CREATION EX NIHILO

L. FRANKLIN GRUBER

LIBRARY OF RELIGIOUS THOUGHT

CREATION EX NIHILO

THE PHYSICAL UNIVERSE
A FINITE AND TEMPORAL ENTITY

BY

L. FRANKLIN GRUBER

With a Foreword by

G. FREDERICK WRIGHT, LL.D., F.G.S.A.

BOSTON
THE GORHAM PRESS
MCMXVIII

Made in the United States of America

The Gorham Press, Boston, U. S. A.

FOREWORD

If the men of science could distinguish between their legitimate scientific conclusions and their metaphysical speculations, and if Christian apologists were less ready than some of them are to set limits to the realm of secondary causes, Science and Religion would have no difficulty in lying down together without either being incorporated in the other. Professor Asa Gray occupied a position in the scientific world scarcely second to any other authority. Yet he had no difficulty in accepting, on the one hand, the Nicene Creed, and, on the other, the Darwinian theory of the origin of species through natural selection. But this did not interfere with his implicit belief of a pervasive design in nature. One of his latest publications was entitled "Darwinian Teleology," in which he showed conclusively that, however much the Darwinian theory might extend the action of natural causes, it could not supersede the necessity of a designing mind to set those causes in operation, and to direct their course. The greater and more complicated the machinery to produce definite results, the greater and more complicated is the design, calling for a more exalted conception of the designer. A book printed by the linotype process involves even more evidence of design than one printed from separate type set up by hand.

The men of science properly deal only with secondary causes, from observation of which they draw conclusions of more or less probability with reference to conditions both past and future. Their investigations never lead them to ultimate facts. It is still as true as ever that, however much you may lengthen the chain of natural causes, you cannot reach the ultimate link that fastens it to its permanent support.

With regard to the ultimate source of the universe of secondary causes, only three suppositions are possible: (1) that the self-existent eternal cause was spiritual and personal; (2) that it was material; and (3) that both spiritual and material essences were self-existent and eternal. The man of science who assumes that the self-existent cause of all things was material,

instead of simplifying the mystery of existence has gratuitously multiplied it; for, out of purely material forces, he must develop personality and design—qualities that do not inhere in material particles and forces. If, on the other hand, he assumes the self-existence of both spiritual and material essences, he has made a gratuitous supposition which makes his mystery threefold; for it involves the mystery of the union of the two independent, self-existent, ultimate causes. Whereas the theist unifies the mystery (which is a scientific process), and finds in secondary causes (which on examination seem to be more and more spiritual) the handiwork of the Creator—too complicated, indeed, for us to fully understand, but whose nature can be easily apprehended by faith. In these secondary causes we can clearly "find God," though we cannot by any means "find Him out."

It is gratifying in these times of ephemeral publications to get hold of a treatise which goes to the bottom of the matter, which is not content with mere generalities but ferrets out all the ambiguities, fallacies, and non-sequiturs of atheism, materialism, monism, and agnosticism and brings them to the test of the most recent and most reasonable scientific conceptions of the universe. The author is specially strong in the use of the facts which demonstrate the finite and temporal character of the universe and the evidences of design apparent both in organic and inorganic nature. The work displays profound and most complete knowledge of the latest theories of astronomy, chemistry, physics, and biology.

We have followed with greatest interest the argument of Dr. Gruber in the present volume, and can most highly commend it for its comprehensiveness, and for the skill which is shown in stating the arguments for Theism, and in answering the supposed objections which have been raised by modern scientific discoveries. The volume commends itself equally to theologians and to men of science, and if read will do much to bring these classes together on a plane where they can reason together without animosity and work together in the promotion of the common ends of science and religion.

G. Frederick Wright.

Oberlin, Ohio,
July 25, 1917

CONTENTS

INTRODUCTION

To the thoughtful mind the questions, *Whence? What? Why?* and *Whither?* spontaneously suggest themselves on every side. The subjects of the *origin, being, purpose* and *destiny* of man and nature, have therefore in all ages occupied the minds of men. Indeed all philosophy is an attempt to answer these great questions. The first of them, that of the *whence,* or of *origin,* lies back of the other three and in a sense involves them. It constitutes the subject to be considered in this book.

IMPORTANCE OF THE SUBJECT

Has the universe existed from eternity, or was it, even as to its material or substance, created by a Divinity in time, or at time's beginning? This is the real question. To one who has arrived at the conclusion that the universe has existed from eternity, there is but a step to every possible negation, from the denial of a miracle to confirmed atheism. To one who has become convinced that it was created, even as to its material or substance, by the Christian's God, everything else, from the simplest miracle to the crowning miracle of the Incarnation of the Son of God, is as nothing for faith to grasp and even for reason to accept.

If a miracle be defined as an event in nature that cannot be explained by the ordinary laws of nature, then the establishing of the fact of the creation of the universe, *ex nihilo* or out of nothing—as this event must have antedated existing nature and therefore nature's laws—should be of supreme importance to both faith and reason. By the very definition of a miracle, such a creation must have been the great primal or fundamental miracle, transcending and indeed involving all accredited miracles in *created* nature.

Thus, the fact of the creation of the universe *ex nihilo* being accepted, that of all other Biblical miracles becomes not only

possible to faith, but also acceptable to reason. Between such creation and its perhaps even more wonderful counterpart, the Incarnation, all other miracles, in addition to their immediate purpose, should serve also as striking illustrations of continued Divine immanence.

Hence, as this subject has often stood out as a chief point or occasion of difference between what might in a general way be called the Academy and the Church, or supposedly between nature and accredited Revelation, it is one of supreme importance to both science and religion.

But even apart from this scientific and religious, or scientifico-religious, importance of the subject, it has also a more purely philosophic side, as we have indicated in our introductory paragraph, that appeals to every searcher after truth and every thoughtful reader. Therefore, even from the purely intellectual—or we might say, scientifico-philosophic—side, the subject is one of absorbing interest.

SCOPE AND TREATMENT

It does not come within the scope of this work to discuss the particular *manner* of creation by a Deity, whether it was instantaneously or gradually, virtually by one act or by a long series of repeated acts, wholly directly or chiefly through secondary causes. Nor do the *creative days* of the first chapter of Genesis enter into our consideration. The chief purpose of this work is to prove that the universe of matter and its correlate energy, together with life, must necessarily have been created *out of nothing* by a supreme or absolute Personality. And it is, therefore, the *fact,* not the manner nor the time, of that primal creation that here chiefly concerns us.

Nor do the Christian Scriptures enter much into our discussion, as we are addressing ourselves more especially to that apparently growing class of people who will not accept the Scriptures by themselves as credible evidence. In reasoning with such upon such a subject, it is only fair to them that we should waive, or at least withhold, the evidence which to them is not acceptable. It is, therefore, necessary to meet them upon the basis of their own premises of reasoning. And, indeed, as the very intellectual atmosphere is becoming more and more scientific, it is not only the professional men of science, but also

those with an acquired scientific attitude, that look for scientific evidence. Hence, it is *this* evidence for a creation *ex nihilo* by a transcendent Deity, not that of the Christian Scriptures, that we are endeavoring to present. We are here placing *science,* not Scripture, upon the witness stand. And, even much less so are we in this work setting forth or defending the detailed *Christian facts* of the Scriptures, as a development of the more specifically *Christian* evidences. The setting forth of these facts in the light of all the evidence of present scholarship, requires a separate volume and a different method of treatment.

And yet, after scientifically establishing, from the evidence from nature itself, the fact of a creation *ex nihilo,* by a supreme Deity, it is also only fair to the Christian view-point to show that the evidence of the Christian Scriptures matches this evidence from nature. This is rather the reverse of the usual method of approaching the scientific searcher after truth or the honest doubter, but it should need no argument to prove it to be the only proper method. An unscientific Christian—if we might use such terminology—would have a right to expect to be convinced, if conviction were attempted, from his own view-point, that a certain scientific fact is not in conflict with Revelation. So a physical scientist—or an individual with a scientific attitude toward truth—who has honest doubts, has a right to expect to be convinced, if conviction is attempted, upon his own premises of reasoning, that a certain Scriptural doctrine is not in conflict with scientific fact. This must, therefore, be kept in mind by the reader, as, step by step, we endeavor to prove, from established and assumed premises of science, that nature really agrees with Revelation in its testimony for a creation *ex nihilo.* Fully believing in the "round table," our invitation is, *Come, let us reason together.*

It is, therefore, because we are reasoning from the view-point of the scientific thinker, that even many of the as yet unproved scientific theories are made to bear upon our subject and are treated as though they were or expressed scientific facts. And, thus, in addition to showing that *established science* really testifies to a creation of the universe *ex nihilo,* our argument also proves that even the *more speculative theories of science* point in the same inevitable direction. Hence, the evident inference should be that all the indications of the present develop-

ments of science point to the same *absolute creation* by an absolute sovereign Personality as is so manifestly set forth in the Christian Scriptures.

Many of the arguments against the anti-theistic conceptions of the universe herein set forth, are a development of arguments repeatedly employed by the writer in reasoning with scientific and other honest doubters, as well as with self-confessed pronounced atheists. As those arguments, in actual discussion, were found to be unanswerable, they were briefly set forth in short papers, as well as in occasional addresses on the evidences for God in nature. And, now, in this volume they are more fully elaborated for wider application.

It should be said also that, for the sake of completeness, certain very important points at least partially enter into the argument of more than one chapter. But, all unnecessary repetition is avoided. In the interests of fuller illustration and greater emphasis of some points here and there only briefly made, the reader is, however, occasionally referred to other chapters, in which such points or arguments are more fully developed.

Throughout the whole, the aim has been clearness in argument no less than perspicuity in language. And, although even the latest scientific theories necessarily figure prominently in the discussions, these are, we believe, made as intelligible as is ordinarily possible in the case of such subjects. Indeed, for this very reason, some of these theories are developed somewhat more at length than should ordinarily be necessary in such a treatise, so as to make their application in our argument all the more definite and convincing also to the scientifically untrained mind.

Moreover, where mathematics enters into our arguments, only such applications of it are made as are necessary to make our points definite and clear. But all its higher functions and applications are avoided. And, indeed, should any of our readers not wish even to follow certain of these mathematical demonstrations, they will still have the satisfaction of seeing the results or conclusions reached. After all, the chief interest in such a discussion lies in the fact *that* a certain inevitable result or conclusion must follow from certain accepted premises, rather than *how* that result is attained. And yet, although we might thus have given only the ***conclusions*** of such

processes of reasoning, for more certain conviction we let the *processes,* in an abbreviated form, appear with their conclusions. Thus, we believe that our argument for the creation of the universe *out of nothing* by a supreme spiritual Personality—Whom the Christian adores as God—will be simple enough for the average reader and yet have some interest for the man of science, while we trust it will bring conviction to both. Care has been exercised to avoid errors; but some may nevertheless have crept in.

And now, with the invitation to the various classes of readers, *Come, let us reason together,* we shall send forth this volume on its intended mission, submitting its contents to their careful consideration and candid judgment.

L. F. G.

St. Paul, Minnesota
June, 1917

CREATION EX NIHILO

CREATION EX NIHILO

CHAPTER I

THEORIES AS TO THE ORIGIN OF THE UNIVERSE

It may be said, in a general way, that there are two distinct views as to the possible origin of the universe. According to the one, it was a creation or a development from an eternally existing substance or stuff, whether that substance be considered as the essence of an ever-operating Divinity, or as eternal matter operated upon by an external Divinity or developed by some supposed inherent potentialities. According to the other, it was a creation *out of nothing* in time, or at time's beginning, by the omnific will of an eternal and absolute Creator. And the former of these views, more especially, comprises a number of somewhat different theories.

I SEVERAL SPECULATIVE THEORIES BRIEFLY STATED

The theories of the origin of the universe that have been offered by unenlightened human reason, are numerous; but they may for all practical purposes be divided into several distinct groups. It is not necessary for our purpose, however, to consider all of them, nor here to discuss even any one of them in detail.

According to the Hindu Rig-Veda, the universe was originally a confused chaotic darkness, which the great originator or god first dispelled and then created water with its seed of light. Out of this seed he developed a golden egg, in which Brahma sat a year in meditation; and, finally breaking it, he made

heaven and earth out of its two halves. According to modern materialism, the universe had no beginning. But it is regarded as the result of an endless series of developments from itself by its own inherent energy. The former may be said to put the hen first; the latter apparently puts the egg first, generally even to the denial of the existence of the hen.

