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## IS THERE AN ETHER?

WILFRED H. HOWARD

To the New Church scientist and philosopher, a consideration of Swedenborg's doctrine of the atmospheres, and of the ether in particular, presents a number of problems that can best, perhaps, be considered under the following headings:

- 1) Our belief or faith in the Divine authority of the Writings and its relation to the doctrine of the atmospheres.
- 2) The nature and analysis of Swedenborg's doctrine of the ether, and the conception of the ether as commonly accepted during the 19th century.
- 3) The facts of science that led to the rejection of the ether.
- 4) The ether as discreted substance.

In discussing our first subject, namely, the relation of the Writings to the atmospheres, it is hardly necessary to state to this audience that of the many distinguished doctrines that the Writings contain, the doctrine of the atmospheres is one of the most fundamental. The reason for this is very evident, for in the *Divine Love and Wisdom* and other works, their uses are abundantly set forth as being the media through which all creation is effected, through which all forces both spiritual and natural are transmitted, and also the media through which all created things are held together and sustained. They therefore perform the function of a creating and sustaining medium.

References to the atmospheres and ether are also contained in the *Arcana Coelestia*, the *Apocalypse Explained*, the *Spiritual Diary*, the *Adversaria*, the *Last Judgment* (Posthumous) and other works.

The treatments of the atmospheres, and of the ether in particular, in the *Principia* and other philosophic works, inasmuch as they are not part of revealed doctrine, have no direct bearing on the question of authority, and will be considered later.

The following brief quotations from the Writings will help to focus our attention upon what has been revealed.

“That the atmospheres and ethers are that which from without keep the whole body in connection, by their continual pressure and incumbence and the consequent acting force, is known; and also that the aerial atmosphere by its inflow keeps the lungs in their connection and form, and likewise its organ which is the ear, with its forms constructed therein according to the modifications of the air. It is also known that the ethereal atmosphere in like manner maintains the interior connections; for this atmosphere flows in freely through all the pores, and keeps the interior viscera of the whole body inseparably in their forms, by nearly the same pressure or incumbence, and the consequent acting force: also that the same atmosphere keeps in connection and form its organ which is the eye, with its forms therein constructed to the modifications of the ether” (AC 3628).

“As regards the atmospheres which are called ethers and air, they are similar in both worlds, the spiritual and the natural, with the difference that those in the spiritual world are spiritual, and those in the natural world are natural. . . . The spiritual atmospheres are discrete substances or least forms, originating from the sun of the spiritual world. . . . The natural atmospheres are similar to the spiritual atmospheres in this, that they also are discrete substances and least forms, originating from the sun of the natural world; which also singly receive the sun and treasure up its fire in themselves, and temper it and carry it down as heat to the earth, and in like manner the light” (DLW 174).

“It is a fallacy of merely natural sense, that there is only one single atmosphere, and that where it ceases there is a vacuum” (AC 5084).

“The atmospheres, which are three in both worlds, the spiritual and the natural, in their ultimates fall into substances and matters of the nature of earths.

“That there are three atmospheres in either world, the spiritual and the natural, which are distinct from each other according to degrees of altitude . . . was shown in the Third Part. And because the atmospheres decrease in the progression downward, it follows that they become continually more compressed and inert and at length in ultimates so compressed and inert that they are no longer

atmospheres, but substances at rest, and in the natural world fixed and natural as earths and matters. *From this origin of substances and matters it follows, that these substances and matters are of three degrees*" (DLW 302). [Italics added.]

From the above quotations, and from others that could be referred to, the teaching is clear that there is an atmosphere or ether proceeding from the natural sun, and that the eye is constructed to receive the modifications of this ether; that this ether is composed of discrete substances, or least forms; that these substances originate from the sun, and by motion transmit the heat and light from the sun to the earth; that there are three discreted natural atmospheres, and from this *three discrete degrees of substance*; and that it is a fallacy of the natural sense that there is only one single atmosphere, and that where it ceases there is a vacuum.

With our belief in the Divine authority of the works quoted above, the statement of many scientists that there is scientific proof of the non-existence of the ether, or that the ether is only a figment of the imagination, is, to say the least, profoundly disturbing.

