browsers were reptiles and consumed a few *per cent* of the quantity of food needed by mammals, *cf.* ref. 70.
This would have taken place within the frame of social restrictions among the animals, as the density of each species would have been regulated by the reciprocal tolerance of its members, not by the food production capacity of their habitat.
The outcome would have been that reptiles would have consumed less plant mass relative to their social density, thus that the reptiles would have added to the climate conservation.
In our time, we see that a series of mammals have reached concentrations consuming more food than the plant production capacity of their habitat.
The world of reptiles presumes a warm climate, since reptiles will need a certain minimum temperature. The effect will be that reptiles will add to the production of plants and conservation of climate. The plants will be better used relative to the climate produced by plants and animals combined.
The part of the outcome relevant to our time is that mammals, man included, need a higher

energy circulation in the plants of their habitat than do reptiles, while the habits of food production of humans and their social and economic activity are destructive for the plant production capacity—and for the climate.
The great reptiles had a relation between body volume and surface indicating that their heat conservation was as good as that of warm-blooded animals. In the tropics and probably to latitudes *c.* 35° they would have had a positive effect on the climate.
Reptiles are apt to conserve or ameliorate a good climate, while mammals will easily graze down a meagre habitat and add to its loss of energy and climate conservation capacity, *cf.* the savannah, the lost woods, and the deserts now covering former cultivated land
Modern man takes most of his food from the grass family. The main part of our food consists of seed; and most of the rest consists of the meat of grass eaters.
The grasses produce seed after a minimum investment in plant mass; and this lets them live through short and cool summers. They can grow in relatively dry and meagre soils. Their gene modification from iridium has produced new proteins and at least one new amino acid, glutamine. Its composites are not soluble in water, but in alcohol-mixed water only.
If an amino acid with this property, or something similar, were produced a few hundred million years earlier, we should never have seen its traces, since its users would have been extinct. Today we see pervading dysfunctions. We cannot measure inflictions on grass eaters like earth worms (Vermes) and the ruminants.
Among humans, we have hardly anybody to whom we can refer as a background and a contrast to our inflictions from the new food, except the find in New Guinea of a people without grain or schizophrenics.[69]

Our problem today is that our metabolism was made, more than 500 M years ago, as a fundamental function of the vertebrates, on other conditions than those of the time of human evolution, which took place after the new plants had changed the conditions of the mammals.
The gene-modification of the grasses has produced glutamine, which is present as more than thirty *per cent* of the number of amino acids in gliadine, a common protein in wheat. Glutamine will form polymers by bonds between aldehydes.

Glutamine can also form permanent bonds with other amino acids and with whole proteins.
An un-dissoluble compound of amino acids is gluten, which lets wheat dough stick well together.
The cell's metabolism has to accept its food as it is served by the blood from the extra-cellular digestion. Through the lack of adequate enzymes, the protein polymers are not broken down, but hamper the blood and cell functions; and some of them are deposited in the blood vessels or in the brain, *cf.* ref. 29.
In principle, these colloids should not have entered the brain. They should have been dissoluble in water and kept out of the brain, whose barrier is one of fat. Alzheimer's disease is one of many showing that our food is no longer that to which our metabolism was made.
A permanent bond including oxygen, the bond between aldehydes, is one way of tanning leather, which is a polymer of proteins. The tanning consists in the permanent removal of proteins from their participation in the metabolism of microbes, or of the body. This can take place by the introduction of aldehydes.
Our bodily turnover of matter, metabolism, presumes the dissolution of proteins to single amino acids. These are used for the building of new tissues, enzymes, and hormones.

The functional changes in brain, nerves, and personality are clinically defined only. They are seen together with a diet of grain and milk products; and they can be ascribed to the adhesive and neutralizing effect of partly dissolved proteins upon nerves.[29]
Alois Alzheimer saw the protein plaque in the brain of a dead sufferer of dementia.[65]
The dissolution of glutamine-composites in alcohol indicates that the tanning, the prevention of the organic function of proteins, will be postponed by alcohol, *cf.* ref. 29. This explains the cultural affinity to alcohol in human societies. Its downside is its effect upon the neural functions, *cf.* above.
No grass eaters, nor their predators, have developed enzymes for the metabolism of gluten, which has a high content of glutamine. Not even mushrooms living on cow dung *(e.g. Psilocybe)*, can metabolize the poisonous residua of the grass. Because of the residua this mushroom has been used as a psychedelic drug..
The baking properties of gluten have been the reasons for developing new varieties of wheat,

richer in gluten. Health has not been a part of the consideration.
Most of the food for humans is produced from the seed of the grass family. Among them, maize *(Zéa mays)* and rice *(Oryza sativa)* are without gluten, though, apparently not without other un-metabolizable proteins.
Through more than fifty million years no animal has been able to let its genes meet the challenge from the change of menu by producing new genes for the adequate use of the new proteins in their metabolism. It seems that new enzymes are not made on order.
Some animals have discovered this. Bear *(Ursus arctos)*, some of the dogs (family Canidae), the spotted hyaena *(Crocuta crocuta)*, and wolverene *(Gulo gulo)* bury food for later use. They do not seem to do this for storing, but in order to make the food better for their metabolism. These animals are strong and persistent. They can run for hours, in contrast to lions *(Panthera leo)*, which are eaters of fresh meat and are easily exhausted.
The humans had learnt this long before they invented agriculture. During the last two centuries purity and absence of smell have become ideals of civilization. It was forgotten that food conservation did not mean the conservation of an apparent freshness. It was forgotten that conservation should be a preparation of the food for our deficient digestion as well as keeping its edibility.
The first process taking place in dead animal tissue is the autolysis, the activity of enzymes resting in the living tissue and starting their activity in each cell after the moment of death.
It seems that no meat-eating mammal has the enzymes needed for digesting un-autolysed meat. This could be taken as an instance and a proof of the lack of compatibility between the primary food source, Poaceae, the grass family, and the metabolism of the grazing animals and that of their predators.
Reptiles secrete their un-metabolized food residua in their saliva or from specialized poison glands. Seen on the background of new properties of the food, this could indicate that reptiles did not develop all their poisons until the meteorite had changed the quality of the plant diet and thus the diet of the predators.
Life's choice of a dominant and stable DNA is given priority ahead of life's adaptation to new conditions. The lack of genetic development is the downside of a strict heredity. Paleobiology shows the dying out of species, followed by a new development from more primitive species.

Ice and warming.

The first glaciation of a recent geological period took place 37 My B.P. During the last few million years a series of glacial periods have shown that the Earth has lost its warmth.
"During the Tertiary there was a significant lowering of the mean temperature. At the transition to the Quaternary there was a catastrophic worsening of the climate." [66]
The variations of climate are understood today as an autonomous system of changes happening by themselves, as an imperturbable system of one hundred thousand years glacial period and ten thousand years of livable conditions.
Why should we then be afraid of global warming? The way climate is understood today, it would be nice to have longer summers. From the way the apparent global warming has been received, the change itself seems to be a threat.
What is the connection between a series of glacial periods and our time? Are there similarities? Will the next glaciation come all by itself, since we have these changing periods? Has there been any signal? Did we overlook an important indication? Why did we not have any glacial period through thirty million years?
As far as is known, the Cretaceous passed without glaciations; and the first of the Tertiary came 37 million years ago.
Is there a connection between climate and functions of energy? Cold and heat are external phenomena of energy functions.
The late Professor Skjeseth pointed to the temperature lowering from the Tertiary to the Quaternary.[66] Should it be possible to find the functions behind the global loss of energy?
Do we know with a degree of certainty that the rise of temperature which is commonly expected and feared will be worse than the cooling of the Earth which was accelerated a few million years ago?
Does nobody think that it would be better for the Earth and its inhabitants that the Earth should become a little warmer instead of much colder?
On the other hand it is possible that there is a connection between global warming and a glacial period. What kind of connection will that be? At the moment, it seems that a further warming will push us into a glacial period.

What signs ought we to have seen? Do the temperature changes provide sufficient information?
Is the sum of weather observations a sufficient description of the climate?
If yes, do they lead to the best recipe for political, economic or technical action?
If no, what is wrong, what is lacking? Is it something in the perception of what passes, or is it something in our understanding?
Before answering, we should question our understanding and will. Do we know the relevant facts? Have we discovered the functions into which we shall have to intervene?

Do we know what changes we want to introduce? Do we know how to obtain them? Do we know our goals? Are we willing to pay the cost? Do we know whether the heating we believe to be observed will heat the Earth, or cool it?

Climate is not a product of the weather. Climate is not a sum of the weather. We cannot influence the climate through the weather. Weather is not a sufficient description of the climate. Weather is a part of the climate.

What happens in the weather without being a part of the climate? Nothing. The rain is the same part of the weather in the Amazonas as it is on a European west coast. It is not the same part of the climate.

If we suppose that the climate should be sufficiently well described by the variables of the weather, what is then climate? If it is not, how should it be defined, described, and understood?

On the other hand: is there anything in climate not understood by and through the collected information about the weather and its variations across the globe?

If we should mean that climate were sufficiently well described by the variables of the weather, what is then climate? Is climate understood through the existing information?

The weather is not its own product. The weather is not autonomous. Weather is the local product of a number of physical conditions which for a great deal comprise air and water.

We should understand climate and weather as physical functions. They should be described as products of energy functions. One important part of this is that life is a part of the energy circulation of climate. In most parts of the world, plant life, animal life, and water circulate the greater part of energy.

Warmer or colder?

If we want to relate to the world, or influence it, we shall have to know its specific relations, their properties and functions. This is necessary as well for understanding what takes place as for obtaining what we want.

When a possible heating of the Earth is regarded as a threat, it seems to be a fear of a possible change of our conditions as we believe to know them. At the same time, the belief in a warming climate is an armoured door in our knowledge, a strong defence against the belief that the common knowledge could be wrong. It is also an excuse for not looking after what really takes place, its conditions and consequences.

It is decisive for our understanding whether we collect information or build insight. Only insight can lead us to an efficient action.

The collected information about the weather of the globe is perhaps the largest body of information existing. It seems to be a near infinite quantity of numbers describing the components of weather through hundreds of years.

This quantity of numerical information seems to be taken as that necessary for understanding climate as it has been for as long as we can know.

Climate seems to be defined as that described by these numbers. The information contained in them seems to be taken as that necessary and sufficient for giving full insight into the climate. It also seems to be taken as the clue to action.

This quantity of data does not seem, though, to be organized in a model, *i.e.* set into a functional connection. It seems that the climate is seen as “the sum of the weather”. This does not raise any problem as long as a small region of the Earth is concerned. In that case, it includes the yearly variations of the weather.

Sahara is a region of high atmospheric pressure. The winds blow away from the North of Africa; and the air from the sea will not reach the northern part of the continent.

The high pressure is produced by the energy radiation from the arid soil, since there are nearly no plants or other water which could have conserved some energy overnight. The loss of energy from the ground cools the air, making it sink and producing winds in all directions away from the desert, (and from the ice of Greenland).

These winds are a drying and cooling mechanism also for the neighbouring desert.

Because of the lack of plants or other water, Sahara has no buffer capacity and is exposed to a continuous loss of energy.

A great number of regions on all continents are exposed to losses of energy by the same mechanism.

Sahara, with its eight M km^2, is the greatest single region of loss of energy. A series of other regions are deserts, some of them established as late as a few thousand years ago, by efforts of man.

Climate or weather ?

It seems that climate is understood as "the weather during the period for which we have meteorological data". The concept 'climate' thus seems to be defined as "the prevailing weather".

Meteorologists and oceanographers manage the information, decide what to include and how it is to be interpreted. Influence from the sun seems to be partly accepted, partly disputed.

The first leader of IPCC (1988) was Bert Bohlin, who was the leader of Sweden's Meteorological Institute.

Weather and climate seem to be understood as autonomous parts of what takes place on Earth. Since they are produced by energy working in the atmosphere and biosphere, that understanding is wrong.

At the moment (2010) it seems that the data are interpreted as indicating the heating of the Earth (perhaps), and urging an end to the heating of the atmosphere (maybe).

Will it be possible to find the necessary information in the wealth of data? For what purpose will it be needed? Will it be possible to find information sufficient for deciding an action? As long as we do not know what kind of action we need, how can the information lead us to the right action?

Temperature seems to be the most important among the variables considered. What can it let us understand? As the heating is losing its prominence, temperature is losing its authority.

A complex of functions is needed in order to establish a model of climate concordant with its ways of conserving and using energy.

It is a strange phenomenon of history that great cultures flourished in countries now too arid for cultivation. Food was not transported far. Many regions were fertile. Around 330 B.C., Alexander's mercenaries lived from the land, like most soldiers in more recent times. Farmers could defend their country by killing their animals, burying food for the next year, and burning down the houses.

Many presently arid lands are products of agriculture. The rain was sufficient for cultivation in historical times. Most of the land between Tajo and Indus was fertile. The Bronze Age was a warm period; and the Little Ice Age, *c.*1400-1850, was possibly not a product of human activity.

Most of the former "Fertile Crescent", the birth-place of agriculture, is now a desert.

The connection between precipitation and a wooded landscape was seen as natural by early authors, who deplored the loss of the woods and the rich soil, and who described the decline of agriculture, *cf.* Plato's dialogues.

That information does not seem to be a part of today's conception of climate. The fate of civilizations is often ascribed to "variations of climate"; and that is all. It seems that the problem of knowledge is regarded as solved when the phenomenon has been named.

Except in the rainy coastlands, the old experience is that removing the woods will also remove the rain. Afterwards, there is not much help in weather statistics.

The removal of tropical woods has reached Borneo and Brazil. The results, *e.g.* bare sands in the Amazonas, raise the questions of conditions, method, results, and interpretation. The healing of Nature's wounds should be the theme of new studies.

More important and difficult is to make it the new politics.

A general problem of description is that the visible and measurable phenomenon is taken as the sufficient information.

A specific problem is that professional insight is pushed aside by scientific, commercial, or political dominance of a theme. Should we see temperature as a sign of the climate, as a part of a function producing the climate, as a part of an unknown product of the climate, or as the climate itself?

From data to model.

Taking measurements as the significant and sufficient information about a theme leads us away from understanding the significant in what was measured.

Believing in measuring as the sufficient determining of the properties and their functions is an instance of the empirical fallacy, the belief in empirics as its own model, and as the significant description of the phenomena.

A model is a formulation of some connection and should communicate an understanding of it. It is important to know what has been measured, and what has not been measured.

The dominant need is a model of the connections and functions.

The hidden common denominator behind the meteorological data is energy, which points to necessary functions of the matter involved. The loss of energy to space makes Sahara a region of cold climate.

Not hidden are temperature, wind, and precipitation. What is the relation between them and the energy involved? Looking after its ways, we can find the energy distribution which produces the cooperation between the weather factors. This is the beginning of understanding the climate.

It is possible to presume that climate is not a collection of empirical data only, but some distributive function. Since the climate is not the same over the globe, we can ask what kind of function it can be. What is it that produces the differences of temperature, wind, and precipitation? Are all differences accidental, or are they systematic?

We may presume that differences are not autonomous, but products of something else than themselves. They have a connection to energy, its origin, its distribution, and its carriers.

The collected data do not point to distributive functions or to fundamental physical functions. The information is that some cold regions are getting warmer, some regions have got a more unruly weather; and the ice is melting in parts of the pole regions.

We may presume that climate should be a distributive function. It is possible to introduce functions into the mass of data. Energy is one of them; and we also find energy storing, transport, distribution, loss, and buffer.

Energetic potentials are seen in differences of temperature in air, sea, and rain, and their release is seen in the transmission of vapour from the tropical seas to rain and snow in temperate and cold regions.

Temperature is not a sufficient measure of climate. The temporary state of climate is one of distribution of energy. Weather, change of weather, and transmission of weather from one place to another are functions of energy; and they are performed by some quantity of matter and its capacity of storing energy.

The climate relations between energy, water, air, soil, and life can be described by buffer capacity. This is a sum of interactions between specific heat capacity, melting energy, temperature, vaporization energy, thermal changes of energy and volume in water and air, with its consequences for convection, currents, weather, and climate.

More specific is the buffer capacity of the vegetation of woodland and cultivated land in relation to the potentials of precipitation and local temperature.

It is possible to identify the physical conditions producing the spreading of desert in tropical and subtropical cultivated lands. These pre-climate functions are not understood as energy only.

One kilogram rain falling from a cloud signals 3 MJ energy transmitted to the air as the vapour was condensed and the cloud was formed.

The energy was received by the water as it was vaporized under the sunshine, somewhere closer to the equator. Clouds condensed up to latitude perhaps 35-40° return their energy of condensation and participate in the energy economy of the Earth.

Transmission of energy to regions further north or south takes place by wind, rain, snow, and sea currents. As long as there is no surplus from the tropics, it leads to a greater loss of energy from the Earth. The spreading of more than a minimum of energy to North and South is a luxury which the Earth could afford when the tropics had a surplus in their system of circulation and distribution of energy.

This surplus was lost through the disaster of 65 My ago.

A buffer is an intermediate store of energy. It can be effective for hours or for centuries. It works by retarding a transmission of energy. The buffer has a certain capacity. Water in plants keeps energy overnight, according to their surface and content of water. A wood is a milder place than a desert because of the buffer capacity of the water in twigs and leaves.

Climate depends upon the presence of water in the biosphere. This water is a part of soil, plants, animals, and insects. Plants depend upon insects and animals.

An indirect or phenomenological measure of this is obtained by measuring temperature through day and night. The functional measure is the quantity of potentials conserved from evening to morning. It is measurable as a number of joules held in the air, soil, and vegetation in a region.

The basis of the function will be the quantity of water in the plants, the air, the lakes, and the top layer of soil. The reason for this is that water's specific heat, which is its capacity of storing energy, is noticeable higher than that of, *e.g.*, the dry air, wood, or soil.