As we have given the theory of the Rig-Veda for Eastern philosophic speculation, we shall also let several authorities speak for Western philosophic science. Upon the subject of the supposed *cosmic development,* Ernst Haeckel, the great champion of monistic philosophy, has expressed himself in the following words: "By this [Monism] we unambiguously express our conviction that there lives 'one spirit in all things,' and that the whole cognizable world is constituted, and has been developed, in accordance with one common fundamental law. We emphasize by it, in particular, the essential unity of inorganic and organic nature, the latter having been evolved from the former only at a relatively later period" (*Monism as Connecting Religion and Science,* 1894, p. 30). And this development is, of course, assumed to have been or be an *eternal* process, as expressed by A. W. Bickerton in the following statement: "Agencies were found that elevated dissipating energy, and others that tended to disperse matter, until a complete mechanism disclosed itself; that rendered it possible that we exist in a cyclic scheme of creation, in which there is no evidence of a beginning or promise of an end, but a cosmic whole infinite and immortal" (*The Birth of Worlds and Systems,* 1911, p. 10). Moreover, the natural inference or conclusion from such a supposed process, on the part of Western philosophic science, is that *matter, energy* and even *life* are eternal. Thus the great Swedish scientist Svante Arrhenius speaks as follows: "Man used to speculate on the origin of matter, but gave that up when experience taught him that matter is indestructible and can only be transformed. For similar reasons we never inquire into the origin of the energy of motion. And we may become accustomed to the idea that life is eternal, and hence that it is useless to inquire into its origin" (*Worlds in the Making,* 1908, p. 218). And, of course, from such premises, it must be only logical to conclude that the universe is an *uncreated* entity. And this has come more and more to be the pet theory of a growing group of scientists. And although

this is the implied view in the works of these men, it has within recent years very frequently become a matter of open declaration. Among many such statements as might be cited, we would quote the following by Dr. Saleeby in *The Academy* of March 25, 1905: "Radium-clocks have been made that will go for a million years; but I believe that the Universe was never made and will go on forever" (Vol. LXVIII., Article: *The Life of the Universe,* p. 342). Thus the universe is held to be infinite, eternal and therefore uncreated, and the idea or need of a God is supposedly eliminated from the universe.

Between this extreme materialistic position and that of the Rig-Veda there are modified theories of every shade, some closely approaching the former and others closely approaching the latter. The mythological theories of paganism are, however, generally associated with some idea of *emanation,* the physical universe being regarded as a series of effluxes from the Godhead. The philosophico-scientific theories are associated with some idea of *development,* by properties and forces inhering in supposed eternally existing matter.

In a general way, it may thus be said that Oriental speculation makes the universe to flow forth from Divinity itself—although even John Milton, Sir William Hamilton, *et al.,* also entertained similar views—while Western philosophy makes it to arise out of eternal matter. And in both there is undoubtedly a bold *groping* after, and almost a *grasping* of, at least a part of the real truth. But while there are elements of truth in both, they nevertheless both sadly miss the kernel of truth itself. In making the universe an emanation from Divinity, Oriental philosophy ends in the ultimate identifying of God and the universe, leaving the universe and all within it essentially divine. In making the universe simply an inherently necessary evolution from eternal matter, Western philosophy tends to eliminate the idea of God, at least as a personality, altogether. And, between these two extremes, human speculation in Orient and Occident has ever been oscillating, now deifying nature, now materializing all; but the true conception of what really constitutes *creation* has been absent from both.

It is interesting to note, however, that there is a tendency in Western philosophy, in a sense, to approach, or rather even to pass, Eastern philosophy on this subject. Impelled by the inevitable *God-necessity* to explain the universe, some Western

philosophers have come to regard the universe as a whole as itself *God.* In Oriental philosophy it is primarily only an emanation from God, though resulting in its own deification. Thus, some Western Philosophers have been driven by the inadequacy of the purely materialistic explanation of nature to arrive at practically the same end as that which Eastern philosophers have reached. There are, of course, several forms of this so-called *pantheism,* one of them being but a very little advance upon pure *materialism.*

Driven by the impelling sense of the necessity of a Divinity back of, or within, the great *All* to account for its existence, Ernst Haeckel gives utterance to the following: "As the simpler occurrences of inorganic nature and the more complicated phenomena of organic life are alike reducible to the same natural forces, and as, further, these in their turn have their common foundation in a simple primal principle pervading infinite space, we can regard this last (the cosmic ether) as all-comprehending divinity, and upon this found the thesis: 'Belief in God is reconcilable with science'" (*Monism,* p. 92).

While we do not want to anticipate our fuller answer, to be given later, we might call attention to the faulty reasoning in this quotation. The whole argument is based upon unproved premises, and therefore the conclusion is untrustworthy. Where, for example, is the proof that "the simpler occurrences of inorganic nature and the more complicated phenomena of organic life are alike reducible to the same natural forces"? And whence did the learned philosopher derive his information that these natural forces have "their foundation in a simple primal principle pervading infinite space"? These assumptions are taken as facts only in the interests of a theory. What then is the final value of the theory? Why could not the author just as readily say *Personality* as *principle,* and thus practically express the profounder Christian truth, toward which all real philosophic speculation has more or less tendency instinctively ultimately to gravitate?

And what is true of the reasoning in the above quotation is equally true of others cited earlier. But the mere calling of the attention to such assumptions should be sufficient in this connection to put the reader on his guard as to the reasoning of these men on this subject in general.

In contrast with the *pantheism* of some eminent Western

philosophers, we might call the conception of creation of Eastern philosophers *panextheism*. The Christian conception might then truly be spoken of by the term *panentheism,* although this word is subject to abuse. There is a broad general sense, therefore, in which all three agree; namely, that *all is from God.* In Eastern philosophy all is from God as an emanation from His divine substance—all *from* or *out of* God—*panextheism.* In the prevailing form of philosophic pantheism all is from God as a manifestation or unfolding of His own being—all *is* God. To the Christian philosopher all is from God as an entity called into being by His creative will—all from, in the sense of *potentially in,* God—*panentheism.* But, in all the speculations on the subject of creation, some creative Divinity is either assumed or implied. Nor can any theory be conceived of as workable that attempts to remove God altogether from His universe.

More than this brief statement of the prevailing philosophic views of creation it is not necessary here to give. Other details of the materialistic conception will be given in our further discussion, as also there will be of the Christian conception.

II SCRIPTURAL IDEA OF CREATION *EX NIHILO*—A TRANSCENDENTAL ONE

The undoubted Scriptural idea of creation, as we hope conclusively to prove later, is that which furnishes the title of this book; namely, that of a creation *ex nihilo, out of nothing.* This idea of creation, by the free volition of an absolute or unconditioned and eternal Being—of the material itself, *out of nothing*—is, of course, foreign to mere human thought and speculation. The mind of man is so constituted that the idea of the unconditioned can never really enter unenlightened consciousness. It must ever reason from known or accepted premises or data, and to it the idea bodied forth in the expression *ex nihilo,* is even unthinkable as an element of such premise.

I MAN'S LIMITATIONS AS TO THE CONCEPTION OF SUCH AN IDEA

To the natural man there are only two sources of information, his limited consciousness and experience. And neither

consciousness nor experience can afford him any data as to ultimate origins. Thus, a *something from nothing*—an effect without any apparent cause—is totally unthinkable. It does in no way form part of experience, for by experience we know only of a making from existing materials; and it cannot enter, or be an element of, the consciousness of a conditioned mind. The mind is finite, as it is but *part* of a *created* (as we hope to prove), and therefore conditioned or limited, material and spiritual universe, as we know even from consciousness; and it is by that conditioned universe that it is in turn conditioned at every point. And, therefore, only as a *creature,* and conditioned, and in terms of a *created,* conditioned and conditioning, universe can the mind reason.

It is this conditioned nature of the human mind that gives such apparent force to the adage, *ex nihilo nihil fit,* and makes it the philosophic axiom that it is commonly regarded to be. It is this also that indirectly gave birth to, and sustains, as great working hypotheses in the present state of nature, such great scientific doctrines as those of *the universality of gravitation, the uniformity of nature, the conservation of matter and energy,* and those of *tri-dimensional space* and *time as necessarily measured duration,* as well as all accepted axiomatic truths. And, indeed, here is its legitimate sphere. Without a consistent application of the principle that underlies these scientific doctrines, both scientific and mechanical progress would be impossible. It is here applied to the determination and application of laws operating in an already *existing* universe in its present state, in which an accumulation of proper data is accessible, but to which, however, such data for reasoning are limited.

But, when that conditioned nature of the mind becomes the ulterior background for, or the ultimate cause of, the mind's denial of what lies beyond its limited or conditioned consciousness and experience, such as a *creation ex nihilo,* it is plainly applied to, or operative in, what is by nature totally foreign to it. Or, when the mind in its conditioned nature attempts with certainty to solve the problem of the primal *origination* of the *existing* universe, then it attempts what does not belong to its proper sphere, and what therefore lies beyond the range of its every function. All its data for reasoning are limited to what already *exists,* however it came to be. Here, then, the

conclusions of unenlightened reason cannot be trusted. It is, therefore, absurd for the human mind to stand in judgment on the problem of creation.

Some statements of Sir William Hamilton bearing upon this subject add confirmatory evidence for the point just made. Note, for example, the following: "We are utterly unable to construe it in thought as possible, that the complement of existence has been either increased or diminished. We cannot conceive, either, on the one hand nothing becoming something, or, on the other, something becoming nothing" (*Discussions,* Third Edition, 1866, p. 605). As we cannot, however, agree with Hamilton in his different application of this principle, an analysis of this statement seems necessary.

As above explained, it is true, as this author says, that we are unable to *construe in thought* as possible, or to *realize,* either absolute creation or absolute destruction. But it is not necessarily true, as he also implies, both here and elsewhere, that such creation and destruction are *not possible.* It is also true that we cannot conceive of *nothing* ***becoming*** *something,* or of *something* ***becoming*** *nothing.* Who would believe in such an impossibility! It is surely far from us to believe in *such a becoming.* Nor do we believe even in a ***creation*** of *nothing* into *something,* or of a ***destruction*** of *something* into *nothing,* as if *nothing* were a *thing* out of which *something* was created or into which *something* might be converted by destruction. Of course, such an impossibility could not be conceived.

By absolute creation, as already indicated, is meant the creation of something without previously existing materials, so that something is made to exist where before there was nothing. And so, by absolute destruction is meant the total blotting out of an existence, so that the existence altogether ceases to be. And yet, as clearly shown, even this cannot be directly conceived of by the finite mind. Therefore, whatever meaning as to creation or destruction Hamilton meant to convey, he said truly that we are utterly unable to *conceive* of it. But, in denying the *possibility* of absolute creation and absolute destruction, he was reading into the being, thoughts and acts of an unconditioned God, the limitations of the being, thoughts and acts of conditioned man.

This error of Hamilton was a natural conclusion from the contradictory elements in his philosophy of the Unconditioned,

and from his apparently faulty notion of casuality. By these errors in his philosophy he was driven to say, "When God is said to create the universe out of nothing, we think this, by supposing, that he evolves the universe out of nothing but himself" (*Discussions,* p. 605). Such *creation* would merely mean *emanation.* And yet, as if laboring under the palpable difficulties involved in his reasoning on this subject, or as though perhaps impelled by his own early Christian convictions, he also in places apparently approached the Christian conception of creation. Some such meaning may be read into the following words: "It [creation] is conceived, and is by us conceivable, merely as the evolution of a new form of existence by the fiat of the Deity" (*Lectures on Metaphysics and Logic,* 1859, Vol. II., p. 405).

The fact is, that in Hamilton's philosophy an absolute creation could have no place. And, when followed to its ultimate conclusions, his philosophy must end practically in a pantheism whose controlling principle is that of a fatalistic necessity. This should be a striking illustration of the inconclusiveness of human ratiocination, especially when based upon faulty premises, on this transcendental subject.

The transcendental nature of the idea of a creation *ex nihilo* has also been recognized by some other philosophers, among them Herbert Spencer and Ernst Haeckel. Thus, Ernst Haeckel has expressed himself as follows: "The conception of creation is perfectly unimaginable, if by it is understood 'an origination of something out of nothing.' This acceptation is quite incompatible with one of the first and chiefest of Nature's laws—one, indeed, universally acknowledged—namely, with the great law, that all matter is eternal" (*Generelle Morphologie der Organismen,* Vol. I., p. 171).