Unlike the natural scientist, who recognizes no authority other than science itself, the New Church scientist approaches the subject with a distinct bias. And however deplorable this state of mind may appear from a distinctly scientific viewpoint, it is nevertheless consciously or unconsciously present in all his thinking.

He cannot therefore dismiss the doctrine of the atmospheres, and of the ether in particular, as one of Swedenborg's scientific errors, as he might be inclined to do in relation to such questions, for instance, as the hibernating swallows, or the color of children produced by a Moorish father and a European mother. The doctrine of the atmospheres and of the ether is too fundamental to be so dismissed, for the whole structure of Swedenborg's doctrine of creation and sustentation in both worlds rests on these atmospheres.

On the other hand, we cannot rest our case simply on the assumption of the earlier students of the church, as contained in *Words for the New Church*, namely: "That true science comes from Heaven and agrees with revelation, whilst false science comes from Hell and disagrees with revelation" (p. 373). For while it is true that our essential beliefs may not have changed in regard to our traditional attitude toward science and scientific hypothesis, our approach to our scientific colleagues has at least become more respectful.

As was, of course, always recognized by us, and is amply stated in *Words for the New Church*, our problems are not with science, but with false interpretations derived from science. To analyze the facts of science from the light of our own philosophy is the responsibility that every New Church scientist accepts; and from an authoritarian viewpoint therefore, we start with the conviction, that there is an ether, and that its modifications will produce discreted substance. We proceed now to our second question, namely, the conception of the ether of science as commonly accepted during the 19th Century, and Swedenborg's ether of the *Principia*.

In regard to the ether of science, the following quotations will make the subject clear. Defining the conception of the ether held at that time, Dr. C. W. Saleeby, in an article entitled "What We Know of the Ether," states "that all ancient philosophies had a more or less crude conception of an ether of some sort. The scientific realization of its presence however, came with the study of light. Hence the name luminiferous or light bearing ether is usually given, it being early realized that for the light from the sun to reach the earth either a medium of transmission from the sun to the earth was necessary, or else corpuscles or extremely small particles of matter were emitted from the sun, and upon striking the optic nerve caused the sensation of light. The only other possibility was that known as action at a distance, wherein one body affects another without the presence of an intervening medium. Its existence is now beyond dispute. We know that it transmits not only the waves of light, but also the waves of radiant heat, the Hertzian waves of radio, the Rontgen or x-rays, and many more. So certain is the existence of the ether that modern chemistry is inclined to believe that what we call ordinary matter is none other than a special product of the ether—in other words, that the ether is the mother of matter. As to its properties, it is a rigid, highly elastic, purely continuous medium, imponderable, without weight, and yet it is the cause of weight, being the medium of gravitation; but it is still a material entity, rarer perhaps a thousand millionfold than the rarest gas but nevertheless material."

Sir Oliver Lodge, in *The Ether of Space*, defines the ether as follows. "The question is often asked, Is ether material? This is largely a question of words and convenience. Undoubtedly the ether belongs to the material or physical universe, but it is not ordinary matter. I should prefer to say it is not matter at all. It

may be the substance or substratum of material of which matter is composed, but it would be confusing and inconvenient not to be able to discriminate between matter on the one hand, and ether on the other." Many other quotations expressing the same conceptions of the ether could be added.

In the *Principia* we have four discreted atmospheres or auras, namely: the universal aura, the magnetic aura, the ether and the air. To each of these atmospheres or auras special or corresponding forces are assigned; thus the universal aura is the medium through which the force of gravitation is effected. The magnetic aura is the plane of magnetic forces. The ether variously modified will produce such effects as heat, light, electricity, etc., and the air is the well known medium of sound.

In the *Principia* series, therefore, we have four discrete atmospheres as media for the transmission of the forces of nature, as over against the two discrete atmospheres of science; and one of the most significant and far reaching differences between Swedenborg's concept and the ether of science lies in the fact that Swedenborg's ether is in the nature of an earth atmosphere, bullular or spherical in structure, and in this respect similar to the air. It is said to be highly compressed at the surface of the earth, and this portion of it gyrates or travels with the earth in the same manner as does the air.

The importance of this distinction between the two ethers—the single and stationary ether of science, and the earth bound or non-stationary ether of Swedenborg—is so important in view of experiments to be described later that we will quote from the *Principia* in regard to it.