The energy of climate, and its loss.

It is not obvious that the energy of climate is different from that of space or dead planets. There does not seem to be any difference between the energy lost during the night from the Moon and the Earth. There is, though, a difference between the Moon's and the Earth's ways of retention of energy.

Rudolf Clausius (1822-1888) stated his first and second law of thermodynamics as "Die Energie der Welt ist konstant. Die Entropie der Welt strebt einem Maximum zu."

(„The energy of the world is permanent. The entropy of the world strives for a maximum.")

As far as they are known today, the conditions of these maxims do not support Clausius' intention. Stars re-circulate potentials of matter, redistributing their energy in the form of light, which has the un-entropic or negative-entropic property and consequence of feeding life.

Clausius did not know this.

Its implication is that the accessible energy of the world is not constant, as it is refilled by the activity of stars.

The potential of this activity is not known, though it could be estimated from the number of stars and their presumed residual age.

The stars have an unknown and great capacity of potentials not released today. This implies that the world's energy is not constant, nor released by the moment of reading these words.

The entropy of the world is not an actor in the energy display of the world. As it is a kind of account made up every day, we take it as the measure of energy lost by not being circulated, *e.g.* because of a low difference of temperature.

This is not quite correct, since significant parts of the matter and energy of the world are re-circulated as light from active stars and energy from dying stars.

The two systems of energy can clarify the relation between the Earth's loss of energy as entropy and its use of solar energy in the conservation of its climate.

The potential exposed to being lost as entropy will require water and vegetation for its redisposition into climate conservation.

Life is a sum of functions making possible a sustained climate. The quantity of plant life needed will have to be evaluated from the actual place in the macroclimate and the local resources of water and soil.

Animals play different roles in the circulation of energy. Reptiles follow the temperature changes, so are parts of the buffers.

Warm-blooded (endothermal) animals need 30 to 50 times the quantity of food needed by reptiles.[70]

That needed amount of energy will have to be collected by plants before it is circulated in browsers, grazers and predators. The warm-blooded animals thus depend upon a high productivity of the plant life.

This has the consequence that a high density of warm-blooded animals is sustained only on the basis of a very high productivity of the plants, combined with the buffer capacity and climate of an extensive and dense plant life.

The reptiles were a factor in the sustenance of the warmer climate of the Cretaceous. Their absence has, reciprocally, been a factor in the sinking average temperature through the Tertiary and Quaternary, *cf.* ref. 66.

Another factor in producing a cooler climate has been the rise in the number and size of mammals. In many regions of the tropics, *e.g.* the savannahs, they are depleting the plant life to a degree of aridity losing nearly all buffer capacity.

An important reason for the sinking temperature is the grasses' adaptation to the cool climate and their lack of water capacity for a sufficient buffer function. Their spread has hindered the transition from a sinking to a rising temperature of the Earth.

Heavy grazing and the removing of cultivated plants for great parts of the year even remove the buffer capacity of the vegetation and are factors of climate cooling.

After the great disaster of 65 My B.P. the relation between plants' water capacity and growth potential was so disturbed by the cooler climate as to reduce the plant cover even outside the regions directly affected by the meteorite.

An important part of the area covered by plants was taken over by the cold-tolerant grasses.

Their water capacity is mostly so low that a great part of the former green surface of the Earth was stripped of the greater part of its buffer capacity.

This led to a loss of water and plants, so that great parts of Earth are now desert. A rough estimate indicates that three quarters of tropical and subtropical land is desert or semi-desert.

Seen as a part of the climate, this indicates that most of the surface of Earth that should have conserved its main buffer capacity has lost it.

Measuring climate.

When a wind blows through the wood we do not measure its buffer capacity, only a difference of temperature. A meteorological measure does not, however, include the water content of the air or the plants, thus it does not point to the climate or its basis in potentials.

It would have been possible to calculate and publish a measure of the energy reserve of climate, in Jm^{-3}, starting with the damp air. This measure should also include the energy reserve of plants and animals, their buffer capacity, which is a part of the climate.

This would be a part of the procedure showing that the use of consciousness in the observation of a process can be the start of making the process better, since it may inspire to some intervention.

The efficiency of this procedure was brought to my attention a few decades ago when I learnt that the starting of weighing lambs in a Norwegian district had been the beginning of a rising production of lambs' meat relative to the number of ewes.

When the pole regions get conspicuously warmer, it signals that the buffer capacity of the tropics is so low as to make the Earth lose energy.

Relative to the buffer capacity of water in trees, rivers, lakes, and the sea, the present buffer capacity in dry air, grass, and dry soil is of negative significance.

The important parts of the buffer capacity of the surface of the globe lie in the woods, the lakes, the rivers, and the sea. The water content of the soil is important in marginal cases, like our time, when the plant cover is reduced and the Earth's magnetism is weakened, both for water's disappearance.

The sun energy not used through plant and animal life will have a lower climate value as long as it is used only for the day-to-day heating of savannah, desert, or mountains.

Deserts have no buffer capacity; so they detract from that of the rest of the Earth. Deserts make the Earth colder. The climate cannot be conserved on any level as long as more than a minimum of desert exists on Earth.

This minimum is long surpassed. During the last three thousand years, the deserts have been greatly extended.

Tropical savannah and temperate grassland are cold regions, relative to the regions which can conserve some energy; thus they are climate regions of loss of energy.

The temperature of the Earth is maintained by two sources of energy. One is its old store of heat, originating from the condensation of the Earth and its nuclear heat, now probably close to depletion. This energy alone cannot sustain a surface temperature suited for life.

The second source is the sunshine. As long as it falls upon a planet having surface functions capable of conserving the heat or radiation energy from day to day and from one century to later centuries, a climate will be sustained.

If not, we are permanently in the situation described from geology as "…a catastrophic worsening of the climate." [66]

This was written about the situation at the transition to the Quaternary, *c.* 2 M years ago. There is no change of this condition.

Our common perception of the climate condition and our understanding of its mechanism and consequences are not consistent. The measuring of temperature renders an insufficient description of the climate.

The knowledge of temperature and other climate factors from the last thousand years have not been entered into a model of climate, or into a connection of distribution of life energy.

Since 65 My B.P. there has been one heavy impact on the climate and one long development of its sequels.

The first was the destruction of great parts of the plant and animal life that had re-circulated, as climate, the sun energy during the Cretaceous.

The second was the growth of new plants not capable of re-circulating enough of the sun energy for sustaining a level of climate. With these plants were developed the warm-blooded mammals, whose food consumption is greater than the plant production capacity of their habitats.

From this followed the change to the Quaternary's cooler climate and glacial periods.

It will be seen that the climate, and its conservation on any level of appearance, depend upon the buffer capacity total of the Earth as well as of its distribution.

The unequal distribution of buffer capacity is a part of the mechanism that makes the Earth lose more energy than it can supply to the losing regions. The heating of the pole regions signals the loss of tropical buffer capacity.

The problem extends to the inner parts of the Earth, as its magnetic field has been weakened by ten *per cent* during the last century.

This will be due to its sinking content of water, since the rain is falling on a smaller part of the Earth's surface. The corresponding part of the problem is that a growing part of the Earth's surface is desert. Much of it has even been developed during historical times.

The present heating of pole regions is a greater loss of energy than that hitherto protected by the residuals of buffer life.

This implies a great loss, adding to the not retained part of the received sun energy, thus making Earth lose also some of the old planetary energy. This dangerous situation is what we see as warming of the pole regions.

This apparent surplus is the product of a serious deficit of buffer capacity, a greater insufficiency than any known to this day. Though hitherto seen as improbable, it is now materializing, partly as a consequence of the human recent (8000 years?) negligence of the plant cover as the most important part of the climate buffer.

The use of less energy will not be a remedy. The only solution is the conservation of more sun energy in a large extension of the plant cover, though grass and parts of needle-wood have a too low buffer capacity for contributing to a better climate and should be excluded from the coming flora.

The remedy will be the planting and irrigation of deciduous wood in most of the world's arid area. Beside deserts, this includes steppe, savannah, and scrub land.

The growth of bare land and of cultivated land uncovered by plants for months every year reduces the Earth's amount of stored energy. This leads to a sinking spiral of energy circulation in the biosphere.

Less conspicuous is the replacement of tropical forest by fruit trees or other plants holding little water and therefore having a low buffer capacity.

The volume of distributed water in the ground, in the plants, and in the atmosphere is the main factor in the climate function of the Earth. It is replaced by the rain from the seas, the water on the ground, and in the plants.

The capacity of replacement was reduced before man could think of doing it. As soon as he could, he continued the process, at the detriment to his children and the Earth.

When the air is saturated with water vapour, it has the buffer capacity of the condensation energy of the dew, as it will return the energy taken up at evaporation during the day.

This energy is 2·6 MJ kg^{-1}. A dew fall corresponding to one millimetre rain will return this energy *per* square metre. A winter night will see the fall of rime. This freezing dew will leave in all 3 MJ kg^{-1}. This was the energy used for melting the ice and evaporating the water.

The added energy from rime falling on a roof is felt as a rising temperature inside the heated house. This is not because it should add to the energy produced by its heating equipment, but because it detracts from its loss.

The dissolved water in the atmosphere is a much needed buffer, which adds to the energy circulation capacity of the atmosphere. Drying out the atmosphere leaves the Earth a colder place.

A temperature rise of one centigrade does not have the same climate significance everywhere on Earth. In Europe and the polar seas it is an apparent amelioration of the climate. The energy will be taken from the tropics, whose buffer capacity has been diminished as the land was cleared.

In Sahara, the temperature is high during the day and low at night. Any climate is a function of energy, its distribution and conservation; and it cannot be correctly described by temperature alone. Great variations of temperature are signs of lack of buffer capacity, thus of a loss of energy.

A difference of pH in the rain or in the soil will have a great influence upon the microbes and the plants, and thereby upon the climate.

Energy carried by water.

Moving one step away from the empirical variables of the weather, we meet the energy of their relations. The wind has a force produced by energy; and the energy is a released potential.

The rain took up energy as it was evaporated in a warmer place; and most of this energy was released as the vapour was condensed and formed clouds. This energy is a part of the climate of the world.

This energy is not a part of meteorological models. What new information could we have gained from including energy in a model of the distribution of weather?

Maybe we could begin understanding the climate? Could it let us understand the heating of the Northern Atlantic Sea and the longer summers of Europe?

The rain over the Amazonas region is, on the average, 1500 mm *per* year. The area is *c.* 7 M km^2. This rain is the condensate of evaporated water from the seas on both sides of the continent.

It is transported to the atmosphere above the continent by the low pressure formed by the tropical sun's heating the moist air.

The air is adiabatically cooled by the lowering of pressure as it rises; and its dissolved water is condensed to a mild rain.

At its condensation, the energy added at evaporation is transmitted to the air, which continues rising. The rising airstream will be replaced by air from the oceanic atmosphere. It will maintain the low atmospheric pressure and the air streams from the sea to the continent.

The air is moist by its contents of dissolved water, taken up from the tropical sea. For its dissolution was used an amount of solar energy; and the potential of this energy is contained in the moist air as it is transported from the sea to the continent. The energy is released to the air in the moment of condensation. This is seen as cloud formation.

This transmitted potential will be released in the expansion and upward movement of the air, followed by cooling at the lowering of pressure at greater height, and of further condensation.

The upward movement is meteorologically seen as a low pressure. It will attract more humid air from the sea.

The energy used for evaporation is *c.* 2500 kJ *per* kilogram water. This energy is received from the sunshine. This amount of energy is returned at condensation. It is distributed in the number of small drops constituting clouds.

They are kept from falling as long as there is a surplus of new condensation delivering enough energy for heating the air and maintaining an upward draught in the cloud.

Clouds exposed to wind and to cooler air will form greater drops, which will fall as rain, hail, or snow.

The condensation energy of water will be the return of the boiling energy, 2257 kJ kg^{-1} plus 4·183 kJ kg^{-1} K^{-1} for the difference between the boiling temperature, 100 ºC, and the ambient temperature, *e.g.* 20 ºC. This is *c.* 2500 kJ kg^{-1} released at cloud forming and the following fall of one millimetre rain on one square metre, which is one kilogram of condensed water.

The greater part of energy from evaporation and re-condensation is released in the lower atmosphere.

The evaporation of water to the atmosphere mostly takes place in the tropics. The rain falls over great parts of the globe, though not great enough for maintaining a distributed climate.

The condensation of the vapour to clouds is the main part of the transmission of energy.

When the vapour freezes to snow, the release of energy is another 334 kJ kg^{-1}. One kilogram snow corresponds to one millimetre rain falling on one square metre.

The dynamics of small differences of energy in the atmosphere corresponds to the low density of air and to its low resistance to movement as wind or storm.

One movement is spectacular and involves a lot of energy. It is the rise of humid air above a sea surface of at least 27 ºC. At some height, it reaches its point of water saturation of the air, thus its vapour starts condensing. The energy of evaporation is returned to the cloud, which continues rising.

When this happens more than five degrees from the equator, the cloud is exposed to the Coriolis' acceleration, an instance of inertia, in which a moving body continues its movement while the Earth continues its rotation. The reference points diverge between the two movements, resulting in a circular storm.

These tropical cyclones take the energy for their movement from the condensing vapour. The air is heated by the condensation, thus it rises into a region of lower pressure and temperature, where the further condensation liberates more energy, *etc.*

The tropical storms diminish as they pass cooler seas to the North-East or South-East. Their role as energy transmitters is not ended, as they transport energy to higher latitudes.

The tropical storms continue outside the tropics as gales and heavy rainfalls. They are the most conspicuous part of the transmission of energy to regions outside the tropics. The sea currents are less visible, though as important.

The North Atlantic Sea receives more energy today than it did a century ago. This energy is transported from the Amazonas and from the deserts, which are without buffer capacity.

More heat is lost by radiation to space from the dark surface of the sea than was lost from the snow-clad ice.

The heating of the pole regions of the Earth is thus not a part of any heating of the Earth, but a part of a greater loss of energy from the Earth by its transmission from the tropics to cold regions before its final loss to space.

More of the energy distributed to regions outside the tropics should be saved before it leaves the tropics, since the globe cannot afford its expenditure. The loss of tropical energy is the most serious problem, since the tropical buffers are the first line defence against the loss of potentials from the Earth.

An ice cover is cold, but it can conserve the potentials under it, if it is not powdered by dust and made to lose its energy store as radiation.

Energy is best saved by buffers. Heating of regions outside latitude 45° is a loss from the Earth. It could be avoided by better buffers. Dense woods of deciduous trees, *e.g. Populus, Salix,* and *Betula* (poplar, willow, and birch), could be the best buffers in sub-polar regions.

Temperature is a bad guide in this process, as the higher temperature of the open sea makes it lose more heat than the snow-covered sea ice. When this is measured as temperature, it is misleading. The warmer situation is the one producing a colder climate, since it leads to a greater loss of energy.

One millimetre precipitation over Europe and its near waters, estimated at $1{\cdot}5 \,.\, 10^6$ km^2, implies a transmission of $1{\cdot}5 \,.\, 10^{16}$ J from the tropics to the air in which the condensation takes place, since the energy of tropical evaporation is returned at condensation.

The rain falling over Europe was evaporated from a tropical forest and a tropical sea. Longer European summers, a little more rain and more wind together imply more energy received. It is nice for us Scandinavians, but it is not good for the Earth. This is not because it is getting warmer, but because this dispersion of energy from the tropics makes the Earth as a whole a colder place.

If the energy distributed had been taken from a surplus, all would have been well. It comes to us because the tropics have lost a crucial part of their buffer capacity.

Higher temperatures in temperate or polar zones are parts of a greater loss of energy.

The concept ‘buffer’ is not new in railway technology or chemistry, though it seems to be in terrestrial physics. The buffer function is that of damping and retarding transmissions of energy. It is not, in principle, different from our clothes, which have a certain external temperature.

They retard our heat loss. When we remove them, our skin will be warmer than the outside of the clothes for some time; but we soon feel the cold of heat loss. The capacity of the terrestrial clothing is limited and sinking.

The vegetation of the rain forest is efficient as long as it is there; but the tropical climate is not given once for all. When the tropical forest is reduced to less than a critical area or buffer capacity, there will remain no mechanism for sustaining the climate, which is the atmospheric system distributing the energy of the biosphere.

The main part of this energy is kept in plant life and water. Its loss is seen as heavy storms, rainfalls and temperature differences.

It seems that the area of the tropical forest is continually reduced, and that one of the consequences is that the rain is falling over an ever smaller area. This is also seen in the augmenting area of desert.

One part of this condition is the sinking strength of the Earth’s magnetic field, due to the sinking amount of water in the ground.

The loss of energy directly from the tropics is a loss for us all, since nobody outside the tropics will feel a whiff of warmth; and the higher latitudes will suffer from the cold. The deserts are the main areas leaking energy from Earth.

The present warming is an unsustainable loss of energy from the tropics to higher latitudes. Together with the unequal distribution of precipitation, this warming signals that the tropical buffer capacity is too low. Together, they lead to a net loss of energy from the Earth.

The vegetation of the temperate and sub-arctic zones has a certain buffer effect, graded from dense wood to low grass. This is another sequel of the meteorite of 65 My B.P. The grasses, rushes, and sedges of temperate and cool climates have small biomasses *per* square metre and a low buffer capacity.

The same is, alas, the case for tropical grassland. This feeds great herds of grazers, which remove most of the grass and keep the land from establishing a climate buffer capacity.

Deserts are characterized by their lack of buffer capacity. They cannot conserve any energy overnight. Their loss of energy has two components: a continual loss of radiation energy, and cooling of the joining regions by the dry and cold air falling from the upper atmosphere.
Sahara is the Earth's greatest region of loss of energy. Its area is probably around half the total desert area, which loses energy and keeps land out of circulation of water and energy.
In great parts of the Earth, the heating believed to be a disturbance of climate, is a part of a lack of water in the atmosphere.