The conception of creation, as an origination of something out of nothing, is truly unimaginable; but it is not so because of its necessary impossibility, but because of the very nature of the human mind. The impossibility does not exist in the nature of creation or of the created universe; but it exists in the created nature of the human mind. So-called imagination itself is in reality governed by experience. Its products contain no new elements, but only new combinations of old presentations. Therefore, even imagination, in its final analysis, cannot transcend the elements of experience and conscious-

ness. Hence, creation *ex nihilo* cannot even be *imagined.* And so far Haeckel has spoken truly.

But, when the learned author is carried away by his preconceived notions that such creation is absolutely impossible, to say that it would be incompatible "with the great law, that all matter is eternal," he is inadvertently led to a *petitio principii.* Whether matter is eternal or not is the ultimate question at issue. Hence, to speak of a creation out of nothing as being incompatible with such a supposed law, is the same as speaking of a creation of something already existent. Such a statement is, of course, a palpable absurdity.

In another of his works Haeckel makes a similar confession of our inability to understand a *creation out of nothing:* "Creation, . . . as the *coming into existence of matter,* does not concern us here at all. This process, if indeed it ever took place, is completely beyond human comprehension, and can therefore never become a subject of scientific inquiry. Natural science teaches that matter is eternal and imperishable, for experience has never shown us that even the smallest particle of matter has come into existence or passed away" (*The History of Creation,* Vol. I., p. 8).

In this passage also his reasoning seems somewhat inconsistent. While he speaks of our inability to comprehend the process of such a creation, *if it ever took place,* he definitely declares that matter is eternal and that therefore it did not take place. And, if matter were certainly known to be eternal, it would be absurd to speak of such a creation, or even of the impossibility or possibility of comprehending it. But "there is the rub." Our author here also, for the sake of his monistic philosophy, is plainly begging the question. It is one thing to *say* that matter is eternal, or that science definitely so teaches; but it is quite a different thing to *prove* such a statement. He therefore assumes what even for his own philosophy must first be proved. If matter were eternal and could be proved to be so, then the question of such a creation would forever be settled and closed. And, whether it is so or not, is the chief burden of our consideration.

Therefore, while these statements of Hamilton and Haeckel illustrate the faulty reasoning with which some eminent men would win the world to their views, they really strengthen our arguments in proof of the transcendental nature of the Scriptural idea of creation.

2 MAN'S LIMITATIONS AS TO THE EXPRESSION OF SUCH AN IDEA

This transcendental nature is illustrated even in the very inadequacy of language to express it. And, this is apparent in the language not only of those who reject the theistic or Scriptural view, but also of those who reverently accept that view. Indeed, all human language is the outgrowth of necessity, terms being born or developed whenever new ideas demand expression, or old terms being pressed into service with added meanings. From primary or root ideas, reason, recognizing certain relations, comparisons, etc., evolves more complex but related ideas. Yet all these ideas may be said to have their ultimate root in the physical sensorium, and are developed and modified by *experience* in contact with a *created* and finite *physical* universe. Therefore, through sense experience and consciousness, acted upon by reason, all language is really the outgrowth of, as it is based upon, the present physical sphere with its needs. *Infinity, creation ex nihilo,* etc., extending or lying beyond the range of human consciousness and experience, can therefore not only not be conceived, but they cannot even be *expressed* in *primary* or *root* terms of human speech.

Thus, the word *infinite* is simply a negative term expressive of that which does *not* have an *end.* The really unknown or incomprehensible idea expressed in the word *infinite* is therefore based upon, or developed from, the well known idea of a something that *has* an end. The same is true, in their analysis, of such terms as *endless, eternity, creation,* as also of the various expressions for *God.* Thus, the etymology of such Hebrew names for God, as *Jehovah, El, Elohim, Elah, Eloah,* only too clearly illustrate the inadequacy of human speech to express the transcendental idea of *God.* This is therefore the natural basis of the many anthropomorphisms and anthropopathisms of the Scriptures, which have been made the pretended ground of objection to its contents on the part of many men of science. Thus, Ernst Haeckel makes the following objection to the Scriptural conception of God: "As a rule . . . it is an open or covert anthropomorphism. God is conceived as the 'Supreme Being,' but turns out, on closer examination, to be an idealized man" (*Last Words on Evolution,* p. 104). In the light of what is said above, it should be almost needless

to say that the learned author ignores the real cause for such necessary anthropomorphism. A revelation of the one *infinite* and *absolute* Creator to a *finite creature* would not really be possible in terms or ideas of the Infinite and Absolute. It must necessarily be made in terms or ideas intelligible to such a creature; and for man these must, of course, be anthropomorphic and anthropopathic.

It is manifestly a misapprehension, or an apparent lack of proper understanding of the necessary inadequacy of human speech to express transcendental ideas like that of *God,* etc., that has thus caused so much confusion, on the part of many scientists, as to anthropomorphisms and anthropopathisms. This has given rise to many really absurd statements along this line in even very recent scientific and philosophic works.

This inadequacy of human language, fully to express the idea of creation, because it transcends experience and consciousness, is therefore itself an additional evidence of the transcendental nature of the idea itself. Hence, the evident struggling for expressions by many writers to body forth such ideas, as well as the palpable inconsistencies and confusion in the reasoning of many of them upon this transcendental subject.

Thus language and idea must match each other, and neither of them is the measure of existence. Hence, *creation, God,* etc., can no more by us be absolutely expressed than they can by us be really known or conceived. But the sphere of our knowledge or conception is surely not conterminous with the sphere of existence or reality. And yet, the two spheres should be virtually concentric, as the sphere of *actual knowledge* must be a real part of the sphere of *reality*—and, of course, that part nearest to the centre of conception. So, the sphere of reality for man must proceed from the centre of his conception outward indefinitely beyond the variable sphere of knowledge. And where the sphere of reality passes beyond the sphere of human knowledge and conception, it becomes the hypersphere of faith. And yet, even that hypersphere of a truly certified faith can not nullify or set aside the sphere of actual knowledge, nor can it even be in conflict with consistent reason—as it is only the extension of the sphere of the same reality as that which constitutes limited real human knowledge. Hence, where knowledge ends faith begins. And where even conception ends, faith in a reality even transcending conception,

rests in that transcendental reality as the *ne plus ultra* which is the necessary postulate for all existence. And that ultimate reality is for the Christian his adorable God; and for others, from the agnostic to the atheistic materialist, it in a sense must also be equivalent to some causal Divinity.

Moreover, as the sphere of our real knowledge enlarges, so also, for us, must the transcendent continuation of the sphere of reality necessarily enlarge with it. The larger the contained or central sphere of light becomes, the larger becomes the containing or ensphering sphere of darkness. And thus, with the expanding of the sphere of our conscious knowledge of reality must necessarily expand our consciousness or conception of the greatness of the reality that transcends our knowledge. This might almost be considered as the same as saying that the enlarging of the sphere of conscious knowledge also necessarily enlarges our consciousness of our transcendent ignorance.

And thus there is truly a variable limit to the certain, and therefore legitimate, sphere of human reason, beyond which there can be no direct evidence of sense, of experience and consciousness, upon which to base trustworthy conclusions. And, therefore, as to truth and reality in that unexplored region, the speculations of unenlightened reason cannot safely be followed. And yet, as above intimated and as implied throughout, there is a universal intuitive conviction, tantamount virtually to a dim indefinite consciousness, of the *existence* of *transcending* truths and realities and of an ultimate or transcendent *absolute* Reality. And here faith in this *natural* conviction of the existence of such realities and truths is as necessary as faith in the *supernatural* revelation of them, devoutly accepted by the Christian. Thus, we emphasize, where real knowledge ends, a real faith based upon other natural evidence than that of the physical sensorium, as well as faith based upon the certified evidence of the Christian Revelation, naturally begins. And to that transcendental realm the subject of creation necessarily belongs, as also pointed out above.

This transcendental nature of the subject in hand must, however, not prevent us from making a careful study of the same in the interests of truth against error, of Christianity against atheism. By nullifying or neutralizing the arguments of the objectors to the Scriptural idea of creation *ex nihilo*, we

shall be taking away, or spiking, their only weapons of defense. And, in addition to this, by incontrovertible arguments in proof of a creation by a supreme Will, we hope to show not only that this transcendental idea of creation is the only tenable one, but also that such a creation is even a demonstrable fact.

CHAPTER II

MATERIALISM'S EXPLANATION OF THE UNIVERSE INADEQUATE

UPON the mere face of it, especially as to some of its fundamental elements, the explanation of the universe, according to materialism, may to many people seem rather plausible. Its primary assumption, as has already been noted, is that matter is uncreatable and indestructible, that it must therefore have existence from eternity, and that therefore also it must through eternity continue to exist.

This assumption is, however, clearly a *petitio principii;* for, whether matter is uncreatable and indestructible or not, or whether it is eternal or not, is the question at issue. The fact that matter is uncreatable and indestructible by human means is no proof of its being eternal. Because of our own limitations, we cannot deny to Almightiness the power of absolute creation and absolute destruction any more than the power of a making from previously existing materials or a changing of form.

Materialism, moreover, assumes certain potentialities or energy in this supposedly eternal matter, by the operations of which the great cosmos, including the phenomena of life and mind and history, through long cycles of progression or evolution, came to be. We shall now consider the explanation of the universe, according to materialism, somewhat more at length, under two heads; namely, *as to inorganic nature* and *as to organic nature.*

I AS TO INORGANIC NATURE

Eminent scientists have come to the natural conclusion that only the form of matter is changeable, but the ultimate substance never. Thus Clerk-Maxwell, in his *Lecture on*

Molecules before the *British Association,* Bradford, 1873, made the following statement: "Natural causes, as we know, are at work which tend to modify, if they do not at length destroy, all the arrangements and dimensions of the earth and the whole solar system. But though in the course of ages catastrophes have occurred and may yet occur in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins, the molecules out of which these systems are built—the foundation-stones of the material universe—remain unbroken and unworn" (*Scientific Papers,* Vol. II., p. 377).

This scientific doctrine of the apparent indestructibility of matter, amid its Protean transformations, is made the basic principle of modern materialism. And, in a general sense, at least from the standpoint of man's powers, it may be scientifically true for the existing or present order of nature. And yet, it is now definitely known that even the atoms—those supposed foundation-stones of the universe—are disintegrating by what is known as their own intrinsic sub-atomic energy, and that this energy must ultimately be dissipated as heat and eventually be equalized and lost for further use.

I THE REASONING OR METHOD AND THE SPIRIT OF MATERIALISM ANTI-THEISTIC

Materialists, of course, hold to the scientific doctrine that all matter ultimately consists of individual but infinitesimal particles called atoms and electrons. And this theory is undoubtedly correct. They declare that these ultimate particles combine into molecules according to definite laws, and that aggregations of these molecules constitute masses. And this is equally true. They teach that, by the operations of inherent energy, these, in their interactions, have evolved into the great cosmos of which man with his body and rational soul is a part. This is, however, only an hypothesis of scientific faith; or, shall we say, of *scientific wish?* But, within and above or beyond the universe, materialists recognize no living divine Personality originating and energizing all. In this theory God has no place, as the God-factor is supposedly not needed. Its assumed eternal matter, with its supposed inherent and ever-operating potentialities, is considered sufficient to account for

all existence. Thus, in such works as Laplace's (1749-1827) *System of Celestial Mechanics* (*Méchanique Céleste,* 1799, etc.), there is no place for an ever-operating and sustaining Deity. This was readily recognized by the great Napoleon, as he read Laplace's book. He accordingly said to the philosophic astronomer, "Monsieur, I have examined your work and find therein no room for the existence of God." The answer of Laplace, from the viewpoint of an all-sufficient materialism, naturally was, "Citizen, premier consul, I have no need of such an hypothesis." In his earlier work, *Exposition du Système du monde* (1796), he had similarly attempted to account for nature altogether without a creative Deity.

And yet, the *nebular theory* of a purely natural mechanistic explanation of supposed cosmic evolution, is more and more being rejected in the form in which Laplace gave it to the world. Thus, after considering the *nebular theory* in the light of irregular movements of comets, etc., Sir Robert Ball sums up as follows: "The solar system consists of some thousands of different bodies; these bodies move in orbits of the most varied degree of eccentricity; they have no common direction; their planes are situated in all conceivable positions save only that each of these planes must pass through the sun. Stated in this way, the present condition of the solar system is surely no argument for the nebular theory. It might rather be said that it is inconceivable on the nebular theory how a system of this form could be constructed at all. Nine-tenths of the bodies in the solar system do not exhibit movements which would suggest that they were produced from a nebula. . . . The planetary system now lives because it was an organism fitted for survival" (*In the High Heavens,* p. 224).