In Chapter 5, Part 3, no. 3, dealing with the ether or third element of the world, we read as follows:

"That inasmuch as this new earth continually rotates round its axis, and exposes once every day its whole surface to the sun; these new elementary particles (the ether) take their rise all over the surface, are generated over the whole circumference . . . and are carried into a certain motion, which is the same with that of the earth. That being as it were colligated or bound together by means of this motion, they dispose themselves round the earth, and do not suffer themselves to be carried in any other direction; that also they assume this motion, from the period of the first commencement of

their sphere down to that of its final completion. . . . Another consequence of the diurnal rotation of the earth is this; that as soon as the ether is originated, it immediately pursues the same motion . . . from the first moment of its existence it disposes itself into a sphere, the center of which is the earth; its motion being assisted by the element of the solar vortex."

To summarize briefly the characteristics of these two conceptions of the ether: the main distinction is that, with the ether of science, we have only one universal atmosphere the modifications of which are responsible for all known physical forces, from gravitation to light, and being universal it follows from this conception, that the earth in its motions must be streaming through this atmosphere. On the other hand, the *Principia* ether is not universal; it is the medium of only three forces, namely heat, light, and electricity, and in the vicinity of the earth gyrates or travels with it in the same manner as does the air.

With this picture of the difference and distinctions between the two atmospheres in mind, let us now turn to our third question, namely, an analysis of the facts of science that led to the rejection of the ether.

The concept of a single universal ether through which the earth was supposedly streaming at a surface velocity of approximately 19 miles per second naturally led, during the latter part of the 19th Century, to a wide field of experimentation; for it was obvious that the ether drift assumed to exist as a result of the hypothesis of a stationary ether should be detectable. For many years a long series of experiments was conducted by Fizeau, Hoek, Lord Raleigh, Mascart, Jamin, Sir Oliver Lodge, and finally Michelson and Morley, only to obtain negative results; and as the Michelson-Morley experiments were the most conclusive the rejection of the ether concept is credited to them, as the following quotations will show.

In an article entitled "Fifty Years of Relativity," by W. R. Bonner, Professor of Applied Mathematics at Liverpool University, and recently published in *Science News*, No. 37, we read as follows:

"Toward the end of the century many attempts were made to establish the existence of the ether. One possible way of doing this was to show that the earth had a velocity relative to it. The earth

was known to be moving at a speed of 70,000 miles per hour relative to the sun, so presumably it had a speed relative to the ether, though of course not 70,000 miles per hour, because the sun itself might not be at rest in the ether. The most famous of the experiments to measure the absolute speed of the earth was that of Michelson and Morley carried out in 1887. These experiments all gave the same result—that the earth had no velocity relative to the ether. Excluding the fantastic possibility that the earth was at absolute rest and the whole universe revolved around it, the inevitable conclusion was that the ether theory was false: the ether did not exist.”

J. A. Eldridge, in his book entitled *The Physical Basis of Things*, says as follows:

“Michelson and Morley wanted to know, in an absolute sense, if the earth was in motion through the ether, and hence the famous Michelson-Morley experiment. . . . In this experiment Michelson and Morley determined the velocity of light propagated in different directions on the earth. Light is a wave motion through the ether, travelling 186,000 miles per second. Thus the time for light to reach us should be somewhat decreased if we are ourselves travelling through the ether toward the source of light, and be somewhat increased if we were travelling away from it. By observing any such difference in light speed Michelson and Morley hoped to measure the velocity of the earth through the ether. Actually no such result was found. The apparatus acted as if at rest in the ether. The result was the same no matter in what direction the apparatus was oriented, no matter at what time, night or day, the experiment was performed. The experiment has been repeated in many parts of the earth, with similar results.

“The velocity of light is invariant. It was as if sound which travels with a normal velocity of 1100 ft. per second should approach a person with the same speed, no matter how fast he ran toward it, and no matter how fast he ran from it. Some claimed that the ether was carried around with the earth, and therefore anyone at rest on the earth was at rest in the ether; but this view was hardly in accord with the other properties which had to be ascribed to the ether.

“Whatever the ether is doing here, it must be doing throughout all space. And indeed so strange became the properties of this

medium through which light is said to be carried, that the idea of an ether was gradually dropped: The ether is seldom referred to today" (pages 1-4).