The river Amazonas discharges 6000 km^3 water *per* year. When this water was condensed as clouds, it delivered to the air an energy of $1{\cdot}5 \cdot 10^{22}$ J. Another 4000 km^3 is condensed, leaving 10^{22} J. This part of the rain is re-evaporated, mostly from the vegetation, by 10^{22} J taken from solar radiation.
The air coming from South America and the tropical parts of the surrounding seas carries energy mostly as vapour in cyclones, which are atmospheric low pressures. Their energy is delivered in the Caribbean, North America, the North Atlantic Sea, and Europe.

Moist air will contain a potential. Over great parts of the Earth, the temperature is measured in drier air than that which can sustain the climate. The result is that temperature will have been measured in many locations where the air is too dry for a significant measurement, compared to the air of normal climates, which includes a minimum of plants.
The temperature of the dry air is not climatically significant, since, at the same temperature, the normally humid air holds a higher energy reserve than the dry air.
The needle wood of a cool climate is a cool place. It does not convert enough energy for contributing to the local climate. The trees produce their collected energy in the form of cellulose of the wood and of the needles covering the ground. The dense needle wood does not convert its received energy to climate temperature, thus is followed by a glacial period.
Our models are not the perfect vehicles of understanding. As they are the means we have got, we should evaluate them, choosing and discarding, as models can be shifted or reformed.

Better than relying upon empirical and phenomenological data, we can build our understanding upon the physical functions of plants relative to the atmosphere.

The low pressure above Amazonas is an example of the atmospheric apparatus for converting potentials from the sun to water-carried energy.

As long as the functions are maintained, energy is distributed as vapour to the continents and to individuals from hundreds of tons to micro-grammes, from the Californian *Sequoiadendron giganteum* to *Poa annua*, our ten cm annual grass, and to microbes.

Mild air and rain over Europe deliver energy from the sunshine over South America and its tropical seas, though seldom the whole energy of condensation.

The reason for this is that most of the energy is released where the clouds are formed.

Water is the buffer, distributing energy over the year and over a region. It transports and distributes energy from one region to another.
There is no automatism in the fact of rain falling in the Amazonas region or in Europe. In Amazonas the temperature is held low enough for life to thrive and high enough for a rich and varied life.
The dominant constraint on life is that the energy should be distributed so as to further life on its conditions.
Water not only performs the function of energy distribution, but is itself a necessary participant in the vital functions which are parts of the energy distribution.
At the same time, water is a buffer by keeping the temperature within the optimum range of these functions.
Water's role in the buffer functions of the Earth also comprises the sea level. The rising sea level, already seen at Venice, should be understood as the consequence of a smaller circulation of water and energy in the biosphere.
This deficient circulation of water and energy is not produced by a warmer climate, but by a smaller and insufficient plant cover of the Earth.

From the example of the Cretaceous we can see that the chemical possibilities are parts of the conditions of life's distribution of energy.
The vegetation of sub-polar regions should be needle wood or heather rather than grass, since grass has a low buffer capacity. The first choice will, though, be a deciduous forest.

Some systemic connections are more efficient than others. Soil rich in quartz will let only a small number of plants grow. Among them are horsetail *(Equisetum spp.)*, which has a limited circulation of energy.
Soil combining a content of calcium and a pH of 7·2 - 7·6 has a higher chemical buffer capacity. It also has a higher thermal buffer capacity; and a great number of plants will thrive in it. Thus it has a higher potential for biological productivity than the acid soil.

Deficient conditions.

Exploiting a growth potential presupposes that the plant cover can fill its role in the maintenance of the conditions, climate included.

We cannot presume anything on the basis of weather measurements.

The factors of climate are each and all needed for the support of plants and of soil conditions.
When the tropical rain forest is removed over more than a small stretch of land, the water of the replacing, discontinuous vegetation cannot offer the same degree of buffer function as it did as a part of the intact tropical forest. The buffer effect is also reduced, and close to lost, when cultivation or grazing holds the vegetation down to grass level, or removes it for long periods.
Woods are important as buffers also in temperate and cool regions. Alaska has a selection of *Picea, Larix, Betula, Populus,* and *Salix,* which together make the climate better than it would have been without the trees. Siberia without its taiga, which lets the sun in, would have been a colder region. Scandinavia would have had a colder climate without woods, though a warmer climate with deciduous trees.
The lack of buffer capacity is seen in the woodless Faeroe Islands (Føroyar). Situated at latitude 62° North, in the middle of the Gulf-stream, their winter temperature is +3 ºC and summer temperature +10 ºC.

The Nordic mono-cultural spruce *(Picea abies)* wood is an extreme among woods, as it is a dense and cool plant cover. The energy it receives is used for cellulose production, not for sharing with its surroundings or for maintaining any level of climate.
In the perspective of a human lifetime or two, it is a cooling factor even in its own cool region. This makes it a part of the development of a glacial period.
The dense spruce wood is a cooling factor because it does not let the sun in, and because the wood is consumed by fungi, not by bacteria, which could have liberated its energy.
The cold nights of the savannah are a sign that the vegetation does not contain the sufficient quantity of water for keeping the biotope in a neutral position relative to the region's overall climate potential.

This is also seen from the instance of the northern part of the Rift valley, in the present Ethiopia and Kenya, which had lakes and abundant vegetation two million years ago. It is not known whether the climate downfall had a relation to local or regional conditions. Seen in a climate relation, neither Sahara nor the desert of Arabia is distant.

The drying and cooling of the regions of sparse plant growth has been the general climate tendency of the last 65 M years. It is a part of the Earth's sinking buffer capacity. Too much of the sun energy received is lost to the air.
Agriculture in temperate regions is not as exposed to the danger of destroying its own conditions as that of the tropics. This is related to the mechanism of the rain.
Since the energy of the condensing water is not released where the rain falls, but where the clouds are formed, the vegetation of, *e.g.* Europe, does not take the same role in the formation of the climate of the Earth as does that of the Amazonas region.
The agriculture of Europe and other temperate regions is therefore not as pernicious to the climate as that of the tropics. Evaporation from the plants is much lower than in the tropics, thus the plants are growing more slowly and consume less energy.
The energy of the rain in temperate regions is not the energy of condensation, but its tepid rest brought across the sea. The energy of its origin, the tropical cyclone, is close to exhausted.

The rain is, though, a necessary condition of the growth of plants and of their buffer function.

It sometimes happens that tropical cyclones, or cyclone residues, pass the latitude 30°. They are heavy rainstorms; and they take their energy directly from the condensing water vapour, like the tropical cyclones. Their rainfall is heavy; and their winds are strong.

In Europe, their inundations are not rare. They seem to reach further north than normal cyclones because of a weakened tropical buffer system.

The normal situation in temperate regions is that the residual condensation of rain takes place at high altitudes. The energy of condensation normally does not play an important role close to the ground.

There is every reason for maintaining and augmenting the buffer capacity of Europe, Canada, Alaska, and Siberia, in order not to squander energy. One useful measure would be the introduction of deciduous trees instead of the woods of conifers.

The deciduous trees use less energy for collecting stem wood, and more for collecting sunshine, even in spring and autumn, and for warming the climate with the help from bacteria, which consume the whole of leaves and twigs.

For the marginal North, it should be possible to find, by adequate research, the optimal species.

Scandinavia would have had a better climate with more deciduous forest and less coniferous forest. The marginal mountain and northern forests could, though, be regions where trees of the pine family (Pinaceae) could be useful.

The reasons for maintaining the spruce woods of the southern Scandinavian lowlands seem to be their high productivity and the markets for building materials and paper.

Their energy built up as several kilograms of cellulose *per* square metre ground *per* year is collected at the cost of a sustainable climate. The spruce forest is a cold and cooling place, a fore-runner of the glacial period.

There is not much economy to fetch from the wood covered by the glaciers of an ice age. It will be better to do everything imaginable in order to prevent a new ice age.

The lost energy.

The climate advantage of the deciduous wood is founded upon its chemistry, which offers bacteria a nice fodder from its shed leaves and twigs. Bacteria break down what fungi leave of the twigs and fallen wood. Thus they keep the circulation of energy higher in the deciduous forest.

The sunshine's access to the soil augments the bacterial heat production in spring and lengthens the period of energy production and release.

The temperature of the deciduous forest is noticeably higher than that of the needle forest, not only in summer, but for many weeks in spring and autumn.

The half open, deciduous wood is often referred to as "warmth-loving deciduous wood", as if it should prefer the warmer climate. It is overlooked that the distinction between this wood and the neighbouring needle forest is that of geological conditions.

The trees of the pine family are found in soils formed from acid-producing minerals, while the high-productive among the deciduous trees are found in alkaline soil. The higher pH and the presence of some metals, especially calcium and magnesium, lead to the prospering of deciduous trees.

The environment offered to the microflora is decisive for the wood's thriving, as it assures a high circulation of energy. The sunshine admitted to the bottom of the wood permits bacterial exploiting of the energy of the leaves for producing heat by rotting them. The result is that the warm period of summer is longer; and the local temperature is kept higher.

The bacterial breakdown of dead leaves depends upon the presence of calcium and magnesium in a basic soil. This soil and the right bacteria make the content of nutritional elements accessible to trees, flowers, and seed.

This also illustrates that the local energy circulation in plants is a necessary condition of the climate.

The other environment is not characterized by needle wood only, but by fungi and an acid soil. Fungi are selective and, by excluding bacteria, they will consume nothing but the protein parts of the plant material. (Penicillin, which discriminates bacteria, is a product of *Penicillium*, brush mould.)

The needle wood ground is therefore covered by a carpet of needle casks and other cellulose remains, all woven together by the hyphae, the thin threads of which the fungus consists.

The energy saving of the coniferous wood is a cooling factor of the climate. The serious sign of cooling is that this wood will oust the deciduous wood at the coming of a glacial period. This is known from interglacial deposits—and from Scandinavia of today.

The substitution of deciduous wood for the needle wood now spreading will therefore be a necessary measure for averting the ice period, though not sufficient. Knowing the mechanisms of the climate, we shall be better prepared for interfering in its development and hold it to delivering the conditions upon which life can subsist.

North of latitude *c.* 40º, planting deciduous forests and giving them the necessary minerals will start building a climate defence against an ice period.

The fundamental climate function is the buffer capacity of water. It includes water's presence as a participant in life's chemistry and physiology as well as in energy carrying and storing. This is seen in functions in which water participates. Water is a main ingredient of the vegetation and the important part of a buffer of great capacity.

There is a strong gradient from grass over taiga and a dense needle wood to the deciduous wood. The three first will receive a greater amount of energy than what they return to the air.

The rest of the energy is either lost in radiation or stored out of reach of the climate functions. This is the mechanism of the sinking spiral of energy circulation as it is expressed in the cooling climate.

The details of the cooperation between plants and climate are soil chemistry, pH, and capillarity, and the organisms living in the soil, be they bacteria, mite, insects, or animals.

When dry minerals are the residuum of a soil, plants have lost their right. There is hardly any climate significance in lichen growing in Antarctica or bacteria living in stone.

Water heated during the day takes its energy from the sunshine or from its environment; thus it is a cooling factor. Since it conserves much of the energy received, its cooling effect is a part of a buffer function.

The energy is released to the environment; and during the night it gives back its warmth. Cooling one kilogram of water from 25 ºC to 15 ºC delivers 42 kJ, which will hold 30 m^3 of air at 15 ºC instead of letting its temperature fall to 5 ºC. This is an instance of water's buffer capacity.

In a deciduous forest, where the water of tree's leaves is exposed by their great sum of surfaces, this is an efficient climate operator.

In temperate grassland and on the tropical savannah, the low water content of the grass makes it a buffer of low capacity. For the conservation of climate on a given level of energy, its buffer capacity is insufficient, thus the nights on the savannah are cold.

Together with the deserts, the savannahs are negative factors on the balance sheet of the tropical climate *cf.* the sinking average temperature during the Tertiary and the catastrophic lowering of temperature in the Quaternary, ref. 66.

This lower energy circulation followed the catastrophe of the meteorite 65 My B.P. The warm climate of the Cretaceous probably had exposed few plants to a hard winter. At the kilogrambeginning of the Tertiary frost resistant plants should have existed in low numbers. The buffer capacity of the dead woods and animals could have damped the sudden great temperature fall and the first part of the period of cooling.

The period of cooling is not terminated. The toxic effect of iridium will be the reason for the great number of plants, maybe also microbes, deviating from those existing 65 My ago. Most of these probably died because of the hard conditions.

The new grasses (the family Poaceae) were survivors, together with their brethren rushes (Juncaceae) and sedges (Cyperaceae). They are all characterized by a great surface and assimilation capacity relative to low water contents. Their high cellulose contents raise the suspicion that their origin could be not only Liliales, as currently presumed, but also some admixture of genes from trees. The embroilment of the meteorite could have been more complex than we imagine.

The advantages of the grasses are our damage. Their properties have let them develop and thrive even under marginal conditions of temperature and access to water. Low water content has given them a negative role in the buffer capacity of the biosphere.

The grasses' adaptation to the colder climate of the Tertiary is a part of the mechanism which impedes the warming of the climate.

The remaining buffer capacity of the Earth is too small for maintaining a stable climate, even if we include a one hundred thousand years' glacial period in case it should be necessary or useful for partially restoring the climate function of the tropics.

The presumed effect of the glacial period is, though, a chimera. A cooling period of one hundred thousand years will not make a later ice age less probable.

The general tendency today is the continued cooling of the Earth, though it is too cold already. The ice ages of our time started two or three M years ago; and there seems to be no sign of their ending.

Disquieting news (2012) concerns a ten *per cent* weakening of the Earth's magnetic field.

Since its probable mechanism is the coordination of the water molecules' magnetic fields (*v.s.*, *cf.*

the magnetic solenoids of the water monomer), the weakening of the field should be the product of water's disappearance from great parts of the Earth.
This mechanism is demonstrated in the drying up of Mars and its loss of a magnetic field.
A part of the background of worry is the short time passed, a couple of thousand years, since the new deserts were fertile land, among them the Fertile Crescent.

The present buffer capacity of the Earth is not great enough for maintaining a livable climate; and we are squandering its remains. We feel the phenomenon of heat as it passes, though we have excluded that part of the world from our understanding.
The presumed temperature rise of the last decades will be due to the loss of tropical buffer capacity, its following transmission of energy to the sub-polar regions and its loss from them.
The measurements do not indicate energy or potentials, though these are the factors producing the climate.
Buffer capacity is the decisive part of the climate functions. Behind it, we find the potentials carried by the matter of Nature, and the energy released by these potentials.
The matter of Nature has different capacities for carrying potentials; and the different kinds of matter play different roles in different connections.
A relevant symptom is the rising temperature of medial latitudes. Those regions can drain energy from the tropics because these have lost too much of their buffer capacity.
One of the reasons for this is human activity like agriculture and wood clearing in tropical and subtropical regions. Through the last five thousand years, maybe longer, we have removed buffer capacity. The motivation has been the short gain of clearing land for agriculture.
The thought of a gain has led to destruction of the resources. Woods are lost; and conditions of agriculture have disappeared by our activity. The results are called "climate changes"; and deserts have taken over.

The common conception of climate seems to include that it should be a property of the place, and that its vegetation should not be counted as a functional part of it.
Since Plato, there has, though, been some astonishment when a forest has been cleared, and, not foreseen, the rain is diminished so as to make impossible the intended agriculture.
The former Fertile Crescent between the Mediterranean and The Gulf, presumed to be the origin of agriculture, is now mostly a desert.
Buffer capacity is the most important and un-losable quality of the Earth. Its unique position between hot and cold planets, combined with buffer capacity, has let its life conditions unfold their consequences.

One of them is the continuation of life. Another is climate's dependence upon life. As we are in a critical position, our present first responsibility is to interpret the signals correctly and behave according to them.
The conditions of climate are based on water's physics and the potentials of its interaction with the charges of substance. They developed life at *c.* 415 K, *cf.* its residua in hot springs of the oceans and volcanic regions.
Later, a second development took place on new conditions, at 275-314 K.
All functions of life have the buffer capacity of water as their unconditional presupposition.
The mechanism of the climate change has not always been obvious. When a tropical forest is removed because somebody sees the promise of a gain in it, the temperature will rise in some northern sea, for some time. Then the rain will disappear from the former woodland. Its average temperature will sink, and the temperature variations will be greater.
These variations are the ultimate sign of the loss of buffer capacity, *cf.* the day and night temperatures of the savannah.

The variations of heat capacity and relevant functions of CO_2, and of received radiation from the sun, are of a minor importance compared to the great and lasting inflictions upon the climate produced by the sum of the present local removal of buffer capacity.

The rising sea level, clearly seen at Venice, is more than a sign, as it is a part of the disappearing buffer capacity.

Entropy and negative entropy.

In his second law of thermodynamics, Rudolf Clausius introduced (1850) the concept 'entropy'.

Its consequence was taken as a general physical necessity. The depletion of all energy is the natural and final consequence of matter and energy.

On the conditions stated by this law, a recipe, maybe marginal, for the Earth, would be that it could keep some warmth under a cover of snow.
Entropy is, though, just a half truth, since it does not include light's or life's role in the intermediate parts of energy distribution.
Light has the property of going outside matter as well as that of going into it. We keep warm under the sun; and it will not be extinct for a longer period than the human perspective of survival.
Plants keep the received radiation energy for later use, for the use of animals, and for maintaining the air and soil temperature on a higher average than that of a naked Earth.
As long as the sun energy is kept in use by the presence of water and minerals, life can prolong the possibility of the continuance of life and its distribution of energy.
As long as the sun delivers a minimum of energy to the plants of the Earth, there exists a possibility of avoiding being frozen down.