This and other conclusions of some eminent scientists should go a long way to put people on their guard against too readily accepting the verdict of certain other scientists as final. And, of course, when these men substitute nature for God, or deify nature and spell it with a capital *N,* and dogmatically declare against the existence of God, it were well to be somewhat timid in following these self-constituted orphans in the universe. Surely, a man who denies his father, must have an ulterior motive and can, therefore, not be trusted as a guide.

Fully as emphatic as Laplace—and even more so in some cases—in their denial of the existence of God, have been some

other writers. Thus, some statements of Schopenhauer, Feuerbach, and others that might be mentioned, border even on the profane. Thus, Feuerbach went so far as to say, "There is no God; it is clear as the sun and as evident as the day that there is no God, and still more that there can be none."

Of similar import is Ernst Haeckel's dogmatic declaration, in the interests of his philosophy of materialistic monism, as follows: "Our monistic view, that the great cosmic law [of the conservation of substance] applies throughout the whole of nature, is of the highest moment. . . . It marks the highest intellectual progress, in that it definitely rules out the three central dogmas of metaphysics—God, freedom, and immortality" (*The Riddle of the Universe,* 1900, p. 232). And equally dogmatic and unfounded are the following later words by the same author: "These two laws [of the conservation of matter and the conservation of energy] are irreconcilable with the three central dogmas of metaphysics, which so many educated people still regard as the most precious treasures of their spiritual life—the belief in a personal God, the personal immortality of the soul, and the liberty of the human will" (*Last Words on Evolution,* 1906, pp. 110-111).

In Haeckel's opinion, monism is the undoubted key to the explanation of all existence. He thus considers settled not only the doctrine of the nature of matter, which he regards as an eternal entity, but even that of the origin of sensation and consciousness. Monistic evolution he considers sufficient to account for the evident order and arrangement in nature, the origin of life, together with rational thought and human speech. There is, therefore, no need of a creating and directing Deity. Free personality has, therefore, also no existence in reality. What might be considered as Deity, is, therefore, not a Personality, but the inherent potentiality or the evolutionary impulse in nature, which may be traceable to the ultimate ether, as he explains elsewhere (*Ibid.,* p. 16). Thus nature and what there is of a Deity are one, as also are body and the so-called soul, matter and so-called energy. Matter and spirit are, therefore, regarded as two attributes, or faces of the one universal substance, which is itself essentially divine. Substance would thus be a *double-faced entity,* as Alexander Bain expressed it. The philosophy of monism may, therefore, well be designated as monistic pantheism.

Somewhat similar in tone to the statements of Haeckel, is the following by Gustave LeBon: "If hypotheses analogous to mine [as to the origin of matter and energy] are rejected, we must return to that of a creator drawing forth worlds from his will—that is to say, from a nothing much more mysterious still than the substratum from which I have endeavoured to raise them. The gods having been eliminated from nature, where our ignorance alone had placed them, we must try to explain things without them" (*The Evolution of Forces,* 1908, p. 98).

It is thus readily seen that materialism's burden is to remove God from the universe by explaining everything without Him. And the wish seems to be father of the thought. There is, therefore, a manifest method in its madness. And, indeed, materialism's explanation of the universe, superficially viewed, seems almost like conclusive reasoning: but let us more closely examine it.

2 THE PREMISES OF MATERIALISM MATTERS OF INDEFINITE UNFOUNDED SCIENTIFIC FAITH

To materialists, the Christian's conception of creation is too much a matter of faith. They must *know,* and surely the idea of God cannot, as they contend, be a matter of knowledge. And yet, their own reasoning is also, in its last analysis—and must necessarily be—based upon faith. Materialists postulate as their major premise what is really the burden of proof; namely, the eternity and indestructibility of matter. They must accept the theory of infinitesimal atoms and electrons, which themselves necessarily lie beyond the range of all certain knowledge gained by direct experience and consciousness. They combine these infinitesimal particles by laws for whose origin they can furnish no explanation. And back of all these combinations for the evolution of the great complex whole they place force or energy for which they can assign no cause. And, the crowning wonder of it all! if we may anticipate, the definite implication is that their own conditioned minds, themselves the supposed result of this cosmic evolution, have thus reasoned out the very processes of their own origination and those by which the universe came to be. This certainly looks like a man attempting to weigh himself while holding his own scale.

Thus, these men must continually assume as working hypotheses what are as much matters of faith as the Christian's God. And, if they regard the existence of the Christian's God as an hypothesis, then, as we shall show, this God-hypothesis—using their own terminology—is immeasurably grander and far more adequate and intelligible as an explanation of the existing universe than the matter-and-energy-hypothesis, the hypothesis of dust-and-death, of materialism.

In thus attempting to explain, or solve the problem of, creation without the God-factor, some physical scientists have been led into a bewildering maze of perplexities and contradictions. They reason as if in the equation *three times five equals fifteen* ($3 \times 5 = 15$), the first member were partly or entirely omitted, leaving it to stand *three times .... equals fifteen* ($3 \times .... = 15$), or .... *equals fifteen* ($.... = 15$), —a manifest absurdity and the latter not even a statement.

While the problem of creation cannot be solved nor really even be adequately illustrated mathematically, we believe that some idea can be gained by expressing it in the form of an equation. Thus, let the word *equals* stand for or represent the word *created:* then the statement, *God by His will or power created the universe,* may be represented thus, *God times His will or power equals the universe (God* $\times$ *His will or power* $=$ *the universe).* The materialist, of course, accepts the last member of the equation, *equals the universe,* for it *exists.* But, in assuming the *eternal existence* of matter or the universe, he might be said altogether to omit the first member of our equation, leaving it not an equation. For, as it did not have a beginning, it therefore had no origin, and therefore no cause; and thus there would be no first member and therefore no equation. Or with him the explanation of the universe might be, "The universe equals the universe." Or he might be regarded as, for its *cause,* postulating eternal matter, as one of its *factors,* and as consciously or unconsciously linking with it some force or energy, unaccounted for, as another factor in the first member. But even this would not cause it to be an equation, but leave it an inequality with the second member greater than the first (cause $<$ universe), as we shall see. He thus fails to link with it or place back of it an adequate or sufficient and definite cause. And the only adequate or sufficient cause that can possibly be sup-

plied as such factor in that equation to complete and balance it—even if eternal matter were assumed—is the factor which the Christian adores as *God,* as we shall show.

Of the materialist we might ask a whole series of questions, which, even from his own standpoint, are absolutely unanswerable. Whence is matter with its property of eternalism? Whence the atoms and electrons that are the elements of matter? Whence the laws that govern their combinations? Whence the motions that are supposed to combine them; for these, apart from an ulterior energy, are contrary to the law of inertia? Whence the forces that produce or produced these motions? Whence the energy that lies back of all these forces? And whence did he, himself the supposed product of all his unexplained *whence* or *thence,* derive his knowledge of all this supposedly *eternally* existing, but really conditioned and conditioning, universe, of which he himself is in one sense the most conditioned, and yet in another sense the most mysteriously wonderful, part? And, wonder of wonders! if his universe is all evolved and is still evolving, how long, or rather how *short,* is his eternity, that the universe did not reach the end of its evolutions unassignable ages ago?

Energy is surely not merely the product of inert matter, because matter would be an inadequate cause to produce such energy. The effect must be in the cause; but here the effect would be totally different from anything in the cause. We are, of course, speaking of a non-absolute entity as a cause. The same reasoning would hold in proving that inert matter is not from energy, if the materialist would change his base and declare for the eternity of physical energy instead of matter, and assert that matter was produced by physical energy. And, to say that energy, or matter, produced itself would be an absurdity. Moreover, to the materialist, energy does not even have any existence apart from matter. Thus, in trying to evade the really inevitable God-factor in explaining what should almost axiomatically be accepted as a God-created and God-governed universe, the materialist tries to hide himself behind glittering generalizations and half-truths, which he attempts to hold together in plausible consistency with a broken chain of inconclusive argumentation. But in his vain attempt he really is burying himself beneath a heap of absurdities and contradictions.

The materialist admits the existence of nature or matter: why will he not admit the existence of a nature-Builder, a matter-Creator, as the ultimate Cause? He admits the existence of infinitesimally small particles, by whose combinations the material cosmos was made possible; and in so doing he clearly implies in those very *fitted* particles and in that very cosmos as an end, a *Fitter* or Designer, and therefore an intelligent First Cause. Then, why does he not openly acknowledge the existence of that First Cause? He admits the existence of definite laws of combinations for these infinitesimal particles: why does he not admit the existence of their law-Giver? He admits the presence of motions and interactions among his hypothetical particles: why does he not admit their implied cause, a mighty Mover? He admits the existence of force and ultimate energy: then, why is he not willing to admit that of the great Forcer or Energizer of all?

Even some of the most eminent materialists are compelled to acknowledge this irresistible logic of facts. Thus, in the famous *Berlin Discussions,* February, 1907, Prof. Plate was compelled to make the following concession: "Personally, I always maintain that, if there are laws of nature, it is only logical to admit that there is a lawgiver" (Erich Wassmann: *The Problem of Evolution,* p. 108). What could be more self-convicting on the part of an acknowledged authority on monistic materialism! He would surely not deny the existence of so-called laws of nature, for these are the foundation principles upon which his theory is constructed. Hence, his statement, upon his own conditions, necessitates the existence of a lawgiver, or else it is nothing but empty words. That the materialist must make these admissions by the very logic of necessity, will be more fully shown when we shall set forth the positive side of the case and *develop* these points in later chapters.

II AS TO ORGANIC NATURE

So far we have spoken of inorganic nature. Now, how about organic nature? Whence came organisms? Whence came life? And yet, even for these phenomena, materialism

has an explanation to offer, and one that is apparently to itself quite satisfactory. It is summed up for us by Robert Kennedy Duncan in the following words: "It may safely be said that many, perhaps most, men of science—physiological chemists, biologists, and psychologists—are agreed upon one, 'There is no Life apparently necessary to, or visible in, the body; therefore there *is* no Life.' Upon this assumption they believe and they teach that all our feelings, thinkings, and willings, our very consciousness, are the products of the play of the physico-chemical processes in the brain" (*Some Chemical Problems of To-Day,* 1911, p. 80). Thus life as a separate entity has no place in the system of materialism. It is a phenomenon of matter and nothing more.

I ACCORDING TO MATERIALISM, LIFE AND MIND ONLY FORMS OR RESULTS OF ENERGY

The fact is, the materialistic scientist necessarily deals with matter and its associated energy alone. And, as life has some similarities to energy, there is a tendency to regard it as a form of energy. As such, in his natural processes of reasoning, it must necessarily either have been co-eternal with matter or it must be the product of matter. Thus the processes of life are explained chemically and electrically. Some hold them to be due to the actions of negative and positive ions. Life, as well as disease, has been regarded as a series of fermentations. As to mind, that is to him, of course, the result of the collocation of the molecules of the highly organized brain, or of the above in still greater complexity.

A purely materialistic conception of life necessarily requires a purely materialistic definition. And such a definition is the famous one by Herbert Spencer, that life is "The definite combination of heterogeneous changes, both simultaneous and successive, in *correspondence with external co-existences and sequences*" (*The Principles of Biology,* 1900, Vol. I., p. 93). From the view-point of materialism this sounds like a sage *ex cathedra* declaration that expresses much in a few words. But, while it has considerable scientific force, it nevertheless reminds us somewhat of a traditional definition by Plato; namely, that man is a biped without feathers. The story runs that his pupil

Aristotle, noticing a possibly wider application of the definition, quickly stripped a rooster of his feathers and brought him to his master, saying, "Here be Plato's man." The application to Spencer's definition is left to the reader.

It is, of course, almost needless to say that with such a conception of life and mind, man, with what has been regarded as an immortal soul, must fall from his exalted throne of being, superior to the rest of surrounding nature. Therefore, in accordance with this materialistic monistic philosophy, Ernst Haeckel is thoroughly consistent when he makes the following declaration: "Our own 'human nature,' which exalted itself into an image of God in an anthropistic illusion, sinks to the level of a placental mammal, which has no more value for the universe at large than the ant, the fly of a summer's day, the microscopic infusorium, or the smallest bacillus. Humanity is but a transitory phase of the evolution of an eternal substance, a particular phenomenal form of matter and energy, the true proportion of which we soon perceive when we set it on the background of infinite space and eternal time" (*The Riddle of the Universe,* p. 244).