Sir Oliver Lodge, discussing the experiments in his book, *The Ether of Space*, says the following: "The experiments were sufficiently sensitive to detect a difference of 1/1000 of an inch in a length of 60 miles, but no difference was detected. Everything behaved precisely as if the ether was stagnant: as if the earth carried with it all the ether in its immediate neighbourhood. And that was his conclusion. The experiment thus seemed to prove that there is no motion through the ether at all, that there is no ethereal drift past the earth, that the ether immediately in contact with the earth is stagnant, or that the earth to that extent carries all neighbouring ether with it." And further: "I may say then that not a single optical phenomenon is able to show the existence of an ether stream near the earth. All optics go on precisely as if the ether were stagnant in respect to the earth" (pages 56-63).

From the book *Foundations of the Universe*, by M. Luckiesh, we read:

"Filling all space, and being infinite in extent, it was natural to consider that the ether is stationary. This led to much discussion and various experiments. Among the latter the most famous was the Michelson-Morley experiment, first performed in 1887. Notwithstanding the utmost refinements in the measurements involved, no trace of the motions of the earth with respect to the hypothetical ether was detected. . . . Science was in a quandary . . . and the natural conclusion was that there is no ether drift, or that the ether is stagnant, or that the earth carries all the ether near it, along with it."

Further quotations could be given to the same effect from Sir James Jeans, Michelson, Paul L. Heyl and others, but time will not permit.

The all important question that we now face is the bearing of the facts of the Michelson-Morley experiments on what we might call two rival hypotheses of the ether. In justifying the conclusion that the experiments prove the non-existence of the ether of science, are we justified in assuming that they rule out the *Principia* theory of the ether also.



Let us assume, for instance, that a New Church scientist, interested in the two rival theories, had set himself the task of attempting to prove by means of the Michelson-Morley experiments the *Principia* concept of the ether, as over against the single ether concept generally accepted.

As the *Principia* ether is bound to the earth, and travels with it, his first and most important task would be to prove that there is no ether drift. If, after repeated experiments, no ether drift was detected, he would certainly be justified in assuming that Swedenborg's hypothesis was correct; and that the single ether concept of science, that would necessarily result in or cause an ether drift, was fallacious.

Further than this, however, he could hardly go. He could not state, for instance, that the facts of the experiment prove the existence of the ether. For they simply prove that, of the two hypotheses, the facts of the experiment support the *Principia* theory that the ether—presuming it to exist—is, at the earth's surface, bound to the earth and travels with it. Conversely, it is equally true that in no sense can it be claimed, as is so often stated, that the facts of the experiment prove that no ether exists. For the experiments prove only that the 19th Century conception of a single ether is fallacious, and it is hardly necessary to remind ourselves of our earlier quotation from the *Arcana Coelestia*.

The experimental measurement of the speed of light has been used in support of the theory that a medium of transmission is necessary, and the fact that light travels at a measurable speed, namely 186,000 miles per second, did much to confirm the physicist in his belief in the existence of a substantial ether.

For as Sir Oliver Lodge stated many years ago, and the argument has often been repeated since: "The ether, by transmitting waves of light at a finite and measurable speed, has given itself away, and has let in all the possibilities of calculation and numerical statement; its properties are thereby exhibited as essentially finite, however infinite the whole extent of it may turn out to be."

Movement through space always involves the idea of something possessing finite properties being moved. We can, of course, conceive of force as distinct from motion—the potential force, for instance, of an automobile engine at a rated horse power of 160; but for this force to produce motion the car must be moved. It would seem impossible for our finite minds to conceive the idea of

motion through space without the presence of something being moved, however impossible it may be for us to describe the nature of the thing being moved; and if we know, as we do, that light travels at a speed of 186,000 m.p.s. through finite space, then something, or medium possessing finite properties, must have been moved, however impossible it may be for us, in terms of material substance, to describe the thing possessing those finite properties.

During the past few years, there has been a tendency to return to an ether concept, as we think the following quotations will show.