Light is the transmitter of negative entropy; and life is its keeper. Climate is what we feel of the received and retained negative entropy.
The second law of thermodynamics is valid for energy used and transmitted within the system 1 of energy. The parts of this system are substance, extension, charge, and field.

Life is fed by the system 2 of energy. The parts of this system are charge and velocity; and the velocity is that of light.
Animal life cannot take the whole of its energy from the local temperature. The plants on which the animals feed can grow under the sunshine, but not by heat alone.

Energy seen as heat is a part of physics leading us away from attention to its functions relative to life.

Heat should be understood as a phenomenon, a felt and measured part of energy's manifestations, though not as the decisive function of energy in life.
The concept of 'heat' now seems to be taken as a central part of energy, as its measure is taken as a sufficient description of an energy potential and its transmission, *cf.* the central role of temperature in the description of weather and climate, and Clausius' concentration upon heat.

Relative to potentials and energy, heat renders an insufficient understanding and measure. Heat is secondary and should be referred to its functional conditions.
Sunshine is substance re-circulated in the outer parts of stars. The process is a re-forming of matter, from its structure to the dynamic form of the negatively charged parts of substance, its negative entropy.
This form is not an object of entropy. Matter enters the world of entropy when it leaves life and is dissolved in stars' interiors.
What are, then, the conditions of not squandering the energy received in the transient form of light?
The first is keeping Earth's plant cover intact. This implies the concern about the plant cover's quality, extension, and role as the mediator between the electromagnetic energy system and that of animal life.
A climate energy account for the Earth could be kept. It should be divided into zones of climate and of specific plant cover.

Mending the plant cover and remaking its lost parts will have to take place on the conditions of light, matter, energy, and life.
The present campaign for saving the tropical forest is useful, though insufficient. Saving the threatened woods and building new woods and buffer capacity on tropical land is the first task.
Without a large extension of buffer capacity, life on Earth will be exposed to entropy, ending soon like Mars and Moon.
Forests of great extension are the necessary means for rebuilding the buffer capacity of the Earth. Sahara is first on the list of indispensable regions to be forested.

It is necessary to see the difference between the functional role of light and the descriptive role of climate and its parts. It is not possible to use a purely descriptive model as a recipe for instrumental parts of a correcting method.
Practical and technical coordination or first aid is possible only on the condition of a model of functions, not of abstractions.
Sunlight is the vehicle of negative entropy. In order to grip the possibility of our own lives that it offers, it is necessary to maintain the sufficient level of energy for other life forms and for the ambient temperature.
The needed buffer function is known in several variants. It is mainly produced by water in living plants; and it depends upon the support from animals, insects, and microbes.
This model makes it possible to see the functions distinguishing weather and climate, and seeing climate as the product of energy from sunlight, kept for a while through life.
A necessary conclusion is that any new heating of the air and augmentation of wind or

precipitation at more than probably 40° from the equator will be signs of unsustainable losses of energy from the Earth.

Until the deforestation of the tropics began, the Earth's buffer capacity was, perhaps, nearly sufficient.

It was broken down 65 My ago and was insufficiently restored by plants having a too low mass and too little water content, thus a too low buffer capacity. The plants were mainly grass.

The new grasses produced a too small quantity of food relative to that needed by the new majority of grazing mammals.

The new plants should have been a necessary adaptation to the new conditions. They were, though, a step down the ladder to the cold depletion of life's conditions.

Man is lucky to having arrived to Earth before the last consequence of the disaster has thrown Earth out into the cold, thus it still seems that he should have the option of retrieving a sustainable climate for the Earth.

The conditions of that chance do not, though, seem to be parts of insight into the functions of the biosphere. The opportunity is rapidly vanishing. Our lucky presence will be short if we miss it.

We are living in the expectation of a glacial period. The present information indicates that we have a possibility of changing the future Earth into a livable place, combined with averting the glacial period—provided we act correctly and before it is too late.

Our present meteorological model of climate is deficient relative to our need for information about energy and buffer functions sufficient for keeping the Earth from freezing.

The information from geology, *cf.* ref. 66, says that we are living in a sinking spiral of energy circulation. Its consequence is that the next glaciation will be worse and longer lasting than any of which we have seen the traces in geology.

The preliminary search for a better model has pointed to functions of thermodynamics. They will offer us a chance of survival on the same Earth, though on new conditions. We have got the option of exploiting these conditions.

This will demand an organisational coordination and an investment and work of great dimensions. Humanity has got the resources needed, with a possible exception for the agreement.

Energy and cooling.

The longer summers of Europe are nice for Europe, though they are the signs of a loss of tropical buffer capacity. They signal a cooling of the tropics; but we depend upon the tropical buffers for maintaining the Earth's energy store.

The rising sea level is not only a sign of the melting of glaciers, but as well a sign of the breaking down of buffers. These are plant systems over great parts of the world. Since a significant part of them is grass, their value is too low already.

The unequal distribution of precipitation over the Earth should be taken as a warning, since a well distributed quantity of water in the atmosphere should be the indication of a good distribution of the conditions of plant growth.

We are far from that distribution.

There is a stream of energy away from the tropics. From Sahara, it is radiated away from the Earth. This energy does not enter the system of buffers. Sahara is a cooling part of the Earth and probably the principal agent of its loss of energy.

From the rest of the tropics, deserts excepted, energy is carried by air and water. It seems that this carrying function is somewhat more efficient than the tropical function of converting sun energy into energy forms useful in our biosphere. This indicates another function of cooling.

If the intensity of sunshine had been the decisive factor in the cooling of the Earth, regardless of its buffer capacity, the cloud-free regions would have been warmer. The problem is, though, that too much energy is lost from its parts not covered by clouds or forest.

Water is the only important actor of distribution of energy, magnetism, and negative entropy. The distribution of water for a great part takes place through life.

Outside Sahara, the distribution of water has been impaired for more than two thousand years, or since the fall of the Tocharian culture of Central Asia.

Now, the loss of water in the crust of the Earth has lowered the strength of its magnetic field.

The most visible impairments of the loss of water in soil and vegetation are the unequal distribution of precipitation, and the growth of deserts.

Less visible is the sinking strength of the Earth's magnetic field. It is perhaps the gravest sign of the Earth's disappearing capacity for sustaining life. Magnetism is a measure of the distribution of water in the Earth's crust.

This distribution is the necessary coordination of plant life, animal life, and climate on a higher level than in deserts of sand or ice.

"Indirect" functions of potentials.

The important questions are how energy is received, conserved, distributed, and dissipated, by what means it is carried; where it ends, and in what functions it participates.
The ice age is not a part of an autonomous mechanism, as it is one of the functions of the energy distribution, retention, and loss on Earth.
Relative to the long-time cycles of radiation-uptake from the sun, the short-term function of terrestrial buffer capacity has a far greater dimension of its variations. In contrast to the celestial functions, which vary over centuries, it has a perspective of decades.
One hope for parts of the world is the movement of climate zones. Parts of Sahara were green during the last glacial period. In order to withstand the permanent winter, we should know the conditions of climate, and of its changes.
We need a tropical plant buffer of sufficient capacity for producing a global climate on the level of that of the Cretaceous.
If the apparent global warming continues, the ice will be over us. It is not the present warming that is our problem, but the loss of tropical buffer capacity of which it is a signal.
On the level of symptoms, the problem is the unequal distribution of climate. The warming measured is a product of traditional measurements and the avoidance of measuring important energy differences.
It seems that important parameters of energy are not entered into the model, which should not be taken as an independent system of temperature and precipitation.
On a level below symptoms, it is a function of distribution of energy in and by water and magnetism.
The climate defects are the products of the lacking water in the Earth's crust. The measured lowering of magnetism is most probably a product of the unequal distribution of water in the crust and above it.
That water should have distributed the potentials which could have maintained an approximately optimum distribution of plant life. This should not be understood as an equal distribution, but seen in relation to a scale from the tropics to the Sub-Arctic.
The insufficiency of the buffer is the main visible problem of climate. Every range of tropical forest removed shoves us further away from the equilibrium we lost 65 million years ago.
The glaring problem is the sinking amount of water in vast stretches of land which used to have some vegetation.
The problem issuing from it is the ten *per cent* loss of strength of the Earth's magnetic field. This field is the intermediate function between the Earth's physics and its life.
The lack of water in the ground leads to a lack of equilibrium in the magnetic field and a following unstable precipitation.
This problem is decisive for the Earth's present and coming capacity of sustaining life.
Since every monomer molecule part of water in the Earth and in each living being is composed by three atoms held together by the magnetic forces of their orbiting electrons, every water molecule in our bodies will produce its magnetic field; and this field will be coordinated with the fields of the rest of our molecules.
Our molecules will be further coordinated with the magnetic field of the Earth. Thus the magnetic fields of every individual are knit together in a communication system fathomed by the magnetism of the Earth, provided enough water is contained in the local parts of it for not breaking the contact.
This is seen in the prism spectra from the two sides of the window frame.
This could explain our need for being earthed in our houses; and it could make us understand that towns and cities should rather be placed close to the sea or a river than in a desert.
Human health should be a part of the biofunctions influenced by the general magnetism as well as by the local water fields.
I would be astonished to hear that scientific tests of the relation between water, magnetism, and plant cultivation had not been performed.
Water in the ground and in the plants performs the maintaining of climate, as long as it is distributed so well that plants are sufficiently provided.

This is not immediately seen, since the water is needed over a great part of the year, according to soil type, climate, plant species, and the length of the growth season.

The whole of the sun energy received in the tropics is no longer taken care of by the buffer capacity of plant life, *cf.* the great areas of desert and savannah.

The energy is rapidly lost to higher latitudes which often have a small buffer capacity and lose their potentials to space.

The details of the relations between plants, their conditions, and the weather are not immediately perceived. The equilibrium between plants and their conditions over the year may therefore be destroyed for years without being noticed. When the conditions finally collapse, nobody has noticed the decisive details.

The energy saving of the northern spruces *(Picea spp.)* does not add to the climate, as its energy is conserved in the cellulose of its wood and its needles.

The thriving of this needle wood is a sign of the depletion of energy useful for the climate, thus of the approach of the ice age.

Climate anew ?

We cannot recover the equilibrium of the Cretaceous without reforesting Sahara and great parts of Asia and Australia. This should, however, be possible. Turning the climate of the world away from disaster should also be possible, provided we invest the resources needed, very soon.

In case we should be too late in the start of remaking the climate, we should have to re-establish a technological civilisation on new conditions and with a new purpose, capable of producing the technology needed for the rebuilding of plant life over great parts of the tropics and deserts of the world.

In order to make probable some life during a coming glacial period and make possible some life after it, the tropical forests should be restored probably within a century.

With their buffer capacity; and that of a wooded Sahara included, the Earth will need the buffer capacity also of a wooded Southern South America and half of Australia and Asia in order to reach the climate equilibrium that will re-establish the distribution of water needed for the restoration of the Earth's magnetic field and for new generations of plant growth and animal life.

The lower limit of that situation will be the distribution of terrestrial water capable of limiting its variations of precipitation to a range securing a better distribution of water in soil and plants than that which we have experienced in the history of man.

The high step will be the desalting of sea water (36 kg m^{-3}) and its transport to millions of square kilometres desert and a distribution securing the new growth of trees.

The political difficulties of accepting a technical and economic plan are the first hurdles to overcome.

The lower limit of climate first aid will be those arrangements which can secure the Earth's capacity of keeping away from climate disaster.

Already this will comprise the restoring and securing of buffer capacity. The next step will be the substitution for today's grass of plants capable of sustaining the climate.

The greater part of today's critical zones are found in a belt from Mauritania over Arabia and parts of Asia.

We should be happy to have the present surplus of carbon dioxide in the atmosphere. It will be needed for the re-growth of the plant cover.

In order to reach a stable climate, the buffer capacity of the plant cover of the tropics should be greatly extended. For this purpose, the presently augmented content of carbon dioxide of the atmosphere should be welcomed.

The distribution functions of the biosphere are partly working by light, heating and carbohydrate assimilation, partly indirectly through buffers of air, water, soil, and minerals, *e.g.* the greenhouse effect.

The losses by radiation are partly damped by the contents of the atmosphere. The rising amount of carbon dioxide in the atmosphere will be useful for the greater growth of plants, thus augmenting the buffer capacity.

Air and water are transport media as well as the most important buffers.

The importance of plants as buffers is due to their content of water *per* square metre of terrestrial surface, their leaf surface relative to their water content, the air passing, and to the sea washing the algae.

The starting point.

Human activity and the density of grazing animals have lowered the amount of living plant mass to below a critical level; thus, not even the present climate can be sustained unless new conditions are introduced. A conscious reversal is needed for restoring a sustainable energy circulation and a livable climate.

Its parts should be evaluated according to their buffer capacity and role in a future climate capable of conserving enough energy for the survival of plants, animals and humans, as well as the Earth's functions of conservation of magnetism and water.

The constraints on the future participants of life and climate will be stronger than those that brought the climate to its present downfall.

The distribution functions of water are, to different degrees, also buffer functions. They are found in clouds and rain, in the sea, in freshwater, and in ice on sea and land.

The crust of the Earth has shown its content of water and its principal role in Earth's magnetism.

Life is not only the carrier of negative entropy, but the condition of its continuation and of its own continuation.

Negative entropy.

Life is a part of energy system 2. Life is an actor of the negative entropy disregarded by Rudolf Clausius. Life and climate depend upon negative entropy and are its parts.

Since the model of energy based upon the concept 'entropy' excludes from our attention the interdependence of life and climate, as well as the functions going other ways than those of entropy, the model should be extended by the known concept of 'negative entropy':

Die Energie der Welt ist gleichgültig. Die Potentiale der Welt sind meistens im Stoff gebunden. Durch die Sterne wird ein Teil der Potentiale als negative Entropie neuzirkuliert in einer Form, die durch die Generationen des Lebens dauert, und deren Distribution durch das Leben die Fortsetzung des Lebens Voraussetzungen abhängt.

This is written in German for comparison with the dictum of Clausius.

The energy of the world is not important. The potentials of the world are mostly bound in matter. Through the stars, a part of the potentials is recycled as negative entropy, in a form lasting through the generations of life; and whose distribution through life is a condition of life's continuation.

Why not phenomena?

It bears repeating that temperature is not an adequate measure of energy. It is an indicator used for distinguishing states in which it is the only distinguishing phenomenon. When it comes to the energy of a quantity of matter, temperature is but a symptom.

In the case of climate and other energy functions, temperature is not decisive for the underlying function, thus is not the decisive or mainly interesting measure. It belongs to the class of dependent phenomena, or symptoms.

It does not belong to the class of functional participants of a function, called variables.

Between sunshine and the produced life, or the energy lost to space, there are plants reforming energy, more or less completely, to local temperatures and to syntheses retaining energy for a day or for centuries. The energy can be measured as joule *per* kg matter synthesized; and this measure will indicate the efficiency of the process.

Some main vegetation zones illustrate the degrees of the process. A tropical forest sustains a rich life; and temperate needle forests produce up to several kilogrammes of wood *per* square metre *per* year.

The savannah is a cool or cold place at night; whereas the deciduous wood of the tropics and of the temperate zone conserves warmth at night. Compared to the needle wood, its spring is early and its autumn is late.

The limiting variables of plants are a rich combination of duration of energy reception, seen as temperature periods or solar radiation intensity, combined with the provision of nutrition.

It seems to be the common understanding of science that it is founded upon phenomena. The modern version was formulated by Comte[13] *c.* 1840 and by Husserl[14] in the first half of the 20th century.

It was perhaps accidental that Pythagoras' first recorded find was the difference of tone between short and long bars of steel as they were hammered by the blacksmiths. In that case, there

was a coincidence between phenomenon and function.
Plato and his followers for more than two thousand years insisted upon the irreality of the visible and allotted reality to ideas only.
The Platonist Ptolemy perhaps felt like a revolutionary when he described the movement of planets and sun the way they were seen.
His explicit program was to describe the planets' trajectories as circles. He knew they were ellipses; still he described them as combined circles, *cf.* ref. 23, in a trick-conformity to the circle, God's perfect form, according to Plato.
It was the cleric Copernicus who went against his faith and postulated the planetary trajectories as ellipses, which are their real movement. Still, he used Ptolemy's circumscriptive model.
In his model, Johannes Kepler described and calculated the planetary trajectories as ellipses, consistent with reality.

Nonetheless, Comte[13] and Husserl[14] insisted on phenomena as the objects of science. It does not seem clear who should be their antagonists.
Ptolemy, in the second century A.D., had used phenomena in his description of the planetary system.
Reality came with Kepler, who described the planetary orbits as ellipses, which they are.
Phenomena, the apparent, are currently used as the basis of science, and have been so after Pythagoras. This pseudoscientific use causes difficulties at understanding the consequences of theses presumed to be scientific.
Planck, in 1900, found the numerical relation between the temperature of a body and its postulated wavelength of radiation. This measure is indirect, as it is built upon the properties of the instrument measuring the light, thus avoiding the properties of light.

The most serious part of this technical model will be that it also avoids the recognition of life's relation to light.

Kepler and Lavoisier did not create schools based upon the use of functions and their variables, though this use is the only way to avoiding appearances as the themes of science.
What could have been a non-phenomenal object of science? Today, it seems that phenomena are used as an excuse for turning away from reality and its functions, thus keeping science on a level of abstraction away from real functions.
There exists a level of reality and functions of reality not described by phenomena. In the chapter on gravity it was seen that its description as a phenomenon, accepted until now, is not the same as its description based on the potentials of substance, thus on the fundamental properties and functions of matter.
It should also seem clear that the description of phenomena and that of functions encompass different variables and render different results, thus that they are not only formally different.
Climate can be an example of a complex system of data not adequately collected, described, or understood as phenomena or independent data. Their functional dependence is not given or understood from the juxtaposition of data.
Their relations are given as functions of physics and chemistry; and these are both parts of biology.