This might as well be considered as simply a beautiful collection of figures of speech. The figures or outlines are there; but the substances or contents are largely a human creation *ex nihilo.* What a strange descent on the part of the learned author from an image of Deity to a placental mammal, an ant, a fly, an infusorium, a bacillus! It must seem like making a discovery to learn by one's own power and choice so much of one's real self! But how was such wonderful knowledge arrived at? What were the premises of reasoning? How were those assumed premises raised to the exalted status of fact in the interests of the dethronement of man? And as to that supposed eternal substance, and man as that transitory phase of its evolution, whence the high authority for such sage utterances about things merely assumed? And as to eternal time and infinite space, where are the proofs? And this should be all the more imperative when some of the most recent discoveries of science, as well as the unbiased dictates of reason, are in conflict with most of these assumptions of this great philosopher.

2 A LIFE-PERVADED ORGANISM ESSENTIALLY DIFFERENT FROM AN INANIMATE CRYSTALLIZATION

Surely the materialist cannot help but recognize the difference even between an inanimate crystallization and a life-pervaded organism. He cannot explain even the crystallization, except by hiding himself behind crystallized statements of supposed laws. Yet, even in so doing, as already noted, he implies a law-Giver back of it. And for the materialist not to acknowledge the existence of a law-Giver back of crystal formations and their *laws,* in the face of those formations and their laws, is as absurd as for his untutored servant, or his own child, to deny the materialist's existence in the face of his crystallized *statements* of those laws or even of his personal presence.

And, if he cannot explain inanimate crystallization without implying the Divine power back of it, how can he explain the mystery of the existence of a living organism without assuming back of it a living *Organist* or *Organizer?* He persistently declares for the adequacy of every cause to produce its effect: how then will he explain the origin of life from dead matter? And yet his whole chain of reasoning hangs with one end upon the peg of supposed eternal matter and with the other upon a life-pervaded completed, or perhaps still evolving, cosmos. By what congeries of reasonings can a universe teeming with motion and life be made to be the product from a motionless aggregation of unnumbered lifeless material atoms or electrons, or what not, not to speak even of the primal origination of these particles? Then, how about man with all the wonderful faculties of his mind, of which the materialist's own ratiocinations—though oft inconclusive—themselves afford a striking illustration? Here, surely, one would think that the materialist would almost bow with reverence before his own wonderful being! But no, even his own boasted intellect he declares to be but the resultant of molecular interaction, or of chemical and electrical action, within the cells of his own brain. And how wonderful! by this molecular interaction, or chemical and electrical action, within his own brain, as a producer, this product of molecules, atoms or electrons, has found an explanation for its own mysterious origin and being! And so he would nevertheless boldly

declare in the words of Descartes, *Cogito, ergo sum!*

What, then, are the facts in the case? Is life an evolution from matter? To say so, without any definite scientific evidence whatever, is an assumption that is well-nigh unpardonable. Surely, materialistic scientists, or mechanists, do not have it all their own way. Among *philosophers,* with but few exceptions, there is probably no great name in Europe or America—and for that matter there practically has been none —that agrees with materialism on this point. To find a mechanist among the world's really great philosophers is virtually impossible. Even the most radically skeptical or anti-Christian see in life more than matter and in the universe more than a meaningless jumble of material or electrical particles. Thus Henri Bergson in the following words gives expression to what must be evident to all thinkers; namely, that life is more than matter: "As the smallest grain of dust forms part of our entire solar system, and is involved along with it in this undivided downward movement which is materiality itself, so all organized beings from the humblest to the highest, from the first origins of life to the times in which we live, and in all places as at all times, do but demonstrate to our eyes a unique impulse contrary to the movement of matter, and, in itself indivisible" (*The New Philosophy of Henri Bergson,* LeRoy, 1913, p. 99, or *Creative Evolution,* p. 270). Thus, Bergson's philosophy unmistakably regards life as more than matter.

Nor are philosophers alone in holding life not to be from matter, and therefore to be more than matter. Many of the greatest men of *science* are equally convinced of this. Thus this same truth, especially as to the higher manifestations of life in thought, feeling, and consciousness, is expressed in the following words by the chemist Robert K. Duncan: "And yet, however unreasonable it may appear, and unnecessary and even absurd, this law-ridden living matter does not consist of matter alone. There are tangled up in it, somehow—associated with it—strange things called perceivings, thinkings, willings, feelings, and consciousness, things that are not matter at all. There are, thus, the two parts of us, the matter part of us and the not-matter part of us. What is the relation between them? In this, of course, is asked the riddle of the world" (*Some Chemical Problems of To-day,* 79-80).

And no less an authority on biology than Alfred Russel Wallace openly recognized the transcendental nature of life and very definitely declared it to be impossible to define it in terms of physical science. Note the following words: "So marvellous and so varied are the phenomena presented by living things, so completely do their powers transcend those of all other forms of matter subjected to mechanical, physical, or chemical laws, that biologists have vainly endeavored to find out what is at the bottom of their strange manifestations, and to give precise definitions, in terms of physical science, of what 'life' really is" (*The World of Life,* 1911, p. 3).

It would seem to need little argument to prove that life cannot be the result of the interaction of molecules or atoms, as it is totally different from anything in such supposed cause. It cannot be explained in terms of matter and energy. If matter were only a mode of energy, as is fast being held by many, a materialistic explanation of life would really make it a form of energy. And life has been so regarded by many; and this theory has also been quite fully elaborated by some writers. Haeckel, in true consistency with his monistic philosophy, has much to say upon this point. He applies the law of the conservation of substance to the phenomena of life and mind in the following words: "Not only the growth and the nutrition of plants and animals, but even their functions of sensation and movement, their sense-action and psychic life, depend on the conversion of potential into kinetic energy, and *vice versa.* This supreme law dominates also those elaborate performances of the nervous system which we call, in the higher animals and man, 'the action of the mind'" (*The Riddle of the Universe,* p. 232).

If life were a form of energy, it would have to be transmutable into other forms, and other forms into it, according to the definition accepted by materialists themselves. But such transmutation is universally acknowledged to be impossible; therefore, the supposition of its being a form of energy cannot stand. Indeed, life, as we know it in all its phenomena, is so utterly different from all accepted forms of energy, that the very suggestion that it is merely a form of energy is palpably absurd. Life is manifestly self-directing or causal, especially in its higher forms, while all forms of energy are

merely the results or effects of operations in material nature, according to fixed or definite laws. Indeed, energy in all its forms is acknowledged to be a mode of motion, molar, molecular, atomic, electronic, etc.; or it may rather be regarded as the result of such motion. But no such motion can be transmuted into, or result in, life.

As great a physical scientist as Sir Oliver Lodge has been led in his researches more and more definitely to hold life to be a distinctly spiritual entity, totally different from both matter and energy. And, even though in *some* of his philosophic speculations as to certain properties of the soul and powers of soul-communication he undoubtedly arrived at unwarranted conclusions, this does not invalidate the authoritative value of the following explicit statement: "The view concerning Life which I have endeavoured to express is that it is neither matter nor energy, nor even a function of matter or of energy, but is something belonging to a different category; that by some means, at present unknown, it is able to interact with the material world for a time, but that it can also exist in some sense independently; although in that condition of existence it is by no means apprehensible by our senses" (*Life and Matter,* 1905, p. 119).

In a somewhat recent philosophic work we find the same position very definitely taken by its learned author, Professor Aliotta, who writes thus: "This most living part, which is nearest to us, which stirs within us, struggles, suffers, and hopes amid the tumult of our mind, cannot be understood by means of the schemes and formulas of mechanical science, but demands for its comprehension another and higher order of categories and principles" (*The Idealistic Reaction against Science,* 1914, p. 470).

But even suppose it were granted, for the sake of argument, that life, especially in its lower forms, might be only the result of mechanical, chemical and electrical processes, and that the adaptations of so-called instinct might be caused by mere chemical stimuli, as suggested by Dr. Jacques Loeb, a creative Power would still have to be postulated back of all these vital processes as their *ultimate* cause. These very physical provisions and adaptations would imply *arrangement* for the very purposes subserved, and therefore a cause transcending physical nature with its material and vital processes. If

the provision of electrical ions were actually found to be so wonderful and so marvelously adapted as to cause muscular movement, reproduction, growth and other mysterious vital processes, we might indeed regard the mystery of life to be that nearer human solution. But such discovery would only deepen the mystery on the other side of our discovery. Its wonder would only seem all the more wonderful, and its cause all the more truly transcendent. Indeed, our admiration of the wonderful ultimate causal, or creative and providing, Personality, would only be enhanced by every successive step in our discovery of what would simply in such case constitute His provided methods of operation. Hence, the believer in God need never fear any legitimate results of scientific research even along this line, although we are not in the least anticipating any such startling real discovery.

3 THE SUPPOSED COSMOZOIC ORIGIN OF TERRESTRIAL LIFE EXAMINED

There have been and still are some eminent scientists, among them Lord Kelvin, Helmholtz and Arrhenius, who would have us look elsewhere than on this planet for life's origin. In apparent seriousness they assume that the beginnings of life here were wafted upon the cooling earth, vast geological ages ago, from some other body of our solar system. And this body may presumably have received it previously from some body in the stellar universe beyond.

As this theory has been favorably received by some great men of science, although it does not strictly belong to this chapter, it deserves a hearing in this connection. This theory, in a general way called that of *panspermia* or the *cosmozoic hypothesis,* has from time to time assumed slightly different forms. But, briefly stated, according to it, life on this and perhaps on other worlds began when, under proper conditions for their development, germs of life supposedly floating through space, upon being picked up, found a proper soil.

There were some quite early intimations of this theory, even before the theory of evolution was formulated by Darwin and Wallace; but they were not fully developed because apparently not specially needed to explain other theories. But Dr. H. E. Richter (1865) in trying to overcome the difficulties involved

in Darwinism to account for primal life on this planet, gave it more definite form, as follows: "The infinite space is filled with, or (more correctly) contains, growing, mature, and dying celestial bodies. By mature worlds we understand those which are capable of sustaining organic life. We regard the existence of organic life in the universe as eternal. Life has always been there; it has always propagated itself in the shape of living organisms, from cells and from individuals composed of cells" (Arrhenius: *Worlds in the Making,* p. 218). Thus life is supposed to have existed indefinitely in the cosmic dust within the interstellar space.

These views of Richter found a ready adherent in the great botanist Ferdinand Cohn (1872). Helmholtz, in his *Populäre Wissenschaftliche Vorträge,* Volume III., also spoke of a possibility that life might be as old as matter, and even without beginning or eternal, and that seeds of life might have been carried from one celestial body to another and developed wherever they found favorable conditions. And Lord Kelvin, in an address before the *British Association,* Edinburgh, 1871, said, "The hypothesis that life originated on this earth through moss-grown fragments from the ruins of another world may seem wild and visionary; all I maintain is that it is not unscientific" (*Nature,* Vol. IV., p. 270). And again, in substance he declared it as his opinion, that, during supposed collisions, life may be carried off from life-bearing bodies, and that in meteoric stones as seed bearers it may be planted on other bodies.

The reader must not fail, however, to see the impossibility of such a transmission, because of the far too intense heat generated by the flight through the regions of the atmosphere (from 15 to 40 miles a second) of such meteoric matter. Indeed, the heat is so intense that it fuses the largest and hardest meteoric bodies. But very few of the myriads of such bodies reach the earth, as in their passage through the upper air most of them are totally reduced to gases and ashes. Then, too, the time required would be too long for life to persist. More need not, therefore, here be said upon this point.

According to the Swedish physicist Svante Arrhenius, who accepts the theory that life germs or minute organisms float in space, these germs are pushed against other heavenly bodies by radiation pressure of sun or star. We might say by way

of explanation that, as light pressure varies as the areas of surfaces, it varies as the squares of the diameters; and as gravitation varies as the masses of the volumes, it varies as the cubes of the diameters. And therefore the tendency of light pressure to drive a particle against the force of gravitation—the distances being equal—becomes greater the smaller the particle is. It will be of interest to note that this law also explains the phenomenon of a comet's tail with its great velocity, extending in a direction away from the sun.