“In the last century the idea of a universal and all pervading ether was popular as a foundation on which to build the theory of electromagnetic phenomena. The situation was profoundly influenced in 1905 by Einstein’s discovery of the principle of relativity, leading to the requirement of a four dimensional formulation of all natural laws. . . . If one reexamines the question in the light of present day knowledge, one finds that the ether is no longer ruled out by relativity, and good reasons can now be advanced for postulating an ether. . . . We have now the velocity at all points of space time, playing a fundamental part in electro-dynamics. It is natural to regard it as the velocity of some real physical thing. Thus, with the new theory of electro-dynamics, we are rather forced to have an ether.” (“Is There an Ether.” Dr. Paul A. M. Dirac. *Nature*, 1951, November 24.)

“As everyone knows, the ether played a great part in the physics of the 19th Century, but in the first decade of the 20th, chiefly as the result of the failure of attempts to observe the earth’s motion relative to the ether, and the acceptance of the principle that such attempts must always fail, the word ether fell out of favour, and it became customary to refer to the interplanetary spaces as ‘vacuous’ the vacuum being conceived as mere emptiness. . . . But with the development of quantum electro-dynamics the vacuum has come to be regarded as the seat of zero point oscillations of the electromagnetic field. It seems absurd to retain the name ‘vacuum’ for an entity so rich in physical properties, and the historical word ‘Aether’ may fitly be retained.” (*History of the Theories of Aether and Electricity*. Sir Edmund Whittaker, Volume 1. Preface.)

We turn now to our final topic, namely, the consideration of the ether as discrete substance.

In the *Divine Love and Wisdom* the teaching is clear that all of the atmospheres are composite, and that as the atmospheres are discrete, so also are the substances that compose them, or which are composed from them by suitable modifications. This is well illustrated in the lowest natural atmosphere, the air. In its normal state it is gaseous; but if heat is withdrawn it becomes a liquid, and if the process is continued it becomes a solid. Its degree of motion, therefore, determines its appearance to us as substance, and we have, by modification, three formations or states of matter, all of which are material.

According to the above doctrine, the ether also, in like measure, possesses its own series of modified substances; and the question may well be asked, as to whether or not many of the so-called particles that compose the atom, such as the electron, proton, neutron, positron, etc., and that come into existence at the vanishing point of matter, cannot be considered as *substances* created by the modifications of the ether.

One of the most difficult problems in regard to these so-called particles is the question of the nature or plane of their reality; in the journals of science and philosophy much has been written on this subject, and the question has been an active one for many years. Mr. Joel Pitcairn briefly discussed the subject in his recent address to the Association.

In an article entitled "The Existence of Theoretical Particles" by P. H. Flanders, Research Physicist to the Medical Research Council, and published in *Science News*, no. 32, the author, as I read his article, argues for what we might call two discrete planes of reality. According to his argument we cannot, for instance, discuss the reality of electrons in the same manner as we discuss the reality of chairs, tables, or potatoes; and each of these degrees of reality must be discussed in relation to its own standard of reference, for to discuss the reality and existence of electrons in terms of the reality of chairs and tables leads only to confusion.

To quote: "The category of 'substance' was characteristic of Aristotelian and post-Aristotelian metaphysics, but was discarded by the (British) Empiricists. Popular philosophy, as might be expected, tends to use categories which professional philosophers have ceased to use, or else to use confidently and uncritically categories which the professionals use with great hesitation. A very

important pair of such concepts are those of reality and existence. These concepts, I believe, have bedevilled not only the philosophy of popular science, but the philosophy of science itself. 'Do Electrons exist?' 'Are atomic particles real?' Such questions are at the very heart of popular controversies, and the strenuous affirmative and negative answers which they receive . . . are both wrong . . . , and the proper way of dealing with them is to refuse to answer them and to give instead an explanation of the function of the concept 'electron' in physical theory (pages 9-10).

"Our language is such that we describe the world largely in terms of properties of things. The idea that the world consists of *discrete* things, each of which has some but not all of the properties of other things, is embedded in the subject-predicate form of our sentences. We tend to carry over this idea into our theoretical systems; we speak not only of the properties of cheese, but also of the properties of electrons, only adding (by a familiar gambit) that atomistic objects have, it is true, not all the properties of ordinary objects, and perhaps none of them (p. 15).

"The justification for the use of the concept 'electron' is not that electrons somehow exist, but that the concept occurs in its appropriate place in an established system of physical theory (p. 16).

"We can visualize an electron as a little red ball, and it is unfortunate that the familiar mechanical models of the atom encourage us to do so. But as long as we think of it as a little red ball, or less absurdly, as a little something, we shall find ourselves wondering about its mode of existence (p. 16).