Can we save the climate ?

The weather is not for saving. If we want to regain a world in which it will be possible to live, even in the future, we shall have to save the climate, not as it is, but from becoming unlivable. We shall have to restore the buffer capacity of the arid areas of great parts of the world. The symptom of its present insufficiency is the sinking spiral of energy circulation of the biosphere. Plant life is the only means for its restoration.
The sun's energy output varies on a far greater time scale than does the capacity of the terrestrial uptake. Relative to this capacity, the variations of the sun radiation are insignificant.

Our problem is not a lowered radiation from the sun, but the Earth's lowered capacity of taking care of the energy received through millions of years and using it for regaining the equilibrium of climate.
If we continue regarding the tropical forests as disposable ornaments to Earth, we shall very soon be lost on a dry and cold globe.
The decisive part of Earth's history which concerns us humans, was the meteorite disaster 65 M years ago. It was the change from a sustainable climate to the collapse of those functions of terrestrial physics and biology that held it away from the destiny of Mars.
They no longer do. There is already too much desert for avoiding the residual collapse of Earth's capacity of conserving a livable climate.
Can we do anything about it? Probably yes, if we start immediately rebuilding the energy retaining capacity of the tropical forests, and building a forest in Sahara and other deserts.

Heat is not the same as energy. Energy and its intermediate storing are the factors of climate. Relative to energy, the differences of temperature are but signs of something happening.
Different amounts of energy are retained as potentials in different kinds of matter, *e.g.* soil, water, and air. Their varying property of retaining potentials is expressed as specific heat capacity.
This varies, *e.g.*, between water (4·18 kJ kg^{-1} K^{-1}) and air (1·01 kJ kg^{-1} K^{-1}). The density of air is 1·293 kg m^{-3}, giving it an energy capacity of 1·3 kJ m^{-3} K^{-1} at 273 K. The energy capacity of water vapour is 2·018 kJ kg^{-1} K^{-1}.
Energy is a transferable property, consisting of the release of a potential. Temperature is a partial measure of the release. In the measure of temperature, the relevant measure of energy is not included.
We do not live in a crisis of global heating, but in a crisis of retaining and distribution of potentials over the globe.
The deficient buffer capacity of the tropics has deprived them of much of the power of retaining potentials. More energy than Earth and life can afford is displayed in subtropical, temperate, and sub-polar regions.
The following loss of energy has, on its way, not served the conservation of climate.
The extension of desert through the last few thousand years is followed by a lowering of the ground water, and by a weakened magnetism of the Earth.
Today, great parts of the Earth are deprived of water as a participant in magnetism and plant life, and thereby in the climate.
It is possible that the presence of Sahara as the only desert was not sufficient for the deterioration of the climate and the production of new deserts. The present state of climate, however, is that the desert area has grown through the last three thousand years.
The present distribution of rain and ground water is so unequal that we are living in a perspective between rain and desert.
We see that something has happened to the weather; but its functions and their parameters have not been sought well enough for indicating its restoration.
Sunlight delivers the energy needed for sustaining life, and through life, the climate. Life is the mechanism of climate sustenance. The density of plants is decisive for the capacity of retention of potentials, thus for the continual conservation of climate. Plants have different capacities of retaining energy, thus are actors of different quality relative to climate and its conservation.
It is probable that the prevalence of great reptiles was an important part of the conservation of the climate during the Cretaceous. Reptiles consume 2-4 (between two and four) *per cent* of the energy needed by mammals, relative to their weight, *cf.* ref. 70.
This implied that the survival and vivacity of reptiles were sustained by small amounts of plant mass compared to those needed by today's grazing mammals.
These even consume nearly the double amount of grass relative to their need and the total nutritional value of the grass.
The grazing animals need the assistance of bacteria for extorting fifty to sixty *per cent* of the energy content of their plant food.
The browsing reptiles left a potential of growth and energy retention in their living food plants, while today's grazers eat to the ground and transgress the plants' limits of energy retention and capacity of re-growth within a time securing a level of climate.
The fundament of the climate crisis was laid 65 M years ago. The crisis became manifest with the ice period 37 M years ago.
Later ice periods came during the last two to three million years.
Their traces are seen in geology. The catastrophic fall of average temperature during the last few million years[66] has not stopped.
The recent heating is not general, as it consists in a loss of energy from the tropics to the temperate and cold regions. The loss is masked and misinterpreted from its corollary, the rising temperature of higher latitudes.

The connection between that catastrophic fall in temperature, its causes, and its consequences, is the lack of adequate buffer mechanisms, as well in the tropics as in the temperate regions.
The main cause of the temperature fall is the deficiency of the plant cover. Added to this is the too small amount of water in the most common plants of the terrestrial surface between the equator and the Sub-Arctic.
A long-term deficiency is that of water in the Earth. The drying up of outer parts of its interior is a product of lasting deficits of plant cover and precipitation. The deserts are cold not only for losing heat as radiation, but also for having depleted their stored heat in the evaporation of ground water.

In spite of this, there is a sinking amount of water in the atmosphere. The sea level is rising at Venice, but the rain is not falling where it is most needed.
It will be seen that climate is a product of life. Living plants are the important parts of the biosphere receiving sunlight and participating in the functions of negative entropy. Plants depend upon other life for their thriving. They are insects, browsers and grazers for the spreading of seed and circulation of minerals and energy.

Tropical forest is the adequate plant cover of the tropics. The rising sea level shows the loss of water-binding plant cover, *cf.* the deserts.
The conservation of the existing tropical forest is most necessary, though not sufficient for the buffer. A further capacity should include extension of tropical forest and broad-leaf wood.

The desert area has grown in historical times. Ground water and magnetism are sinking.

The conditions of climate are approaching a level which will not permit any amelioration by human interference. Producing changes of climate seems, though, still possible.

It is technically possible to produce desalted water for the irrigation of Sahara and other deserts, if agreement and funding are procured.
A partial solution could start with a better distribution of water. It would avoid the distillation of sea water; but it would demand logistics for the transport of river water.
The problem of a partial solution would be that the exchange of plants would not be broad enough; and the lack of water would be permanent.

Turning the climate ?

The sea and air currents around the Antarctica reduce its biosphere interaction with the tropics.
The measured higher temperature in parts of the Earth is not an adequate measure of their energetic conditions.
A question concerns the producing conditions of biochemistry and climate. Another question concerns the relation between food as chemical conditions and the animal and human physiology as products.
They are related through the food plants' small mass and the common vertebrate metabolism, dating from the Cambrian, more than 500 M years ago.
Relative to this common metabolism, the new amino acids of the Tertiary have inflicted grave disturbances upon physiology, psychology, and social life.

Climate is the visible side of the energy retained by life in the biosphere. Turning its negative spiral into sustainability will rest upon several conditions:

1. The greater part of the tropical deserts should be reforested.

2. The greater part of plant cover over the Earth should consist of a certain minimum of plant mass *per* square metre.

3. Most of the grasses should be excluded from any future place in the world flora, as their plant mass and water content are too small for sustaining any climate level.

4. Some species of *Picea* and *Abies* have a negative climate energy account and should follow the grasses out.

The conditions of health and climate are coincident. The health of grass-eaters, their predators, and humans is impaired by the composition of amino acids of the grasses and their seed.
The biomass of the grasses is too small for maintaining the equilibrium between energy retention in the plants and the loss of energy from the terrestrial surface occupied by them.

This is not an irremediable situation, since gene-modification and plant reproduction are known methods. New knowledge is needed for finding the relation between grasses' content of new amino acids and their consequences for health and life. The relations between their compounds and the human diseases now referred to civilization or autonomous spontaneity are beginning to be understood, *cf.* ref. 29.

For the evaluation of temperature changes, we should remember that temperature alone has a limited significance. For comparing temperatures, we should know the quantity of matter which has the actual temperature; and what is its specific energy capacity. *cf.* p. 184.

Conditions of hope.

With a smaller energy account for the Earth we ought to diminish the losses. This is not the whole problem. We can see the rise of temperature in one place as a transmission of energy from a place where it could have been used for a better purpose. When the corals of the Great Barrier Reef to the East of Australia are dying in warm water, the energy is taken from the driest parts of Australia.

The sparse vegetation in those parts makes the continent a climatically cold region. Half of its 7·7 M km^2 is covered by desert and barren land. It is one of the loss factors in the energy balance of the Earth.

The loss is augmented by agriculture, since the cultivated land is partly under grass, partly bare for much of the year. Part of the energy is lost by heat radiation, and part is lost in heated air or water, *e.g.* moist air.

Sahara and the other deserts lose energy as radiation from the ground. The cooling of the air and its transport from the continent are functions of this radiation, as it produces a sinking airstream over the continent. Its high-pressure is permanent in Sahara, while in Australia it varies over the year.

Energy can be felt as heat when on its way to be lost. Instead of letting it be lost from the pole regions, we should learn to manage it. Much of the energy heating the sea comes from the land, since the buffer capacity of the land is sinking as the loss of forest.

Climate is now believed to include an automatic changing between glacial and interglacial periods. This is not founded. There was one glacial period between 65 and *c.* 2 My B.P. and a series of them afterwards.

This distribution should include at least one function of energy.

The heating, commonly presumed to be global, seems now to be understood as a sum of phenomena freely interpreted as if no physical function should be involved in their production or distribution, except the sun's variation of radiation and the air's content of CO_2, *cf.* the present campaign against global warming and release of carbon dioxide.

The heating is not general, nor an autonomous change of temperature. The heat measured is a transient of energy lost from the tropics, since their buffer function is impaired.

The greater quantity of CO_2 in the air will be needed for an extended plant growth.

The climate is a sum of energetic and quantifiable functions. A model of climate will have to include energy. Climate is not autonomous, though it is regarded today like a cloud cap over functions not searched.

Functions of energy, like its transport and buffering, are parts of climate's role and ways.

It is possible to manipulate these ways provided we know them and are willing to use resources for influencing them. The resources should include agro-engineering for making the climate more stable and avoiding an ice age.

Removing trees has, through history, been seen to remove the rain. New trees will bring new rain, if they are planted in sufficient numbers and get enough water for growing.

Waiting for the next ice age to come is a fatalistic lack of will to caring for the conditions of life.

It is possible to establish an insight into the functions of a complex, even a multifunctional whole. We can avoid a catastrophe.

The apparent heating of the globe is a partial heating by energy on its way to be lost.

This is a part of a serious problem, which is the loss of a critical part of the Earth's most precious property, its tropical buffer capacity.

The energy heating the sea is partly taken from the sunshine, partly from the land, since the terrestrial buffer capacity is diminishing as the loss of tropical forest. This is seen in the critical heating of shallow sea habitats, *e.g.* coral reefs.

We may have the choice, on behalf of life, between trying to turn conditions into supporting life, and letting changes come to life while we observe its theatre like the Romans observed the dying gladiators.

Most of the energy heating the temperate and Arctic zones today is lost from the central part of the Earth's precious energy capital, its tropical and subtropical buffer capacity.

If this heating had taken place by means of a surplus from the tropics, it would have been the normal part of distribution of energy.

Amazonas is the only great region of approximate tropical normality; and it is the source of mild summers in North America.

The general heating of other temperate and sub-polar regions is, however, produced by energy from tropical regions whose buffer capacity is deficient or lacking, *e.g.* Sahara.

We should begin to take care of the tropical energy and restoring the plant regions' capacity for keeping it at work during its passage from the tropics to the Arctic.

If we do not, very soon, start rebuilding the tropical buffers, we have already started on the road to emulating the cold of Mars.
Our guilt is, though, partial. The human race is not responsible for what happened before it existed. But our possibility of producing correctives is greater than our part in the problems. It is limited only by our will to extending our insight and using resources for saving the Earth from the cold. By intruding unwittingly into functions of the Earth, we have extended our responsibility. This started with agriculture twelve thousand years ago. Maybe we do not have the means for repairing the climate. We have, though, the resources for their development; and we cannot undo the knowledge of the problem, its mechanism, or our guilt in its rapid extension.
We even have an interest in a continued life on Earth.

Food and metabolism.

The pervading food problems are the lack of adequate enzymes in grazers, seed and grain eaters, and in their predators. The problems are the conditions produced by the proteins of the grasses that are not broken down to single amino acids through digestion.

Only the single amino acids are compatible with the metabolism of humans and the concerned animals, which is their plurality.

Vertebrates are suffering from this situation. We do not know all the details of the proteins' way from the grasses to the grazers' and seed eaters' brains. A short way is that of the earth worms' food from grass to their metabolism.

We are ignorant of the metabolism of the earth worms, though we know the paranoia of their predators, the shrews (Soricidae).
Unlike the earth worms, we do not eat the grasses, only their seed.
Like the shrews, we eat the grazers. The cows are descendants of animals which, like us humans, acquired their metabolism more than 500 M years ago. We eat the seed of the grasses and the meat of the grazers.
Our digestion was formed from that of the monocellular animals a long time ago, maybe more than one thousand million years.

It was modified during the Cambrian, when three groups of animals were developed, by lack of choice, into the three classes of calcium-users.
Carbonate developed the Mollusca, sulphate developed the Arthropoda; and phosphate developed the Vertebrata.
Each of the groups developed its own system of chemical treatment of the digested food, the metabolism. Our cells, which shelter complexes of functions, still depend upon the correct food, by which they were developed more than 500 M years ago.
Any deviation brings disturbances. They are clinically seen as dysfunctions or intoxications. The cell-internal dysfunctions are not primarily related to specific causes of our days, but for essential parts to the sequels of iridium.
In medicine, the symptoms are treated, while the biochemical defects are mostly untreated.
In addition to reversing the negative spiral of energy circulation, the gene-modifying of plants will be needed in order to adapting them to the metabolism of humans and grazers.
With the aid of bacteria, the grazers have developed a digestion adapted in some degree to the conditions of the Tertiary.
Their metabolism is a product of heredity and cannot be adapted to external conditions.
Horses, rhinoceros, and elephants take most of their energy from the cellulose content of the grass and wood they consume. Most of their digestion takes place with the aid of bacteria in the caecum; and it is ended after 48 hours, when 45 *per cent* of the nutritional content of the food has been extracted.

Artiodactyla, except swine *(Suina)*, are ruminants, from the small dwarf musk deer *(Tragulus)* to the giraffe *(Giraffa camelopardalis).* Their bacterial digestion takes place in the rumen; and it takes 80 hours for extracting 60 *per cent* of the energy of the cellulose of the food.
The plants also contain proteins in variable proportions. In the plants of the Tertiary, seed seem to contain the greater proportion of proteins, while the leaves of the plants of the Cretaceous must have been a rich source of proteins suited for the animals.
Their browsing made them grow to dimensions not seen from the Tertiary or Quaternary, except in whales.

The proteins offered from the plants, however, are not the same today as those offered during the period from *c.* 530 to 65 million years before the present. This implies that the metabolism, which is the cellular continuation of the extracellular digestion, is no longer compatible with every product of digestion.

This is due to the development of metabolism during the Cambrian, when the fundamental characteristics of the three groups of new animals were formed. The mussels, crabs, and vertebrates have different properties of metabolism, as well as of anatomy.
Metabolism has been conserved by heredity. No change of conditions can change the expression of heredity. The functions of cells were apparently not challenged during that period of *c.* 465 M years. If they were, the species challenged disappeared without traces.

New food, same metabolism.

The disaster 65 M years ago was more than a challenge. New proteins were produced in the plants exposed to the toxic iridium. The new amino acids were changed to the extent that, in their new combinations into proteins, they were not separated from each other in digestion like their fore-runners.

As metabolism is formed by genetics, not by external changes of conditions, the digestion was from then insufficient by producing proteins alien from the metabolism of the animals.
The heritage is expressed through the enzymes. It was formed in life long before the multicellular animals were aggregated from mono-cellular life, probably rather two than one thousand million years ago.
The great difference for plant eaters and their predators was made by the grasses. They are products of iridium's gene-modifying and toxic effects, changing the heredity of many plants.
The grasses are believed to have been developed from the order Liliales. To this order belong plants of different degrees of toxicity. A gene-modification is a normal product of the toxicity of iridium and, *e.g.*, mercury.

The grasses were new after 65 My B.P. They survived because they contained little water and could proliferate at low temperature. They were one of probably many products of gene-modification by iridium; and they were a hit of an adaptation to the cooler and drier climate.
These new plants circulate less energy, as they are much smaller and grow better at low temperatures than the surviving plants of the Cretaceous.
This adaptation precludes that higher circulation of energy which could have augmented the total buffer capacity and raised the average temperature of the globe.
The deserts, the grasses, and the lack of forest are the impediments to a sustainable climate.
Iridium produced a decisive change in the conditions of mammalian life by changing the proportion of cellulose in some plants at the cost of the composition of their proteins.
These gene-modified plants were capable of surviving under the harder conditions of the Tertiary, when the climate became dry and cool because of the destruction of a great part of the plant cover of the Earth.
A specific teaching from that change, which has lasted for 65 million years, is that the new amino acids from gene-modified plants are not followed by a change of enzymes for the digestion of the new proteins.
The toxic effect is a lasting discord between food and metabolism as it is expressed in the details of bodily functions.
Neurons and brain seem to be the organs bearing the brunt of the gene-modifying. Compounds of the amino acid glutamine are not dissoluble in water, but are fat-compatible, thus they will adhere to nerves and cross the blood-brain barrier.

Alzheimer's disease, with its plaques on brain nerves, is the most conspicuous of the organic sequels, even before death.
The fat-compatible amino-acid compounds. *e.g.* the composites of the common amino acid glutamine, are dissoluble in alcohol, which, in washing them partially out of the nerve system, produces its own problems by dividing tetramers of water.
Inflictions upon the nerve system, probably from un-metabolized proteins, are seen, *e.g.*, in lions, while the food-conserving wolverenes and hyaenas are enduring.