Arrhenius calculates that it would require only fourteen months of radiation pressure for such an organism, upon being detached from the earth, to reach even the distant planet Neptune. And, unless arrested in its journey by some intervening body, it would reach our nearest stellar neighbor, regarded as the centre of a neighboring solar system, in nine thousand years. To be thus driven onward by radiation pressure, he finds, according to deductions of Schwarzschild, these supposed organisms, if spherical, could be .00016 mm. (.0000064 or $\frac{1}{156,250}$ inch) in diameter, though some get slightly different results. And there are some organisms, such as spores of bacteria, known to be but little larger than that. And, as he points out, it is not impossible that smaller organisms, not yet discovered, do exist, positing which, this theory might be supposed to become workable. At least, as far as the mere physical possibility is concerned, such transmission might in itself not be inconceivable. Arrhenius, further, then makes the following summary statement: "In this manner life may have been transplanted for eternal ages from solar system to solar system and from planet to planet of the same system. But as among the billions of grains of pollen which the wind carries away from a large tree—a fir-tree, for instance—only one may on an average give birth to a new tree, thus of the billions, or perhaps trillions, of germs which the radiation pressure drives out into space, only one may really bring life to a foreign planet on which life had not yet arisen, and become the originator of living beings on that planet" (*Worlds in the Making,* p. 229). In the closing paragraph of his treatment of this subject, Arrhenius, however,

even himself expresses doubts as to whether any actual demonstration of his theory will ever be made.

It is, of course, readily seen that there are obstacles that would enter into such a transmission of organisms, that it would be very difficult to overcome, such as temperature, already noted, *influence* of the various radiations of light and heat, persistence or non-persistence of life, etc. Then, too, this theory must assume that these organisms are detached from a planet against gravity, etc., and driven into space by some unexplained power, such as that of an electric discharge of some kind. It also assumes that within each one of them are all the potentialities for the development of the marvelously complex flora and fauna of a fully developed world. Indeed, it supposes that the forms of life in all worlds would be the same under the same or similar conditions.

What a stretch of the imagination is required to make this theory workable! It presupposes the matching of far-fetched theoretical deductions with cosmic facts. The fact is, that we are by no means even certain whether our scientific theories as to the constitution of the interstellar ether, and even as to matter, energy, electricity and gravitation, correspond to reality. But of this we shall speak later. And, in examining this theory in relation to the law of causality, we are amazed at the amount of faith required in every step from a life-germ's supposed detachment from one world to its fully evolved flora and fauna in another. And this faith must be all the greater when it stretches after such a migratory organism between far distant stellar systems. Surely, reason must here be superseded by a faith that is far more difficult of acceptance than the Christian's faith in the life-creating and life-sustaining God.

As a mere scientific hypothesis, the theory of Arrhenius is, however, by far the most suggestive and plausible one on panspermia that has yet been offered in explanation of the origin of life on this planet from a purely physical standpoint.

4 THE COSMOZOIC HYPOTHESIS INADEQUATE TO EXPLAIN LIFE'S ULTIMATE ORIGIN

This theory of panspermia, in its various modified forms, may seem erudite and somewhat satisfying to those who would

pass up the need of the Almighty in accounting for the universe. And yet, even though one would accept it, it would not solve for him the problem of life's *origin,* any more than does the theory of pure materialism, more generally so-called. But even this theory fails of its apparent purpose. For however far backwards in time or outwards in space one might trace the origin of earth's primal germ or germs of life, and however great the number of successive steps in these supposed waftings of germ-life from body to body, the ever-recurring question would still be, Whence that most outward link in the succession of life's chain? In implying successive transmissions of life, it necessarily implies a first transmission, and a first or primal life as the *beginning* of life's supposed indefinite chain. And if it be contended that this surely must have been of spontaneous generation from molecular or atomic combinations and motions, then we would reply that this brings us no nearer to the solution of the origin of life than if we had stayed in the lap of mother earth. Indeed, it would only complicate the problem of life's origin. And to hold that such dependent life has existed from eternity, as Arrhenius and some others do, is only to make it serve as a premise for reasoning; but such a premise is necessarily erroneous, as explained elsewhere. Moreover, no number of successive removals of life's origin from body to body could push it back into the infinite either of time or of space, as no number of removals or steps, however far or long, can make up an infinite, as we shall more fully show. But every step would bring us only nearer to the first step, beyond which there could be no other; namely, to the First Cause of life, an infinite Will—as we hope to prove. And, of course, in that ultimate sense of life, life has always existed; that is, in Him Who is back of all temporal life in the universe—whatever the theory of life—the life-giving, life-creating Life of the Cause of all.

Moreover, the presence or operation of that Life or Will at each successive step would be no less real, though perhaps less direct, than at the origination and starting on its supposed long journey of life in its primal germ—according to this theory—as will be clearly shown later. Its very transmission from body to body would even imply the energy of the great Energizer or Transmitter, the source of all energy. At

every step and at every point of the supposed transmissions, we should be in the presence, and feel the pulse-beats, of the life of Him Who is immanent in—as also He must necessarily transcend—all nature and everything within it, Himself the only ultimate life, as He is life's only source. Even in such a consideration the words of the Psalmist are true, "Whither shall I go from thy spirit? or whither shall I flee from thy presence? If I ascend up into heaven, thou art there: if I make my bed in hell, behold, thou art there" (Ps. 139:7-8).

5 THE THEORY OF SPONTANEOUS GENERATION EXAMINED AND FOUND INADEQUATE

We should not need in this connection to discuss this point as to the origin of life much further, especially as to the once partly accepted doctrine of *spontaneous generation* or *abiogenesis,* or even of an artificial production of life. We should say, however, that, since its explosion by such men as Pasteur, Liebig, Tyndall, *et al.,* this theory would now have gone into "innocuous desuetude" as a scientific hypothesis were it not for its revival by men like Jacques Loeb, *et al.* Of one thing, however, we are certain, that life from life, and all life indirectly, and primal life directly, from the creative power of an infinite Will—yea from Him Who is Life indeed—is an intelligible explanation of this otherwise inexplicable phenomenon. Chemistry cannot produce it, nor can philosophy explain it. It exists and challenges explanation as the greatest and most solemn of all facts. And if it be held, as has been asserted, that the whole material cosmos is itself one vast chemical and vital laboratory, in which every phenomenon of nature, including life, is produced or generated, then even that very assertion itself would imply a mighty immaterial ever-operating Chemist.

The testimony of a few recognized men of science on this point should give double force to our argument. Lord Kelvin expressed himself very emphatically against the theory that, under certain meteorological conditions in the past, dead matter might have been crystallized or have run together, or might now run together, into "germs of life" or "organic cells" or "protoplasm." So, in his *Preface* to *Worlds in the*

Making, page xiv., Arrhenius, whom we have already quoted, who of course holds that life has existed from eternity, also expresses himself very decidedly against the theory of spontaneous generation, as follows: "Some kind of 'spontaneous generation,' origination of life from inorganic matter, had been acquiesced in. But just as the dreams of a spontaneous generation of energy, i. e., of a *perpetuum mobile*—have been dispelled by the negative results of all experiments in that direction, just in the same way we shall have to give up the idea of a spontaneous generation of life after all the repeated disappointments in this field of investigation." And no less emphatic against the artificial production of life are the following words of Sir Oliver Lodge: "Many have been the attempts to generate life *de novo,* by packing together suitable materials and keeping them pleasantly warm for a long time; but, where all germs of pre-existing life have rigorously been excluded, the attempt hitherto has been a failure: so far, no life has made its appearance under observation, except from antecedent life" (*Life and Matter,* 1905, p. 171).

Indeed, even E. A. Schäfer, the famous professor of physiology at Edinburgh, though a pronounced advocate of the materialistic theory of life, considers the theory of spontaneous generation, in its older form at least, untenable. Thus in his *Presidential Address* before the *British Association,* Dundee, Sept. 5, 1912, he expressed himself on this point as follows: "I am myself so entirely convinced of the accuracy of the results which Pasteur obtained . . . that I do not hesitate to believe, if living torulæ or mycélia are exhibited to me in flasks which had been subjected to prolonged boiling after being hermetically sealed, that there has been some fallacy either in the premises or in the carrying out of the operation. The appearance of organisms in such flasks would not furnish to my mind proof that they were the result of spontaneous generation. Assuming no fault in manipulation or fallacy in observation, I should find it simpler to believe that the germs of such organisms have resisted the effects of prolonged heat than that they became generated spontaneously" (*Nature,* Vol. XC., p. 10).

It might be said, however, that, while Prof. Schäfer rejects the theory of a so-called *spontaneous* generation of life, he believes it not impossible to produce life by artificial or chemical

means. And, in speaking of the supposed *ultimate* origin of living matter from lifeless material, he was nevertheless moved to say, "In spite of the dictum *omne vivum e vivo*, there was certainly a period in the history of the earth when our planet could have supported no kind of life, as we understand the word; there can, therefore, exist no difference of opinion upon this point among scientific thinkers." And this is the natural and necessary conclusion of materialism as to the origin of life. Indeed, if the existence of a creative Will back of nature is denied, what other alternative as to life's origin could be possible? Thus, though one may reject the older form of the theory of spontaneous generation, unless he accepts the factor of a creative Will to make the origin of life possible, he must assume that life at some time, under favorable conditions, originated from some evolutionary process in inorganic nature. As the impossibility of this has already been pointed out we shall not further discuss it.

And if the other horn of the dilemma were seized—that dependent life had *no beginning,* as is the case with some of the advocates of the theory of panspermia—the implication would be that there must be two eternal, and even dependent, entities, matter and life. But, as will be shown in the next chapter, there can be only one eternal entity, and that must be a spiritual essence, or *Life absolute.*

Moreover, to continue our consideration of a supposed possible *natural* origin of life, we hold that, even though a case of so-called spontaneous generation were in the future to be discovered, that should shake no man's faith in the necessary existence of a Creator as the ultimate Cause. Such supposed spontaneous generation would no more be really spontaneous than any so-called accidental event really occurs by accident. Law or method, the operations of secondary causes endowed with the necessary potentialities for the production of life, would no less be back of such generated life, if we could trace the same. And such generation would, therefore, be only a creating or bringing forth by processes or methods of the Creator through secondary causes not thitherto known, but perhaps even yet operative in nature. And, although the assertion could easily be misinterpreted, even if by chemical or artificial means life could thus be produced, it would have to be in accordance with methods and by potencies which the

Author of nature Himself placed there. Man would be discovering only a hitherto unknown method of His operations, or reading another thought after Him in His creation. But, while such a discovery should shake no one's faith, we are not in the least considering its possibility.

Indeed, it would appear as unlikely that life can spring from, or be generated by, matter, as that matter can spring from, or be generated by, life. This latter should seem to be, if anything, the more natural hypothesis, especially if life be viewed as a distinct and higher entity, totally different from matter. And yet, this is not true even as to matter. But as to the mere question whether life is the cause or the effect of organization, it is surely the former rather than the latter. Thus life would antedate organization, and therefore organized matter. And in the application of this thought to our thesis it is readily seen, as will more fully be shown in our next chapter, that life or spirit, as the First Cause, must have existed before matter, and must therefore have existed from eternity. And, of course, in its final analysis it might in a sense be said that matter emanates from or is preceded by ultimate Life, the creative Source both of all matter and of all secondary or derived life, as well as of all energy in the universe.

6 THE THEORY OF NATURE AS A LIVING ORGANISM INADEQUATE TO ACCOUNT FOR LIFE

There are men who hold that the material universe itself is one vast living organism and that everything within it is alive, probably as the result of physical operations. Thus all matter would be permeated with life; and motion or vibration would be its manifestation. But even this fanciful theory, which does, however, not strictly come under materialism, can no more explain life and its origin than any other—no more than it can explain even matter and its origin. If the universe were all, as it would have to be unless it had been created, it would have to be self-existent and absolute. But as it is finite and can, therefore, not be all, as we shall show, it could not be self-existent and absolute. And, if it were conceded that it is not all, it would have to be a *created* universe: and thus our point would need no further defense, as that is

our contention. Then, moreover, all else as to the origin of matter, energy, life and mind, might as well be acknowledged by the objector. If it was created, then no matter how long ago, it must have been a creation *out of nothing.* And, no matter by what processes it came into its present cosmic form, it also would have had to be directly or indirectly by the same Power by which it had first been called into its primal being. And that Power that created it and fashioned it into a cosmos was its Creator, the Being Whom the Christian Scriptures reveal as *God.* Hence, even this fanciful theory of life and the universe must fall.