"To say that electrons are real can be to say no more than that a certain concept occurs in an established theory. To deny that they are real could be either to deny this, which would be absurd, or else to appeal to some alleged defect such as unobservability, which would be irrelevant" (p. 17).

P. W. Bridgman, in his book *Reflections of a Physicist*, asks among others, the following questions "Are experiments on single electrons possible? What is the evidence that an electron has independent existence? To what extent does an electron have identity? Can a stationary electron be detected?" And he continues with other questions of a like nature (p. 117).

We have already spoken of the difficulty of describing the medium, or the thing, possessing those finite properties that are responsible for the transmission of light. A like difficulty in describ-

ing the thing is encountered in electrical phenomena. It is quite probable that as many as fifty radio stations are transmitting waves of measurable wave length through this room at this moment. These waves, starting at distant or near transmitting stations over the earth's surface, can be received by a sensitive receiving set in this room, and by suitable instrumentation can be changed into sound waves which, fortunately, we can turn on or off at our pleasure.

The particular radio wave received is so substantial or real that its wave length is fixed by government decree; the government, however, having nothing to do with its velocity. Having velocity, or moving through space at approximately 186,000 m.p.s., it must be the velocity of something. The physicist will describe it as the movement of electrons through a field of force; and, accepting this theory, the electron can be pictured as the thing that is moving through a spatial field at a known velocity and wave length.

Our difficulties begin, however, when we ask ourselves: What is the electron? As our previous quotations from Mayo and Bridgman implied, it seems to have no spatial characteristics as does material substance or matter. We have only to realize that all of our fifty wave lengths are present and acting at the same time, on the single wire leading from the antenna to our radio, and also that the waves pass for the most part unimpeded through the substances of our buildings, to appreciate the fact, that although our electron very definitely exists in space, it does not (in the atomic sense) occupy space; in short, it has not the properties or characteristics of material or atomic substance.

The *Divine Love and Wisdom* doctrine implies that by due modifications the ether has its own discreted substances, as real and substantial on their own plane as are the substances of the lower or atomic plane. Both are substantial in their own degree; but as they are discrete we cannot measure or discuss the properties of one in terms of the other, as Mayo and others have reminded us, any more than we can discuss the properties of the substances of the spiritual world, in terms of the properties of the substances of the natural world; in spite of—as the Writings so often tell us—the similar appearance to us of both worlds. The spiritual chair will always appear to us as its natural counterpart, and if the appearance is there, we shall probably not be too disturbed about its so-called reality.

Unless we accept the doctrine of Preestablished Harmony, that is, action at a distance without the presence of an intervening medium, the facts both of light and electricity would seem to require the presence of a medium or ether; and, in the case of electrical phenomena, what appear to be substantial particles, which we may assume could be produced by the modifications of the ether.

In regard to the atom and its composition, the scientist is led to postulate many particles, the presence of which the facts require, but the properties or nature of which cannot be described in terms of atomic substance.

As the Writings tell us, the key to the solution of a rational understanding of the creative process lies in the application of the doctrine of discrete degrees, and it would seem that the evidence in regard to the atom, and the nature or properties of the particles that compose it, lead even the scientist himself to at least a vague perception of substance discretely above or differing from the material substance of the atom. The question that we would ask therefore, is, whether in the light of the facts of science as we understand them, and our interpretation of these facts in the light of our own philosophy, we are presuming too much in assuming that the particles that compose the atom are in reality manifestations of those discreted substances of the ether referred to in the *Divine Love and Wisdom*.

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## TRADITION vs. OCTONARY ARITHMETIC

KENNETH ROSE

“But we’ve always done it this way!”

What an immense influence this plea has had on human affairs through the centuries! It has challenged reason at every level, from affairs vital to the welfare of the human race to trivia affecting individuals, and emerged victorious in an unreasonable percentage of the conflicts. It can be used to defend any mistake that has been made more than once, and becomes stronger as the need for correction grows. It has delayed some scientific advances for centuries after their conception, and has foisted onto civilization such monstrosities as the English system of measurement, the Gregorian calendar, and men’s formal wear. It cannot be said that tradition has no value, but it is often an enemy of the scientist, both in his own thinking and in the world’s acceptance of his ideas.