'Conserving' is not the best concept for what takes place, since the process in the meat is the activity of enzymatic autolysis.
The enzymes are *post-mortem*-active in all living cells. They dissolve the former active parts of the cell's metabolism; and this is the important precursor of digestion.
When the predator cannot produce the enzymes needed, its metabolism will depend upon the autolysing enzymes of the food.
This is the reason for wolverenes' storing their killed animals and for the weak salting and curing of fish and meat in Northern Europe, *cf.* ref. 68.
The changes of heredity of the plants after 65 My B.P. brought changes of their biochemistry, thus of the food to which grazers and their predators were exposed.

The outcome for the grazers, the seed eaters, and the predators, us humans included, has been that these changes are not compatible with the hereditary conditions of metabolism, as this was developed more than 500 million years ago, *cf.* the following diseases.

Discrepant food, or discrepant eaters ?

Possibly eight to ten million years ago a group of the climbing animals which had been quiet and inconspicuous inhabitants of the remnants of tropical woods, were separated from their main habitat in Eastern Africa for several million years. The known geological changes included a separation of the present mountain range Danakil as an island for five or six million years.

Alister Hardy was a young marine biologist who saw a possible connection of environment and development between the human subcutaneous fat layer and that of marine mammals. His colleagues made him keep silence on the subject, which he then did for thirty years, for the sake of his career.

Hardy's tardy publication[50] of the theory of man's separation from the apes and development into a separate species in a marine environment did not become a breakthrough, in spite of a broad and well-researched support, *cf.* ref. 71.

The traditional theory of man's development on the savannah is deficient by not explaining *e.g.* the development of the brain or the respiration control.

Tertiary food and its inflictions on the human brain and nerve system give a perspective to a possible brain development without the food based on grass or its seed.

During the period of isolation the apes ate what they found on the shore and in the sea. In the trees, they had been living from leaves and fruit. The closest to this food was species of the seaweed *Fucus*. These do not have the protein complexes of seed; but they offer a choice of more than forty elements.[76]

Through the millions of years, those apes acquired a heat conservation by their new subcutaneous fat, which otherwise is known in marine mammals.

By holding their breath under water, they acquired a breath control known in whales and seals, but unknown in terrestrial animals other than man. Our speech and song depend on it.

Our walking on two legs was at first an adaptation to stretching our back and legs in swimming and food search. Our brain was an adaptation to drinking cool water, *cf.* above.

It is well known among teachers that children who have not been crawling as babies are handicapped at learning to read. The under-water crawling was combined with a need for distinguishing the vital details.

Our biological clock, our un-influenced rhythm of waking and sleeping, is close to 25 hours.[72] Life on the sea-shore was defined by our relation to Sun and Moon. Our circadian rhythm is the product of millions of years of searching for food at low tide and in daylight. Every second low tropical tide comes during the day, nearly 25 hours after the former daylight ebb.

The sea life and its food was the condition separating humans and most mammals. Like all evolution, ours was an adaptation to conditions for which we were not prepared.

The brain grew until a range of sizes, which was reached two or three M years ago. Its absolute size is less important than its capacity of abstraction and combination.

What seems to be most important is its lacking of turning in on itself seen in the societies of seed eaters. This turning in has now become the characteristic even of human societies together with agriculture, *cf.* ref. 69.

The brain's capacity and complexity grew as long as proto-man was developing. When the developed human changed from sea-food to grain and the meat of grazing animals, his brain stopped its development. During the last twelve thousand years of agriculture, its food products have inflicted cultural diseases upon us.

The problem is the food's conflict with human conditions and with protein physics and chemistry.

The compatibility between seed and metabolism is low, *cf.* the ensuing diseases.

One of them is pervading, but has not been found in every people. It is schizophrenia, which was not found in a people not consuming grain.[69] The human metabolism depends upon our Cambrian digestion.

The explanation is found in the toxicity of the fallout from the meteorite of 65 My B.P. Its content of iridium modified the genes and chemistry of plant life so that no animal was capable of metabolizing the new proteins.

Since these are not compatible with our metabolism, they are not metabolized; and they are inflicting dysfunctions upon our blood, nervous system, and cell membranes.

They produce pervading traumas in the grazing animals and their predators. As we humans live mainly from grain and the milk and meat of grazers, we are massively exposed to the poisonous effects of the grasses' content of the new amino acids and their compounds.[29]

The problems are not bound to grasses only, but to seed in general. Plants' seed are resistant to the environment of the alimentary canal of the plant eaters. The episode of its passage is the second most important in the life of a seed: it should not be broken down.

Our treatment of grain by grinding and heating may have some influence on our digestion, but not on our metabolism, as the protein complexes of seed and grain are not exposable to mechanical separation.

It is known that compounds of amino acids are broken down at 360 kPa and 140 ºC. This implies that a great part of our consumed food has not been exposed to conditions permitting the release of the whole of its energy. The amino acid complexes not broken down cannot serve their social purpose as food.

They are, though, biochemically and physically active, to our detriment, as they hamper neural activity. The problems are several, *cf.* ref 29.

1. Polymers of amino acids augment the osmotic potential of the blood above the normal relative to the cells, dehydrating the cells and lowering the communication between blood and cells. This hampers the cell functions. In the brain, this produces megrim *(migraine)*.

2. The new amino acids (after 65 My B.P.) whose compounds are not dissoluble in water, *e.g.* glutamine, are not adaptable to our metabolism unless dissolved in alcohol, after which they are partially adaptable.

3. Fat-compatible amino acid compounds cross the blood-brain barrier and adhere to cell membranes.

4. Amino acid compounds adhering to the phospholipids of our brain produce Alzheimer's disease.

Humans have varying preferences. Some people prefer an odourless food; others prefer not being deadly tired after the meal.

In the Faeroes, sheep meat is left hanging outdoors in the damp air for months, and then eaten as it is, with algae on it, *cf.* ref. 73.

In Norway, surface-salted herring and sheep meat are still hanged outdoors over the winter for autolysis and drying; and it is eaten as it is.

One hundred and fifty years ago, Norwegian food specialists and medical doctors agreed that the habit of weak salting of fish should be the cause of leprosy.

Before that, the fishermen ate their weak-salted saithe (also called pollock or black cod, *Pollachius virens* or *Gadus virens*) unboiled, with great appetite, while the visiting sociologist (one of the pioneers) hoped that they would accept the medical wisdom and stop eating the fish emitting the rotten smell.[68]

The same procedure of weak-salting is still followed in the inner parts of Norway for conserving trout *(Salmo trutta)* and other inland fish. The campaign for ending the tradition did not reach the inland, as its basis was the medical authorities' belief that the weak-salted fish should be the cause of leprosy, which was not a plague of the inland regions.

Mycobacterium leprae was identified in 1874; but by then the campaign for heavy salting had been successful.

Weak-salted and autolysed fish is not finally described by its smell. The taste of the autolysed fish carries no trace of it. It is not strong, but extremely delicate.

Today, the highly estimated "rak-ørret" is served at formal occasions. It has its name, "wet-trout", from not being dried, the way fish was conserved for storing or sale.

Salting took a long time to reach Norwegian fish, as the salt should be imported from Southern Europe or boiled locally, while the cold winter was ideal for drying the fish.

Wolverene, the spotted hyaena, and the bear certainly discovered by themselves that they gained a greater perseverance by eating the cured meat.

The fishermen at Haram preferred the cured fish, as the fresh or salted fish gave them a disagreeable feeling after eating.[68]

The difference is one of the contents of the blood, which cannot defend itself against the products of the digestion. The following part of the procedure, the metabolism, takes place in the cells; and the blood is the transport medium between the extracellular digestion of the intestine and the cells of the body.

When there is a lack of correspondence between the food and the enzymes needed for its metabolism, there will be a surplus of peptides in the blood.

A lack of single amino acids inflicts its specific defects, like soft bones and skin.

The residua of un-metabolized peptides produce obstructions in the transport of the blood as well as a high osmotic potential, inflicting a lowered communication between blood and cells, in addition to a lowered fluid pressure in the cells. This is heavily felt as megrim.[29]

On the present conditions, autolysis is the best preparation of food for our metabolism.

Seed and metabolism.

It is possible to combine two purposes by extending the plant cover of the Earth with forest and selected plants. The first is to change the present sinking spiral of terrestrial climate into a sustainable climate. The second is to obtain a plant cover compatible with the metabolic condition of humans and today's grazing animals. The plant cover should be significantly more extensive than the present, and compact enough for its two purposes.

We have to live mainly from the production of the plant cover, for a small part aided by the products of the sea. We also have to live within the climate energy sustained by the plant cover, our climate producer. Its energy from sunlight produces plant growth, animal life, and bacterial break-down of matter in a perspective of a week or a century.

The energy level of the perspective should be stable in order to secure the stability of the process. A sinking or rising spiral of energy conversion, seen as changing temperature, will introduce new conditions and threaten survival.

The implied perspective is large. On the one hand, the hot-water life was primitive and changed fundamentally after a drastic cooling. On the other hand, the function of our neurons breaks down when our fever reaches 42 ºC.

The climate's secular variations caused by solar radiation are insignificant relative to tropical grazer's depletion of the grass and the dwindling buffer capacity of the tropical forests.

This buffer capacity is the main and residual function producing and sustaining the climate. This takes place at any level of received radiation energy from the sun, within a wide frame of variation.

The solar radiation is not the finally decisive factor of climate. The variations of the sun's radiation during a million years are small compared to Earth's potential of secular variations of buffer capacity, thus its retention of energy and maintenance of a livable climate.

In order to turn the negative spiral of climate energy, *cf.* ref. 66, it is necessary to extend the plant cover of great parts of the Earth and to augment its plant mass relative to the area covered.

This double purpose can be combined with an extended cultivation of gene-modified plants containing amino acid compounds suited to the metabolism of humans as well as to that of today's grazing animals.

The grazers, developed around 55-50 My B.P., have, with the aid of bacteria, got a digestion workably adapted to the Tertiary conditions.

The next step in the passage of the food in the organism takes place in the blood, which distributes the dissolved food to the cells.

The cell process is the metabolism, which was formed by the conditions of the Cambrian. These conditions were changing during the 70 or 90 million years before 500 M years B.P.

The change relative to life was produced by the periodically up-welling lava from the sea-bottom volcanoes. Life was remade into strongly mineralized functions. It was divided into the groups of carbonate, sulphate, and phosphate metabolism, which made different animals live on specific chemical conditions.

There is no tolerance relative to these conditions. In order to make metabolism work, digestion should deliver what metabolism needs. Our present condition is that there is no conformity between the Tertiary digestion and the Cambrian metabolism of animals or men.

The human digestion seems to be unequally adapted. Our Cambrian metabolism is not adapted to the products delivered from grass seed (grain) or to the meat of grass eaters. The grasses and their eaters did not exist till around 60-55 M years ago, but today are the two main sources of our energy.

There is no hope of adapting the old metabolism to the present external conditions.

The defect calling for attention is the lack of enzymes for an adequate metabolism. The amino acids offered from the food are not all those needed; and others are accessible in noxious combinations only.

On a grain-based diet, the amino acid lysine is in short supply; and another, glutamine, inflicts dysfunctions upon us, as its compounds are dissoluble in alcohol only, while our biochemistry mainly takes place among watery solutions.

Fat-compatibility, thus solubility in alcohol, is the exception leading to the brain, since the blood-brain barrier is a shield of fat.

Enzymes are the key to metabolism. They are composed of amino acids, which are needed in single form in order to be useful for their building. Enzymes are needed for the production of new enzymes.

The situation does not fulfil the conditions. The lack of an adequate enzyme repertory follows any gene-modified food. Our enzymes follow our genes, not the food we are offered.

What we call enzymes today should have been that part of the biological prime matter not condensed into the compound which became a part of the living cell. This is hinted at by the transition from pre-Cambrian hot-water biophysics to Cambrian biochemistry.

At some time early in the Tertiary, the surviving animals were offered food from the new plants; but even the new-developed grass eaters were incapable of living directly from the new plants. Their enzymes had been developed earlier and under other conditions.

This incompatibility has followed life for between fifty and sixty million years. The digestion of ruminants and horses is lacking enzymes for the digestion of grass proteins.

The help received from bacteria has not been sufficient for adapting digestion and metabolism to the animal physiology.

A complete breaking down of proteins to single amino acids would have made them soluble in water and compatible with the metabolism of higher and lower animals.

This complete breaking down is not seen in animals, insects, plants, or fungi, *cf.* the toadstool *Psilocybe*, which lives on cow dung.

Fat is the defence of the brain. Some compounds not exposed to the adequate enzymes are fat compatible and enter the brain, where they make havoc. The plaques seen after death from Alzheimer's disease[65] are deposits of such compounds.

The pre-human life on the stony sea-shore, urging the brain by demanding the steering of eyes, hands, and fingers in the collecting of algae, mussels, and snails, was the long holiday giving humans the perspective exceeding that of his ape brethren.

The change of brain functions was not well sustained by the menu of the woods and savannahs, though, after a couple of another million years, just sufficient for understanding some of the brain's possibilities.

The fat-compatibility of the glutamine compounds lets them cross the blood-brain barrier. This and connected problems are the theme of ref. 29.

Glutamine also has the unlucky property of forming insoluble polymers by bonds between aldehydes.

The problems still arise for the grazing animals, their predators, and for us seed eaters. The problems follow because the protein components of the plants are not decomposed to single amino acids in digestion.

A lack of single amino acids accompanies compounds not broken down because some single amino acids are not present for the building of enzymes according to heredity.

Our genes do not comprise those needed for the building of all enzymes we need for the metabolism of the new food. The outcome is that protein compounds circulate in the blood and are deposed in tissues and blood vessels.

This had led to pervading and permanent dysfunction and harm, like *mb.*Alzheimer and schizophrenia.

Some animals have discovered that the autolysis of dead tissue performs a part of digestion which living mammals cannot perform. Wolverene *(Gulo gulo)*, dogs *(Canis spp.)*, and bear *(Ursus arctos)*, among others, store their food by burying it for weeks or months, depending upon temperature. During this storing, the enzymes of autolysis dissolve proteins not dissoluble through digestion.

Seed from many plants contain poisons serving their conservation, *e.g.* cyanide. Even without specific means of conserving, seed will resist decomposition for the time between autumn and sprouting.

Seed are not adapted to metabolism; nor is digestion or metabolism of plant or meat eaters made for treating seed.

There is no reason to suppose that the purpose of seed should have led to premeditated properties. Seeing them as products of development could be the simplest way of understanding them. The plants producing seed capable of repeating their properties will have the success of survival through several generations.

Peptides from grain, nuts, or other seed are not acceptable parts of our food, as they hamper our brain functions. They are a problem adding to our lack of understanding. We see the properties and purposes of seed:

1. They should conserve the heredity.

2. They should be spread directly to the soil or by eating without digesting.

3. They should not be digested or otherwise lose their property of transmitting the heredity.

4. They should resist frost and heat.

5. They should sprout under definite conditions of temperature, humidity, and chemistry.

Digestion's task is to prepare the food for metabolism. That which is not completely digested will thwart functions in all organs reached by the resulting compounds.

The purpose of digestion is contrary to that of seed.

Seed is made to resist digestion.

Some plants produce small seed in great numbers; and they are inconspicuously made for fast sprouting, as they seem to be without the quantity of matter necessary for survival through a winter. Among them are the seed of fireweed *(Epilobium angustifolium).*

Fruits are for eating, but their seed are not: apples, plums, apricots, figs, pears, and mango are made for eating, but not their seed or nuts, almonds, walnuts, *etc.*

The plant species whose seed are most resistant to destructive conditions, will survive through the longest period. Grass and grain will survive even in the North. Seed or grain is made for eating, though not for digesting. Chewed or ground, they release proteins not made for being broken down to single amino acids in digestion.

Even if some kind of seed should be without a specific resistance to digestion, we should have a better life without a seed-based food, since the complexity of seed proteins exceeds the enzyme capacity of our metabolism.

Amino acids from the grass family (Poaceae) leave amino acid complexes in our metabolism as well as in that of grazers. Those compounds are not digestible by animals and enter the blood whole.

One of their afflictions is megrim, whose physical condition is the augmented osmotic potential of the blood.

This elevated osmotic potential will draw water from the brain cells and lower their internal potential. The outcome is a heavy and long-lasting, one-sided headache.

I was incapacitated by megrim until I was made to understand its mechanism[75] and changed my diet around twenty years ago.

More common is the blood's higher viscosity, demanding more energy for its transport, leading to an elevated blood pressure.

Food, energy and climate.

During the Cretaceous, trees and bushes covered a great proportion of the green parts of the world; and the browsing animals most probably had a better health than today's grazers.

Several functions were active in producing the climate. The plants' forced accept of calcium, and its presence, were necessary conditions.

Today's reptiles take a sun-bath every morning in order to raise their muscle temperature to a functional level, mostly in the range 20-40 ºC, *cf.* ref. 70.

Food consumption of ectothermal animals is 2-3 *per cent* of that of endothermal animals.[70]

One specific function, to which we cannot return, was the buffer function of the reptiles of the Cretaceous. For their motility, they would rely upon a certain body temperature. Without a great ingestion of energy from food, they could, by means of the sunshine, participate in the maintenance of the climate. They were parts of the buffer function of their habitat.

A similar function could not have been established on the savannah of today. The food energy cost of maintaining the body temperature of grazers is 30-50 times that of reptiles.[70] Relative to the climate, the energy consumption of reptiles is nearly insignificant.

The relation between the grasses' limited capacity of energy conversion, their low water content and high tolerance for low temperature, lead to their low buffer capacity and a cool climate.