Again, there is a modified form of the above theory; namely, that the life of the universe is the indwelling Deity. Thus, in the language of poetry,

> "All are but parts of one stupendous whole,
> Whose body Nature is and God the soul."
> (Pope: *Essay on Man.*)

The elements of such a theory appear already in some of the writings of Sir Isaac Newton. And since his day there have been various speculations along this line: and this is, of course, a very delightful and fruitful field for such speculation. Very suggestive and rather beautiful is the somewhat modified form of such a theory, as expressed by Sir Oliver Lodge in the following words: "It has been surmised . . . that just as the corpuscles and atoms of matter, in their intricate movements and relations, combine to form the brain-cell of a human being; so the cosmic bodies, the planets and suns and other groupings of the ether, may perhaps combine to form something corresponding, as it were, to the brain-cell of some transcendent Mind" (*Life and Matter,* p. 97). Sir Isaac Newton also suggested this universe brain-cell idea for the indwelling Deity.

Though this theory also does not really come under materialism as such, nevertheless, because of its relation to the above, we shall briefly speak of it here. As Poetry this theory has some attraction, but as philosophy, weighed in the balance of matter-of-fact reason, it is readily found wanting. In a sense this is only a refined pantheism. According to this theory, man would really be a part of God. And, of course,

in so far as man is a sinner, God would be a sinner. Thus God would not be perfect nor absolute, while absoluteness and perfection are necessary attributes of God. But there is another fallacy in this theory; namely, that, if its God were conterminous with the universe, as its advocates hold, He would necessarily be finite, because the universe is finite, as we shall demonstrate. The finiteness of such a God was even already implied in the statement above that He would not be perfect nor absolute. And, if it be contended that space relations could not be ascribed to such a spiritual entity (which in a sense is true), so as to speak of Him as finite because confined within a finite universe, then we must remind the advocates of this theory that their fallacy lies in thus confining Him, and that they thus ascribe to this God-soul a finite body, or a finite brain. A God as the soul of the finite universe as His body or brain would not only not be infinite nor absolute, but such a conception would be a near approach to a monstrosity. This form of the theory, therefore, also is found wanting.

7 MATERIALISM'S NECESSARY FATALISM FATAL TO ITSELF

Another fact that is destructive of the purely materialistic explanation of nature is its necessary fatalism. If everything were caused by inflexible laws working with deadly precision, then all things, including even all human thoughts and acts, would be what they are by unavoidable necessity. There would, therefore, be no moral action nor any moral accountability. Even murder and every other wrong, every impulse of love and every deed of progress, every creation of the imagination bodied forth in poetry or fiction and every hope and aspiration of the soul, as well as every thought and adoration of a Deity, would be the result of law. Hence, it is only to be expected that materialists, like Laplace and Haeckel, are determinists.

This determinism is seen in expressions by Haeckel, already quoted. To these we shall add the following very definite declaration: "Another psychological dogma, the belief in man's free-will, is equally inconsistent with the truth of evolution. . . . Theoretically, determinism, or the doctrine of the necessary character of our volitions, was established long

ago" (*Last Words on Evolution,* pp. 103-104).

What confusion in the moral order of the world such a theory naturally implies! Why commend or punish; why love or hate; why delight in the creations of the imagination or in the material progress of the race; why even strive to know and grow—if all things must come to pass by a fatalistic necessity? Ah, we hear the whispered answer, Because these acts themselves are predetermined by inflexible laws! Well, then, if so be that all things are from necessity, what is the cause of such necessity—*what* is it that *necessitates?* Surely, then, as the soul by necessity conceives of and worships a Deity, that Deity must by the same necessity be a reality. Or else, by one act of necessity there would be a God and by another act of the same necessity there would be no God. Thus necessity would by necessity nullify or contradict itself, or there would have to be two necessities in eternal antagonism. The same necessity would issue in murder and its condemnation and punishment. It would in one individual approve, and in another disapprove. In one it would assert the existence of God, and in another deny His existence. In one it would hold to the philosophy of necessity or materialistic determinism, and in another it would reject that philosophy. And, supposedly, this argument of ours against materialistic necessity would necessarily be an act of necessity.

Any such philosophy is thus seen to be self-contradictory and self-destructive, and therefore not worthy of even further consideration. Surely, this alone should be an unanswerable argument against the materialistic explanation of the universe, as logically issuing in the self-contradictory and absurd doctrine of necessity as applied to man.

While there is some foundation in nature's unerring laws for such a doctrine of necessity as to the operations of nature, no one has any right to claim for it universal application to the exclusion of an immanent and transcendent creative and directing Deity, and to volition of the designing human mind. As the will of man transcends the ordinary operations of nature, so must some supreme Will transcend the operations of the universal whole.

Moreover, to declare that an act of a Deity in creation no less implies necessity in all creatures, is to deny freedom of action to such a Being Himself. Or else it assumes that He

must have created all things with an imposed necessity. It should be sufficient to say that a free or absolute Creator can surely create beings with power of choice, and therefore morally accountable. And this is exactly what the Mosaic account of creation declares He did with reference to man—whom He created in His own image.

Thus, to him who would explain God away from His universe and rely solely upon his own reason for the solution of the great question of reality and origin, there arises difficulty after difficulty of ever-increasing magnitude. Sphinx-like the universe stands before him with ever-increasing mystery, before which the pride of man might well bow and submit to the Revelation of the eternal Word.

CHAPTER III

THREE POSTULATES AS TO A FIRST AND NECESSARILY ETERNAL EXISTENCE

In our last chapter we pointed out some of the *fallacies* in the arguments in defense of *materialism.* In this chapter we shall begin to consider the subject rather from the *positive* side, at the same time further answering objections and arguments of those who do not accept the doctrine of a creation out of nothing.

The objection has been made that the Christian, basing his faith upon the Scriptures, also assumes something as a starting point; namely, what he calls *God,* as over against the materialist's *eternal matter.* Let us now proceed to analyze this objection and point out its total invalidity. By a process of elimination, virtually amounting to a demonstration, we hope thus to show that the universe must necessarily have been God-created.

There can be only three postulates as to a possibly first and therefore necessarily eternal existence. One may postulate the eternal existence of mind or spirit alone, or the Christian's God, as the intelligent First Cause Who created all things. One might postulate the eternal existence of matter alone, from which the universe arose by a supposed indefinite series of developments. Or, one might postulate the eternal co-existence of both spirit, or God, and matter. But in each case he must postulate an *eternal* existence; or else he would find himself in the dilemma that that first existence, whichever it be, had its being begun in time, sprung from nothing, and therefore without any cause.

I POSTULATE OF ETERNAL CO-EXISTENCE OF SPIRIT AND MATTER UNTENABLE

Taking the last postulate, that of the eternal co-existence of mind or spirit (God) and matter, it will readily be seen

that, regarding matter merely as a *unit,* such would give us two first causes instead of one, and these two totally different. Then, too, it would be making matter an absolute existence together with spirit, thus giving us two absolutes, and these two totally different. But, by the very nature of an absolute, there can be only one absolute, or else each would have to have a necessary relation to the other and would therefore, in being thus relative, cease to be absolute. Moreover, to make matter an absolute would be making that absolute which by its very nature must be finite, as we shall show in our next two chapters. But no finite can be absolute, for finiteness implies limitation; and what is limited is relative and not absolute. And, if it be contended that matter is infinite, then we should have two infinites as causes, and these two different and in a sense mutually excluding each other, which is an impossibility.

But it might be argued that matter need not necessarily be absolute or independent, but that God or spirit and matter might be regarded as having existed from eternity, related as absolute or independent and relative, dependent or conditioned. But this again would be a contradiction. For, then, a conditioned or dependent would be made eternal, whereas the very terms *conditioned* and *dependent* imply a time or cause or purpose of conditioning. The term *eternal* can therefore not be applied to a *dependent* or *conditioned.* So the terms *conditioned* and *dependent* cannot be applied to an ***eternal.*** Therefore, to speak of conditioned matter as eternal, in conjunction with spirit, would be self-contradictory. Therefore, matter, thus related, cannot be eternal, unless it could be proved also to be unconditioned and infinite, which is impossible, as we shall see. And, even if it were unconditioned and infinite, it alone could be so, as seen above. This last postulate, that of the eternal co-existence of spirit, or God, and matter, must, therefore, necessarily fall.

II POSTULATE OF ETERNAL EXISTENCE OF MATTER ALONE UNTENABLE

Taking, now, the second postulate, that of the eternal existence of matter alone, we shall find the arguments against this postulate equally unanswerable.

That something has always existed is a self-evident truth. We know that something does now exist, ourselves included. We know also that something cannot come from nothing, for there can be no effect without a cause, and one that is adequate. Therefore, because the universe exists and is governed by apparently unvarying laws, there have been thinkers in all ages who have considered the universe itself, or at least its material basis, to be that eternal something. If that were so, it could not be an effect; and, therefore, for it there would have been no cause. And to this belief many of the discoveries of modern science have added their apparent testimony. Thus the law of the conservation of matter and energy, as indeed the general uniformity of nature with her myriad laws, has gone a long way toward establishing some scientific philosophers and philosophic scientists in what might be called their scientific faith of the eternity of matter. Thus, in the *Berlin Discussions,* February, 1907, Prof. Plate was moved to make the following declaration: "We scientists maintain that matter exists, that nothing is formed out of nothing, and that matter is everlasting. We cannot accept the theory that matter was created, and if we did accept it, we should be no better off. We are modest enough to dispense with a further solution of this problem" (Wasmann: *The Problem of Evolution,* p. 96).

It, of course, goes without saying that this is merely an assumption, but that it proves nothing. The implied reasoning seems logical enough; but, as it is based upon unproved premises, its conclusions are untrustworthy. In short, it is a begging of the question; but the *solution* of the question is acknowledged to be beyond this scientist's reach. Such a conclusion on the part of this and other materialistic scientists is, of course, an inference from the so-called law of the conservation of substance, as comprehending both matter and energy. It is, therefore, quite a natural conclusion, viewed from the merely human angle and from this mere point of time and space in the universal all. But whether this conclusion would hold from the view-point of eternity and before the comprehensive whole is another question.

According to the law of the conservation or indestructibility of matter, proposed by A. L. Lavoisier in 1789, the amount of matter in the universe is supposedly a constant quantity, however it may change or vary in form. Thus the mass of

the universe cannot by *known artificial means* be added to nor can it be reduced; or, as it is generally expressed, "Mass can neither be created nor destroyed." So, according to the law of the conservation or indestructibility of energy, proposed by Robert Mayer in 1842, and more fully developed by different scientists since, the sum of all the forms of energy in the universe is a constant quantity, regardless of its various forms and transmutations, or "Energy can neither be created nor destroyed." This should also, of course, be modified by adding, by any artificial means known to man.

That there is such a thing as a conservation of matter and of energy no one attempts to deny. But it must be emphasized that this conservation necessarily belongs, and is limited, to that in which it exists; namely, the present order of nature, in that part more especially known to man. For the unerring operations of a closed system, it must scientifically be considered as sufficiently true as a postulate for reason and action in the infinitesimal span of human life. Thus, in the words of James Weir, speaking of the law of the conservation of energy, "The finger of Nature ever points to closed energy circuits, to the earth as a complete and conservative system in which energy, mutable to the highest degree with respect to its plurality of form, attains to the perfection of permanence in its essential character and amount" (*The Energy System of the Universe,* 1912, p. 200).

But whether this law of the conservation of matter and of energy is true for the whole universe, and for even a closed system for all time, is far from established. Science has not yet furnished us with sufficient data to determine the universality of this law, as is more and more being acknowledged. Thus, Dr. S. Lawrence Bigelow, after having in a few sentences expressed the law of the conservation of energy, makes the following statement: "These sentences are open to objections, stating as fact more than we really know to be fact. We do not know how much energy there is in the universe. We do not even know how many different kinds of energy there are. We do not know what conditions prevail on other planets or fixed stars, or beyond the fixed stars, yet within that broad term we use so glibly the 'universe.' We ought to append to these statements a modifying phrase such as, 'as far as our experiences have taught us' " (*Theoretical*

and Physical Chemistry, 1912, p. 26). Of similar import are his words in connection with the statement of the law of the conservation of mass, as follows "These statements are open to the same objections as those brought against the statements of the law of the conservation of energy. They say more than we really know, although they are based upon an enormous number of experiments. The same qualifying phrase should be added, 'as far as our experience has taught us'" (*Ibid.,* p. 29).