Relative to the productivity of the savannah or prairie, the energy consumption of the grazers is too great for the maintenance of the plant production level, though not high enough for retaining the potentials and producing the heat needed for maintaining the climate.

In regions receiving rain energy from tropical low pressures or from residues of tropical forest, the climate is now maintained by external energy.

In this respect, North and South America, and Western Europe, are favoured by the rain from Amazonas.

The state of the climate is dominated by the too small water circulation in the biosphere.

The heating observed is not significant for the totality of climate. Regard should also be had to the great regions heated without the addition of water, or with a small precipitation, and to the great regions of sparse plant cover.

Those regions cannot participate in a distribution of water sufficient for maintaining the extension of plant growth and quantity of plant mass needed for the bio-circulation of water and for maintaining the climate energy.

The sufficient level is that produced by a quantity and density of plants great enough for securing a distribution of water in the soil and plants over the greatest part of the land, mountains excepted; deserts not excepted.

The solution compatible with sustaining the climate and with the needs of mammals and plants, is the re-planting of desert and savannah with perennial plants of a minimum mass, and a leaf surface perhaps thirty times that of grass.

The fact that the first glacial period after the Cretaceous came 28 M years after the catastrophe, indicates that the surviving vegetation should have had a good buffer capacity. This could have been a part of the survival of some tropical forest.

The age of the forest of Amazonas has been estimated to 100 M years. This estimate could be prior to the knowledge of the time of the catastrophe. Regardless of this, the remaining buffer capacity of the tropical forest should have been great enough for postponing the glacial period.

Still, so much of plant life was destroyed that the cooling of the Earth continued.

During the recent two or three M years the drying out and cooling have been approaching a point of no return, if not checked before the glacial period is manifest, or the desert is pervading.

This could be the end of life as we know it. Subglacial bacteria is a life alternative of low interest. Our time may be closer to its end than we appreciate. Ducks and swans not nesting and fruits not maturing are Nature's warnings.

The weakening of the Earth's magnetic field signals that the water of the crust is seriously depleted. This is a part of the drying out of the terrestrial surface, seen in the spreading of deserts. This signals that the Earth is on its way to giving up a role in the sustenance of life.

During historical times, a few thousand years, great stretches of forest and cultivated land have become arid. Ruins and former cities are seen from Mauritania to Mongolia.

This shows that precipitation reaches an ever smaller part of the Earth. Probably, it is also lower in sum than it was a few thousand years ago. The sea level is probably higher than at most times.

The variations of sea level are ascribed to the prevalence of glaciers. This is partly correct, though an insufficient explanation, since it excludes the relation between the rain and the rising amount of water not circulated.

The amount of water circulated as rain is seldom mentioned. When it is not falling, it is found in rivers, in the ground, in plants, and in the air. This amount of circulating water is probably lower than ever before.

A lower and more concentrated precipitation shows that less water is used for life's buffer capacity, as a greater amount of water does not carry a potential received for evaporation and liberated in condensation.

The buffer capacity of living plants is the most important part of the climate.

A well distributed plant life and its circulation of energy on a high level are the indispensable conditions of conserving the climate. A deficiency of any of its conditions is sufficient for its downfall.

From a desert the potential is lost. The tropical forest can maintain a level of climate by means of its plant and animal life, as long as it has a certain quantum and density of biomass.

Its role as a climate buffer for regions outside depends upon its size and level of energy circulation. Amazonas and Equatorial Africa are probably the only regions of some size which have a surplus of climate energy for sharing with their neighbouring regions.

This presupposes equilibrium between buffer capacity and other conditions. When the buffer capacity is too low, the energy is spread to the neighbouring regions by water and wind, and dissipated from them. This is seen as an unexpected rise of temperature in high latitudes.

Climate should not be seen as a phenomenon of temperature only.

Climate consists of energy and potentials distributed mainly in the water of a biomass. These two carriers are necessary for the maintenance of the climate.

The spreading of climate properties is performed by water and air within a limited range of temperature, determined by life.

The heating of The Great Barrier Reef, to the East of Australia, is an instance of the difference and connection between producing and receiving regions of climate energy, as the heating is due to the loss of water, biomass, and climate potentials within Australia. Around half of the continent's area is too arid for maintaining equilibrium of potentials.

(Energy is released when potentials are not maintained. The sun conserves the potentials in its inner parts by locking them in behind the magnetism of its outer part.)

We see the same loss in a greater dimension in the heating of Arctic and Subarctic regions. The energy for raising the temperature is taken from Africa and from Middle and Southern Asia.

Around 10 M km^2 of the land between the Atlantic Sea and the Persian Gulf is desert, thus it cannot retain any energy. This includes the former Fertile Crescent. Much of the lost energy not re-radiated to space is brought by the winds towards the North. It melts the snow and ice and adds to the Earth's loss of energy.

The sum of energy, and its loss.

The sum of potentials of the biosphere is now distributed in a way such as to diminishing their use for keeping the biosphere in the condition needed for sustaining life.

It is remarkable that it has taken 65 million years to let the situation be manifested beyond doubt. This long time includes the period of human inflictions upon the conditions of climate.

Though the harmful effect of human activity was well known to the Greeks of antiquity, the breadth of the pertinent functions does not seem to be duly perceived now. The currently understood is a sum of phenomena, which, as such, does not describe the functions of the biosphere.

Combining food and climate.

We can produce a sustainable climate by means of a wood cover of all continents; and we can expect trees and bushes to provide a better fodder than that offered by grass.

The purposes of conserving the climate and producing food adapted to our metabolism can be combined by gene-manipulation of plants for a great production of metabolizable leaves, stalks, and roots.

Seed are made to resisting chemical accidents until the conditions of sprouting. They are made for being swallowed, though not for being digested or metabolized.

Many plant families do not invite us to their eating. We have to rely upon the contents of the leaves and structure of the plants, since their seed are impervious to our digestion and noxious to our metabolism.

Some plant families will offer metabolizable food. Brassicaceae offer a series of digestible plants (cabbage, broccoli, turnip, *etc.*) suited to grazers and humans.

Some of them could be gene-manipulated into tree shape in order to cover the ground for the whole year, for the sake of the climate.

Some of the Umbelliferae are appreciated as food, like carrots *(Daucus carota)* and parsnips *(Pastinaca sativa)*.

We should develop cultivable plants producing a good climate as well as amino acids metabolizable by humans and grazing animals.

The protein complexes of plants of today and of our metabolism could attract bacteria making us sicker than we would have been without those complexes.

Single amino acids and other proteins would attract other bacteria, perhaps less malign, so that we could avoid *Helicobacter pylori* and its preference for human food and blood.

A problem is that human diseases are, for a probably great part, caused by peptides for which the adequate enzymes are lacking. This problem can be circumvented by an adequate manipulation of food plants' genes. Without a fundamental change of diet and the conditions of climate, the perspective of the human race is gloomy and cold.

Should we save the Earth from the cold ?

The snow cover of an exposed region makes it lose less energy as heat. By the energy conservation of woods, tropical and subtropical regions may recover their climate, if they are not disturbed by humans.
New woods are needed for avoiding the present loss of energy from the Earth. Water is needed in a distribution better than now, together with a sustained radiation from the sun, and a sufficient buffer capacity of the other factors of the Earth, the atmosphere included.

The quantity of water in the upper parts of the Earth is indicated by the strength of its magnetic field. The present lowering of the field's potential will be due to the critically sinking amount of water in the Earth's crust.

There is no hope of avoiding an ice age if the Earth is left alone to bear its history of loss of climate resources. The recent part of its history is the human negligence of the climate.

Our first means of relating to the situation is our consciousness. Further resources should be applied to the situation and to intervention in the climate. We know what is happening; and we should apply our attention to the details of the situation in order to understand it.

Our prehistory is a unique condition. It offers us the possibility of mending some broken parts of life's conditions. These were seriously damaged more than 55 M years before a group of apes were isolated on a tropical sea-shore and were forced to develop a broad consciousness and a complex evaluation.

Perhaps because of a normal inertia of societies in their choice of interest, we have not yet applied our attention to today's general problem, though it is on the brink of overwhelming us.

We should see our present situation in the perspective of the disaster 65 M years ago, when the main loss of vegetation took place.

The grasses were developed by a cool climate, and, by means of their small plant mass, they maintain the cool climate.

By human's later development, initiated by a geological accident close to The Red Sea, and our forced brain growth, we got the resources for understanding the present state of climate and its need for specific intervention.

Since water, by the hydrogen-atoms of the monomer parts of its molecules, will be the carrier of Earth's magnetism, the extension of deserts will have to be the cause of the weakened magnetic field.

Sahara alone is an energy drain great enough for ensuring the arrival of an ice age.

Human intervention can hardly be part of the development of the great Sahara; but other deserts and steppe are regions carrying the traces of heavy grazing, and partly of critical human intervention, like tre-felling.
Man should not blame himself for the great loss of climate conditions after 65 My B.P. Our responsibility is primarily to seeing what is wrong, analyse its functions, and do our best to prolonging our conditions on Earth.
We know the conditions of politics and technology needed for restoring the water, vegetation, and climate of the deserts.

Despite the crossing political interests, there should be a common interest in survival which could be the fundament of an international agreement for saving the climate and the conditions of life.

After the series of half and near total destructions of life during the last five hundred million years, man's chance of living to the end of the Earth is nil.

This is not, however, a sufficient reason for letting our conditions be finally destroyed.

Our choice of this century will most probably close the option of a different choice of our descendants. This should be a warning against removing the possibility of their lives.

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Addendum:

S U M M A R Y
of
Peptider i blodet [29]
(Peptides in the blood).

From first principles of chemistry and electricity it is argued that the interactions of atoms, ions, and organic electrolytes are identifiable in our metabolism.

A group of diseases get their aetiology from a knowledge of the pathological interactions and of their influence upon our tissues and physiological functions.

The properties of water, the nature of ionic electricity, and the properties of peptides, lead to an understanding of the presence of extrafunctional peptides in the blood as part of a complex physiological situation where physical interactions may produce ailments that have not hitherto been adequately treated. Among them are multiple sclerosis, Alzheimer's disease, schizophrenia, autism, fibrositis, hyperactivity, auto-immune diseases, psoriasis, and schizoid disorders ranging from depression to paranoid violence. Combined with a lack of metal ions, the less severe degrees of osteogenesis imperfecta develop osteoporosis. Asthenia, from fatigue to myalgic encephalopathy, is also included in the group.

The reasons for this are found in the properties of peptides as organic electrolytes, in the inhibition of enzymes, in carbohydrate colloids as metal ion binders, in the loss of metal ions to aldehydes, and in the insufficient replenishment of buffers for our digestion and metabolism.

Peptides taken into the blood are active by their charges. Some are ampholytes; and others are lipophilic at one end and carry a charge at the other. These properties account for atherosclerosis and auto-immune diseases.

Oligopeptides enter the brain and are attracted to the neuron membranes and synapses according to their charges. They will neutralize the local electrical activity and thereby immobilize the neural activity. From this follow schizophrenia, autism, and Alzheimer's disease. Multiple sclerosis is probably more complex, like fibrositis, in being influenced by a lack of selenium.

Parts of the argument rest upon a more detailed description of the properties of water, of the electrical and magnetic functions of the neuronal and synaptic signals, and of the development of physiological functions within the constraints of changing environments through the ages. The Cambrian revolution of the chemical environment of monocellular life was the trigger of cell division without cell separation, and of the following explosion of complex animals. The gastrula cell specialization is the frame of our tissue differentiation, and of the different reactions to the chemo-electrical influence from food-derived particles.

We receive particles that are extrafunctional relative to genetics. They are products of insufficiencies of the food, and in some cases of genetics. The limitations and possibilities of chemical and electrical interactions lead to a normal or a deviant metabolism depending upon the energies present and upon those needed *e.g.* in enzymatic hydrolysis. When proteins are not

divided into single amino acids, the resulting peptides are extrafunctional electrolytes. They will interfere with normal functions and adhere to tissues according to their charges and to those of, *e.g.*, neurons, synapses and endothelium.

Peptides are introduced into us from wasps, mosquitoes, and cobra; they are made in us for our own use; or they are the results of incomplete digestion.

Those of the first and third group are extrafunctional peptides, ep. They are found in diseases, both in functions and deposits.

In the blood, they augment its osmotic potential by their number. According to charge, they affect the electrostatic repulsion between the normal constituents of the blood, raising its viscosity and lowering the blood pressure, especially in the limbs and the head.

A higher osmotic potential in the blood impedes the nourishment of the cells, affecting cell function, dehydrating the cells, stiffening muscles and producing headaches, *e.g.* migraine.

Ep-electrolytes, lipophilic ep and fat are the makers of atherosclerosis. Ep of a certain size, probably above 1-1·2 kDa, will provoke an immune reaction. When ep have reduced the resistance of the endothelium by their electrical charges, they may be found around the vessels.

Ep originate from cereals, cow's milk, fish, and meat. Our digestion was made for autolyzed animal proteins during the Cambrian explosion of multicellular animals. The animals relying on unautolyzed meat, like Carnivora and Insectivora, are hampered by the quantity of ep that lower the functional power of their muscle cells. Our modern menu of fresh meat and fish, wheat and milk products, lets us approach the fatigue of lions and the schizoid hyperactivity and paranoia of the insect eaters.

Autolysed meat is the advantageous diet of scavengers. Hyaenidae and wolverene (*Gulo gulo*) are strong and not easily exhausted. We used our first tools for scraping meat off the bones of carcasses.

In the brain, the smaller ep-electrolytes impede the membrane function. Bigger ep invade the synapses during months and years, and inhibit them irreversibly. Schizophrenia and autism are seen in severe cases. Schizoid infliction are seen in different forms and degrees.

Negative charges are reciprocally repellant and keep the normal blood particles and clathrates from sticking to the endothelium and each other. The place for a new molecule is signalled by a charge differential.

In our digestion, enzymes divide molecules; many of them first separated by hydrochloric acid. Hydrolysis consists in placing a monomer of water where a molecule may be divided. An enzyme carries the water into place under constraint of the forces between its main peptide, its metal atom or -ion, the water molecule, and the molecule to be divided, on the one hand; and those inside this molecule and the water molecule to be divided, on the other hand. The water molecule is divided and the peptide or the sugar is then divided.

An equilibrium of binding forces and transferring energies is easily disturbed by extrafunctional forces. The specificity of each process is seen in the electrical capacity of each enzyme. Food and water should bring us what we need for building the body and digesting the food. A limited diet will strain part of our enzyme capacity if the food does not contain all the required parts for enzymes.

Incomplete cleavage of proteins leaves us with unwanted molecules whose effects, for physical reasons, we cannot avoid. The effects are extensions of the forces and energies of the molecules; and they are seen both in the organic electrolytes and in the lipophilics.

They are appreciable already in the small intestine. Anionic deficiency in its mucosa makes it release its contents as incompletely divided molecules.

Water makes up less than half the volume of the blood, which has a strange capacity to flow in spite of its contents. Even small discrepancies from the norm will disturb the interplay of charges, deranging partly the flow capacity, partly the repulsion from the endothelium. Opposite charges will produce clusters of molecules and clathrates, and a resistance to the flow, thus lowering the peripheral blood pressure and the capacity to deliver to the cells what they want.

Osmotic potential in a fluid is a function of its content of particles larger than the molecules of the fluid. The osmotic potentials in blood and in cell fluid are supposed to be equal and the transport between them depends on electrical forces.

Reverse osmosis shows the interdependence of osmotic potential, osmotic pressure and mechanical pressure. Too few or too many molecules or a wrong blood pressure will be an additive or subtractive force that keeps molecules from traversing the cell membrane. Too little albumine produces oedema: water retention in the cells. Too many molecules in the blood stream dehydrate the cells by their osmotic potential, keeping water and food from the cells. They will reduce blood velocity and pressure, especially in the capillaries. The results are depression and a lack of physical capacity.

We build our tissues and exert our functions with certain salts, ions, amino acids and carbohydrates. The bigger molecules should be divided before entering the blood. With single amino acids we build hormones, enzymes, tissues and free cells.

Charged particles in blood and neurons are covered by clathrates, groups of water molecule complexes, so that their charges are neutralized during transport. When ep are present in great numbers, the capacity for forming clathrates is overloaded; and peptides will adhere to any point showing an appropriate charge. Ampholytic ep will interfere with the contents of the blood and with the endothelium. This often leads to penetration or adhesion, provoking an immune reaction and affecting the function of the blood vessel. Some ep are lipophilic at one end. When they adhere to the endothelium, they will attract both lipophilics and fat, building atherosclerosis. Immune cells are found as a response to the alien nature of ep. The vessel is often found nearly filled with an adhered mixture of polar and lipophilic ep, and immune cells. The adhesion is a result of the physical properties of the particles. They have been found followed by immuneglobulines (Ig) in a dissolved («motheaten», ref. 21) perivascular tissue.

Small ep are excreted through organs of ectodermal origin. The kidneys offer a passage, except when ep feed streptococci and are found in glomerulonephritis. The skin lets them out with the sweat, except when they have properties that make them interfere with the skin building, inflicting psoriasis or eczema. Ep go, however, to all ectodermal tissues, since they were all external and excreting well into the Cambrian, 570–500 My BP.

The electrical activity of the brain attracts ep with the greater charges, like gluten and *Clostridium*-toxins. The points of highest electrical activity are the synapses, where the signal passage is blocked in the course of hours or years, leading to death or schizophrenia. Small ep enter the brain helped by citric acid, maltol and aluminium. With lesser charges, they adhere to un-myelinated nerve cells, neutralizing their potential for passing on the nerve signal.

De-potentialized nerves are catabolized as far as the supply of enzymes permits; but an incomplete catabolism hinders the exit from the brain of their lipophilic remains. They will be adsorbed to the myeline of nerves in the combining parts of the brain, where the personality resides. When this is diagnosed as Alzheimer's disease, it is the last stage of a malfunction that started decades earlier in dyspepsia and metabolic dysfunction.

The elements of water are the monomers of H-O-H, each with covalent bonds by the electron from each H-atom: H·O·H. In an imagined environment of electrical and magnetic neutrality the three atoms will be in equilibrium. In the real world they are bipolarized $^{+}HO^{2-}H^{+}$. Two monomers will bind together like a Y with an angle of 104°·5 in one monomer, while the other stays straight. At 37 °C the complexes consist of tri- and tetramers, perhaps with a small part of dimers.

Ice is a crystal of angled molecules. At melting, the oligomers carry a straight molecule at one end. This molecule fills a smaller space, so water has shrunk.

The covalence is not a fixed internal distribution of charges, as external fields will move them. This soft covalence permits each monomer to take up energy and communicate it internally, and via H-bonds to the next molecule. The extrovert charges are not full elementary charges; and this accounts for the water's fleeting contacts as clathrates around charged molecules, which are delivered where the charges are appropriate for binding.

The bonds exist as long as thermal or other energies are not too elevated. They are influenced by electrical and magnetic forces and fields. Do not put your hand in the microwave oven.

The call from the place where another molecule is needed for building some cell or structure, is an electric signal appealing to the specific charge of the free molecule of, *e.g.*, amino acid.

The small but well defined and different forces between metal, water and peptide in enzymes are easily disturbed by the presence of extrafunctional ions, be they metals like Al^{3+}, Cd^{2+}, Hg^{2+}, non-metals like NO_3^-, F^-, or organic electrolytes like peptides. Hydrolysis and anabolism are easily disturbed. So are mucosa, endothelium and membranes of neurons.

Nerve cells keep up a potential of inorganic, oxygen-free electrolytes across the membrane. Protein aggregates in the membranes produce magnetic fields like any dynamo, and haul Na^+-ions out of the cell; but they will return, driven by the potential as in a pile. An electrical signal from a brain cell or a sensory organ comes as moving ions. Their accompanying magnetic field will release ions from their clathrates in the neuron and send them out through the membrane. In a part of the cycle they will go against the potential, which is then changed. The transport of this change along the neuron is what makes the nerve signal. The energy for the movement is stored in the electrolytic potential.

It is used when the magnetic field of the ions moving in one place of the neuron lets the clathrates release the neighbouring cations, which are then given a momentum by the field. The membrane's inner and outer surface molecules carry negative charges and receive an opposite momentum, without which they would have retained the cations. This tunnelling in channels 0·4-0·45 nm wide is the quantum Hall-effect known from electrons around 1 K. In us it works at higher levels of temperature, weight, time, momentum and energy involved. Each molecule and particle carries one elementary charge in both cases. The magnetic induction seems to be above 10^3 T.

Glucose is an uncharged molecule. In diabetes, a surplus of 15-20 mmol may be found in the blood. The ensueing osmotic disturbance dehydrates the cells and makes the muscles stiff and acheing. Polar molecules have their clathrates added to the viscosity, reducing the blood flow through the capillaries, the blood pressure and the transport through all cell membranes. Migraine, fibrositis, depression and myalgic encephalopathy are sequels of these two mechanisms. An added quantity of polar ep may result in an anaphylactic shock.

In dementia, personality is conserved into an advancing loss of conscious contact with the surroundings. Short time memory passes with understanding of what happens. Long time memory is a part of personality and stays alive to know what has been forgotten. This, however, is lost with the lot of lesser neurons first inhibited by polar oligopeptides, then broken down. For lack of catabolic enzymes, their lipophilic remains stay in the brain and adhere to the myeline of the more important brain neurons, where they were discovered *post mortem* by Alois Alzheimer.

Autism is partially characterized by a low degree of combination and understanding. The combinatory regions of the brain are the more active, and more so when well myelinated. Their electrical activity attracts ep with greater charges. They will adhere electrically to one side of the synapsis and impede the passage of its transmitter substances. Recognized poisons like nerve gases are attracted by the highest electrical activity, which is in heart and lungs. The slow poisoning of the brain is possible when ep are small or lipophilic enough to slip through the blood-brain barrier and carry charges great enough to follow the call of synaptic brain activity. Thus, the most active parts of the brain are first inhibited and degraded.

In dementia, un-myelinated, functionally peripheral nerves attract by their standing potential ep that neutralize the potential and inhibit any signal sending along the neuron. The two ways of brain destruction happen over different periods and reflect different mechanisms.

In autism, schizophrenia and schizoid inflictions, the main, myelinated neurons work as long as their synapses are not completely blocked by polar peptides somewhat greater than those of dementia. They are gluten and its analogues from un-autolyzed fish and meat; *i.e.* raw meat or meat boiled or fried from raw, salted or frozen. The personality suffers their impact, *cf.* Insectivora*,* that show a paranoid distance to other members of their species. Our society suffers the impact of schizoid violence. Paranoid groups are growing.

Memory is restricted, possibly in a monomaniacal, paranoid way. Contrary to dementia's remembrance that something is forgotten, the schizoid erases the thought that something was to be remembered. This may account for strange denials heard in court.

The savannah theory of man's divergence from the apes is simple in postulating the simplest transition from the trees to two-leg walking. It does not, however, point to the links between the exigencies of the new habitat and the functions that were to develop in order to fill them.

What distinguishes us are the traits we do not share with the animals of the savannah Our subcutaneous fat was collected from algae, mussels and fish and served us well for floating and for keeping our head and body temperature in sea water. The unsaturated lipic acids in their ectodermal deposits not only gave us insulation but worked wonders with the brain and let it grow under sensoric and motoric challenge from the marine environment, which is also the only one known to have demanded hind leg movements resulting in stretching the legs into line with the body as in seals and sea otters. With better insulation, we needed more cooling sweat glands when onshore; and we got them; the eccrine glands were spread over our whole body.

Our circadian rhythm is nearly 25 hours, in spite of most living creatures' 24 hours. Ebb time was the right for searching for food. Every second ebb comes 24 h 48 min 39 sec after the former daylight ebb. Today we reset our clock at noon, with the aid of serotonin. Lack of it is a reason for sleeplessness in winter in Northern Norway, when daylight is scarce. The availability of serotonin depends upon single amino acids, thus on enzymes.

The baboon marker is a retroviroid part of the genes of African apes and monkeys. It is the response to a retrovirus carried by baboons and is found even in prosimians living in the tree-tops, but not in man. We were not climbing or on the savannah when the plague raged .

Empirical knowledge does not amount to science. Knowledge is not achieved when everything is dissolved in εμπειρία, experience, empiricism. Data, even in an epidemiological connection, are useless except in a model of presumed functions. What can we do without empirical knowledge? Nothing. What can we do with empirical knowledge only? Nothing. As soon as we say: «We do this because…», we presume a model.

Models are concepts for connections and functions; and, like concepts, they are not true or false. Models let us derive contentions and predictions, which in turn may be supported or falsified. A system of empeiría permits any interpretation. This, alas, is the medical method. In order to build models of parts of reality, this reality should have its functions described in a way that can go into a model of known steps of physical functions, not one dependent on an unidentified «control mechanism» (*sic*, 52) of unknown nature in allergy or «somatization» in internal medicine, *e.g.* depression as a supposed «cause» of fibrositis. And if our health is psychically controlled, by which means and mechanisms do we exert the transition to a low blood pressure in the head, to dehydration of muscles, to an immune reaction against ep? Back to square one. If we want to think, we need some brain for doing so, and senses providing material for thought. Any intrusion into the physical world requires a physical tool, be the psychic prime mover as abstract as empty space. We need acetylcholine in order to use the muscles and to relax.

«Somatization» is a postulated function of unknown nature. Its whereabouts are better described as physical sequels of physiological impact from food for which our enzymes were not designed.

On the other hand: it is possible to describe complex structures by the relations of their constituents. This is not reductionism, saying that something is but its parts, but a challenge to find and describe partial functions and the mechanisms and results of their relational functions.

An elevated osmotic potential in the blood will dehydrate the cells, and more so in combination with a lowered blood pressure, producing headaches and stiff muscles. There is no reason to believe that the following depression be the cause of this condition.

A model built from scratch in controllable steps offers aetiological functions and adequate therapy.

Coeliac disease is an inherited condition known to be influenced by food. The steps between genes and soma are enzymes and their environment in the body. They form the frame for influences that may support the heredity, hamper its expression or override it.

Familial ep-ailments are not necessarily genetic. When ep reach the embryo before the immune system has been developed to distinguish between mine and thine, they will be accepted as belonging to the individual. Later in life, they will provoke no immune reaction, but will still be foreign to functions (12). It is the poisoning with ep that makes us sick, not the immune reaction.

Allergy is strong when the immune system is weak, since the protein particles influence in ways that are not clinically distinguishable from those of histamine, as their physiological aspects are much the same. Introduced from food, they bring lifelong poisoning. It is experienced as lack of force, a depressed and blurred mind and eventually as dementia. Ep with greater charges show their effects mostly in the brain, blocking synapses and most often producing autism and schizoid and paranoid syndroms, *e.g.* unprovoked violence.

There are indications that polar ep destroy catabolic enzymes in the body in the same ways as they inhibit digestive enzymes in the gut. Deviant cells should be catabolized; so cancer is helped on its way when enzymes are made to fail.

The metabolic fault is expressed as a change of charge or polarity. Affinities between molecules consist in opposite charges. They are specific and have to be the correct ones in order to lead to the right synthesis. Similar molecules, atoms and ions either produce tissues that are not viable; or they are antagonists, more or less poisonous, from ep inflicting psoriasis to phenylpyruvic acid in phenylketonuria, destroying brain functions and structure for ever. Nitrogen and phosphorus have the same chemical properties, but N is the more active and will discriminate P. Aluminium and fluorine are extrafunctional but will interfere; F^- as the strongest negative ion of all, Al because of its *omnibus* properties.

Al breaks down the lipid resistance of the blood-brain barrier and leads to a loss of catecholamines from the brain. This is enhanced by citric acid and maltol. Baking-powder contains Al; so marmalade and sweet cakes are efficient for breaking down the brain functions. Al has not been found in all examined brains of deceased patients.

Mb. Alzheimer and other dementia forms are more common in regions where more than 0·5 mg Al has been found *per* litre drinking-water, than where less than 0·2 mg *per* litre has been found (191). Al does not seem necessary for the development of dementia, which is sufficiently explained by polar and lipophilic properties of oligopeptides, though it will enhance it.

Auto-immune diseases are characterized by immune reaction to our own tissues. In order for this to happen, the epitopes must be modified, which they are when ep are electrically adsorbed to them. The diseases are mostly seen halfway in life, developed slowly after inconspicuous metabolic changes. The «rheumatoid factor» seems to be a deficient immune globuline; deficient because some enzyme needed to build it was destroyed before it could be used or because the necessary amino acids were not at hand; perhaps were they parts of peptides for the hydrolysis of which the enzymes were not present.

We developed as single cells in lack of oxygen. Perhaps we swallowed a new kind of cells as predators; perhaps these new cells, which had benefited from the oxygen of our reducing metabolism to turn their inner world on its head and starting an oxidizing metabolism, were scavenging on our reduced offal on us and in us. The latter seems the more probable hypothesis, since the oxidizing metabolism is more efficient at turning out energy and gives a higher vivacity. We still use the mitochondria for this purpose. Glucose is broken down in many anaerobic steps and finally oxidized.

In the Eocambrian, the sea bottom sprang open and released lava and acid-producing gases, *e.g.* SO_2. This new environment changed our habitat and our chemistry. We stopped behaving normally, dividing without leaving our daughter cells alone. Our Pre-Cambrian metabolism was essentially reducing and covalent. Now, the stronger ionic bonds gave us a new physiology. We could not leave the old one; thus we are both oxidizing and reducing. Many resisted the cohabitation and stayed monocellular at the cost of new methods of osmotic control. We developed a blood in blastula and a new, extracellular digestion in gastrula. The ionic energy encouraged us to grow at the cost of a greater carnivoracity and the prize of bigger bodies and a long life for each cell.

The sea was still full of metal ions, so we saved energy by not excreting them, but binding their salts to collagen, an ectodermal glycoprotein that leads cell growth. Mollusca started using $CaCO_3$, Arthropoda $CaSO_4$, and we use $Ca_5(OH)(PO_4)_3$, hydroxy-apatite. Because the OH-group is not strongly attached, this salt is not completely mineral-like and may be recirculated in our metabolism. The OH-group may be chased away and replaced by anions, *e.g.* F^-. The bone salt is then immetabolized and the bone weakened. Bone is made from HO-apatite, water, and collagen with HO-lysine, HO-proline and water. The two amino acids are hydroxylized after having been put into place. The H-ends of water molecules bind to the hydroxyls, taking up all forces and mechanical energy. Thus, water accounts for the toughness of bone by taking up energy from external forces.

Lack of the hydroxylyzing enzymes leads to osteoporosis, as does F^- and other anions of sufficient strength for dismantling the enzyme by taking its metal ion. Peptides are possibly capable of interfering with the building of the bone by adhering to the OH-end or to the H-end of the water. Osteogenesis imperfecta leads to perinatal mortality or to a degree of bone brittleness, which is often seen in elderly women. Norway holds the world records of osteoporosis and milk drinking. Calcium from the milk is presumed to cure the disease, which, however, it does not. The ailment is anabolic. The availability of enzymes is restricted by ep; both by their electrostatic forces and by their containing amino acids needed for enzyme and tissue building. Ep will bind to enzymes needed for digestion, thus establishing a vicious circle. After decades its effects on bone structure get more serious and are discovered.

Used matter was excreted through the ectoderm. Unusable matter was not taken up through the ectoderm, so everything was simple before Nature had produced, 500 My later, new proteins not foreseen by our Cambrian digestion. They came with grass, its seed, and the milk of its grazers. Our capacity for digesting gluten and extraspecific caseine is low. We need a strong immune system and strong kidneys in order to cope with them.

The immune system is, though, as dependent as any part and function of the body on receiving free amino acids. In ep, they are bound and unusable. When ep are taken into the blood, which happens when mucosa is not perfect in its chemo-electrical capacity, they are excreted through the ectoderm. Unluckily, nerves and brain receive their part but are no longer part of the road to the outer world. Our sweat will have the smell of peptide metabolites from the bacteria on our skin; and meningitis is a threat. The tonsils wipe up lots of ep and bacteria that also thrive on ep in the inner ear, the sinuses, nose, throat and lungs. Asthma medication and tonsillectomy are consolation for the physician, who believes in doing something and comforts himself and the patient by being active. A control group is not established.

Gluten and caseine are not easily divided. When they enter the blood, they will strain the immune system, which is also antagonized by male hormones.

Many multiple sclerosis patients have had their tonsils removed at an early age and a long history of infections (70) that is best understood as accessory invasions into the systemic presence of good food for the bacteria. The infections are most severe in male adolescents because of the antagonism between testosterone and the immune system. Between periods of rut the gonads are in recess in many species. Since males are faster killed by parasites when given extra testosterone, this recess may save lives.

Sertoli cells from testes protect xenoimplants (294). The antagonism may have evolved with sexual propagation, which implies the risk that the female will reject the sperm or the zygote by her immune apparatus. For good measure, males suppress their own immune system. This is possible because of the common endodermal origin of gonads and, among others, thymus and pancreas.

Sexual propagation must be a Cambrian feat, and so probably is the immune suppression by male hormones. Keeping cells together to form one individual must have been difficult. We see this in genetic diversity in vira and monocellular life. There is no resistance against mutations. We suppress strange cells every day, as long as our enzyme capacity reaches. Any conjugation must be free of immune interference. Male mitochondria are not brought into the zygote. Mature cells could not have started conjugation after the development of an immune system.

Our Pre-Cambrian reductive chemistry gave us and let us retain a surplus of electrons. The oxidation pervasively introduced in the Cambrian was the starter of multicellular life. The electron carriers were not removed; but the oxidants were added. Together, they gave life a greater circulation of electrons and energy. Circulation and life are sustainable as long as electrons are available on conditions established long ago. Today, a lack of electrons gives us ailments. The beginning of therapy will be found in avoiding strong oxidants, like fluorine, and in providing a surplus of electron carriers. Not any metal will do. We are formed by those we used before the Cambrian; so we can rely upon zinc, calcium, and a few others, whereas, *e.g.*, aluminium and mercury are poisonous by having the wrong potentials after delivering their electrons.

Many of our problems today are lack of adaptation to conditions that developed long after our metabolism was formed under conditions that no longer exist. Now we are too complex to be able to reform it. We would perhaps do better with sulphuric acid in the stomach, seen from the point of view of a changing environment; but we got HCl as a part of a reducing metabolism and that is the way we are. As single cells we might be able to adapt. Should we start over again?

For the daily killing of deviant cells, we need catabolic enzymes. Their provision depends upon single amino acids and metal ions, like other enzymes. The prevalence of cancer is an indicator of lack of enzymes.

The values of society have two faces at least. They are expressed in our moral; and they engender the frames and concepts of our thoughts, whence our science. A particularized, schizoid society sees no reason to think in a continuous way. A knowledge consisting of empirical evidence only permits a similitude of science that may deliver uncontrollable theories *ad hoc*. A body of *empeiría* is a caricature of science, though an excuse for scholastics.

In a world of separate sciences, each of the professions has no reason to search for a model that will make a link possible to the next science.

Consistent methods are founded upon defined concepts and models. They are the necessary prejudices or *prae-iudicata* that form the base of any science. They will permit a description of certain aspects of the functions of reality.

The values of society have two faces at least. They are expressed in our moral; and the engender the frames and concepts of our thoughts, whence our science.

New models are conceived and born with difficulty, as history shows from Copernicus to Bohr.

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