This law of conservation in its wider sense is, moreover, not necessarily so absolute even here as to preclude the possibility of being set aside for the annihilation of the present order; nor does it afford any real evidence for the eternal existence of that order in the past. These and other laws of nature pertain to the *existing* universe. If the universe had a beginning—as we hope to prove—they must necessarily have begun either with the universe or at a later stage of its existence. And if the universe will have an end, as is only too manifest from its own evidence—as we shall see—these laws must surely end with it. Their presence in nature is, therefore, not the slightest evidence either that the universe was eternal and uncreated in the past or that it will be eternal and indestructible in the future. And, in the face of the overwhelming proofs to the contrary, they constitute only an argument of straw in an attempt to reason out of existence the Almighty Will before and above and beyond the material universe, by Whom that universe exists. These and other laws of nature thus afford no evidence whatever that matter is eternal, or that it either *is,* or is the *cause* of, all existence. There are several impossible, even contradictory, things implied in this postulate, in the light of which it is totally untenable, as we shall now proceed to show.

I THIS POSTULATE IMPLIES A CONTRADICTORY MULTIPLICITY OF FIRST CAUSES

This postulate of the eternal existence of matter alone would really be multiplying the number of first causes, which, in the final analysis, might be considered as numerous as the number of infinitesimal particles, whether spoken of as atoms, or by whatever other names. This would, of course, make *eternal*

all these necessarily mutually interdependent particles, which is contrary to what may be regarded as almost a philosophic axiom; namely, that a conditioned or dependent existence cannot be self-existent or eternal. Moreover, to speak of more than one first cause, would be absurd, as only one could be first. And, if there were numerous such supposed causes eternally operating in the development of the universal cosmos, their separate operations would necessarily have to be a co-operation. Such co-operation, or joint operation, of numberless causes would surely be unspeakably wonderful, especially when considered in the light of the marvelous unity and uniformity of nature amidst its almost infinite variety and complexity. For them thus to work together it would require intelligence on the part of every infinitesimal cause. Indeed, because everything in nature's complex constitution is so related to everything else as to affect all and be affected by all, it would require well nigh infinite intelligence on the part of every such supposed cause. It would, moreover, require on their part also absolute unanimity of purpose and perfect harmony of operation to produce such a purposeful and purposive universe. But, surely, not even the wildest dreamer or enthusiastic nature-worshiper should ever ascribe to nature's ultimate particles or causes any such attributes. To account for nature thus, would practically be making divinities of every particle of matter; and, therefore instead of eliminating God from the universe, it would almost infinitely multiply the number of gods. And yet, this is what Ernst Haeckel, *et al.,* have practically done. To the ether, or its ultimate particles, they thus ascribe consciousness, will, etc., to make their theories workable. Thus, in an attempt to get rid of the mystery of the one self-existent absolute God as the great First Cause, some men have been led into the most palpable absurdities; while the mystery of cause and origin only deepens, and the difficulties of their explanation rise in ever-increasing greatness, before the astonished investigator, at every step.

It should, moreover, be said here that such a multiplication of supposed first causes, in necessarily implying finiteness of number—as we shall see—would also imply interdependence among them. And this would contradict the idea of first or independent cause (or causes), as it would also contradict this postulate as to the eternity of matter; for eternal

existence necessarily implies independence. But more of this matter of cause later, when we shall consider it in all its bearings on this subject. It will thus be seen that, instead of making our problem easier, this postulate would make it all the more complex.

Let us further consider some facts already partly developed in stating the position of materialism, in so far as these directly afford an additional cumulative and convincing argument against the tenableness of this postulate. They thus indirectly and in anticipation also amount to a practical demonstration that the first postulate—that of the eternal existence of spirit alone—is not only tenable but must incontrovertibly be true, and that, therefore, the universe is temporal and God-created.

2 THIS POSTULATE IMPLIES THE IMPOSSIBILITY THAT ALL ENERGY, LIFE AND MIND HAVE SPRUNG FROM MATTER

This postulate of the eternal existence of matter alone would imply that all those subtle forces and agencies of nature, or by which nature may be said to operate, are the result of development. And yet the same reasoning that would make matter eternal would also make energy eternal. On this point Ernst Haeckel is only scientifically consistent when he makes the following declaration: "Both these great laws—in physics, the fundamental law of the conservation of energy, and in chemistry, of the conservation of matter—may be brought under one philosophical conception as the law of the conservation of substance; for, according to our monistic conception, energy and matter are inseparable, being only different inalienable manifestations of one single universal being —substance" (*Monism,* pp. 17-18). And yet, in his *Riddle of the Universe,* speaking of the cause or nature of energy and life, he inadvertently makes them dependent upon matter or material movements, as illustrated in the quotation given below.

This postulate would mean even that all life, including the human mind with its subtle powers and attributes, of some of which we are only beginning to catch glimpses, is also a generation from dead matter, by the interaction of its infinitesimal particles, through long cycles of evolution. Among

prominent advocates of this view may be mentioned such well-known men of science as Huxley, Spencer, Bain, Moleschott, Vogt, Büchner and Haeckel.

It is, of course, almost needless to say that, according to materialistic monism, all energy, life and mind are developments from, or manifestations of, matter as the only *reality*. Haeckel, the greatest authority on monism, expresses himself thus: "Experience has never yet discovered for us a single immaterial substance, a single force which is not dependent on matter, or a single form of energy which is not exerted by material movement, whether it be of mass, or of ether, or of both. Even the most elaborate and most perfect forms of energy that we know—the psychic life of the higher animals, the thought and reason of man—depend on material processes, or changes in the neuroplasm of the ganglionic cells; they are inconceivable apart from such modifications" (*Riddle of the Universe,* p. 221).

This author thus reasons upon the supposed absolute data of experience, as if human experience were unlimited in its scope and nature. The argument is therefore inconclusive. Moreover, to say definitely, without proper modification, that psychic life, thought and reason depend upon material processes, is to assume in a sentence that which has puzzled philosophers in all ages as an unsolved, and indeed insolvable, problem. That psychic life, thought and reason are in some way related to or generally associated with physical processes is beyond question; but that relation need not be one of effect and cause any more than it is one of cause and effect. Further we need not here answer this statement, except to say that it proves nothing.

A Arguments For Eternity of Matter Equally Valid For Eternity of Life and Mind

Not only does the reasoning that would make matter eternal also make energy eternal, but it would also make life and the soul eternal. Thus Soddy is as consistent on this point as is Haeckel above, when he says: "Deep down somewhere in the processes of thought the ultimate test of reality appears to be the Law of Conservation. Does the soul exist? If so, it must be immortal. Is matter real or a mere impression

of the mind? It cannot be created or destroyed, and therefore has an existence apart from the mind. Lastly, has energy a specific existence, or is it merely a convenient abstraction? Energy is conceived like matter, and therefore obeys this test of objective existence" (*Matter and Energy,* p. 41).

Thus, it is seen that the same evidence that is appealed to to prove matter to be eternal, might with equal force also be used to prove energy and life and mind to be eternal. And yet, according to our postulate that matter alone is eternal—to which most of these men subscribe—energy, life and mind must be a development from matter, and hence of later origin than their material basis.

But that is precisely the point at issue: whether matter, and matter alone, is eternal, and whether energy, life and mind have sprung from matter. As already intimated, that matter does exist, who can with certainty deny? But that it is the sole original existence, or that of which all other existence is but a manifestation, who can affirm? Nay, rather, that it does not exist alone and is therefore not the only existence, or that which caused all other supposed existence or of which it is only a manifestation, is a truth to which every manifestation of life and mind bears witness. Descartes' dictum, *Cogito, ergo sum,* expressing the consciousness of his separate certain existence as a personality, regardless even of whether matter exists, is true and applicable the world over. Human consciousness everywhere testifies that mind or personality is something different from matter. This fact of human consciousness, that the perceiving personality is something different from the materials perceived, is well expressed in the following words of Tennyson:

"The baby, new to earth and sky,
What time his tender palm is prest
Against the circle of the breast,
Has never thought that 'This is I':

"But, as he grows, he gathers much,
And learns the use of 'I' and 'me,'
And finds, 'I am not what I see,
And other than the things I touch.'

"So rounds he to a separate mind
From whence clear memory may begin;
As, through the frame that binds him in,
His isolation grows defined."
(*In Memoriam,* XLV.)

B More Than Matter in the Universe

Every operation of life or act of mind in contravention of laws governing material nature, is a proof that here is a power not governed by purely physical laws and therefore a power or essence not of matter. The evidence is overwhelming that there is more than matter in the universe. The universe is greater, and includes more, than matter.

The transcendental nature of life, or that it is an entity different from matter, should be as evident to the scientific investigator of the twentieth century as it was to the philosophic speculator before the birth of modern science. All the discoveries of modern science have not brought us any nearer the solution of the mystery of life than were our earlier generations of thinkers.

The mind or the soul is as much a reality as is matter. We cannot explain matter any more than we can explain the soul. Many scientists have fully realized this. Thus, Ernst Mach speaks as follows: "To us investigators, the concept 'soul' is irrelevant and a matter for laughter. But matter is an abstraction of exactly the same kind, just as good and just as bad as it is. We know as much about the soul as we do of matter" (*History and Root of the Principle of the Conservation of Energy,* Translated by Jourdain, 1911, p. 48). In line with this statement of Mach are the following words, which are a slight modification of a toast reported to have been given by a man of science:

What is mind? No matter.
What is matter? Never mind.
What is the difference between mind and matter?
It is immaterial.

The eminent geologist Joseph LeConte, in his lecture on *Man: His Place in Nature,* with equal frankness expressed

his conviction that there is more in nature than matter or mere stuff, as follows: "As I have already stated, there are two poles of existence, without the recognition of which, philosophy is impossible; they may be variously represented as matter and force, or matter and spirit, or Nature and God. Matter is essential *inertness,* spirit is essential *activity*. The very origin of our notion of force is, I believe, the consciousness of our own mental energy. Matter reveals itself to our senses, but energy, or force, only to our consciousness. We then extend it to external Nature" (*Religion and Science,* pp. 277-8).

Other scientists were driven by their investigations to the same or similar conclusions, among them Du Bois-Reymond, Sir Oliver Lodge, Balfour Stewart, Alfred Russel Wallace, Cesare Lombroso and Peter Guthrie Tait, some of whom were led to even unwarranted conclusions in their speculations. But, even though several of these men were led into error on the opposite extreme, their testimony against the existence of matter alone is none the less valuable in our discussion.

C Matter An Inadequate Cause to Produce Life and Mind

The evidence is thus overwhelming that there is more than matter in the universe. But, as already seen, dead matter cannot bring forth life without being itself impregnated with life. Harvey well said, *Omne vivum e vivo*. The stream cannot rise above its source; the effect cannot contain anything that was not potentially first in the cause. We are, of course, speaking of pure cause, unmixed with other, secondary causes—a cause, moreover, that is not itself an effect. Thus, also, if matter in the aggregate is not a pure cause, it must itself have to be an effect; and hence it must have been brought about by an antecedent cause, a cause that is therefore not matter. That is, as there would have been an antecedent cause for it, matter would necessarily have had its origin later than its immaterial cause, and therefore in time as reckoned from the supposed time, or rather eternity, of its cause—which is contrary to this postulate, that matter is eternal and that it is the only eternal existence. This reasoning could therefore not be applied to a First Cause, or an un-

caused or absolute cause. The full force of this will presently appear.

Some of the most eminent scientists, convinced that consciousness and mind cannot be accounted for or explained by physical laws, have borne witness to their convictions. They have come to regard the step from energy to life, from matter to consciousness, an impossible one. All must acknowledge the impossibility of passing, by natural explanation or natural law, from an object of consciousness to the consciousness of an object. Thus, the great physicist John Tyndall was very pronounced in his conviction that "the passage from the physics of the brain to the corresponding facts of consciousness is inconceivable as a result of Mechanics" (*Fragments of Science,* Published by Appleton, 1915, Vol. II., p. 87). And, he further said, "I do not think he [the materialist] is entitled to say that his molecular groupings, and motions, explain everything. In reality they explain nothing. The utmost he can affirm is the association of two classes of phenomena, of whose real bond of union he is in absolute ignorance" (*Ibid.,* p. 88).

The evolutionist John Fiske also fully recognized the inability of accounting for consciousness and the soul of man by material or physical forces. On this point he expressed himself as follows: "Whence came the soul we no more know than we know whence came the universe. The primal origin of consciousness is hidden in the depths of the bygone eternity. That it cannot possibly be the product of any cunning arrangement of material particles is demonstrated beyond peradventure by what we now know of the correlation of physical forces. The Platonic view of the soul, as a spiritual substance, an effluence from Godhood, . . . is doubtless the view most consonant with the present state of our knowledge" (*The Destiny of Man,* p. 42).

It is needless to say that the above is a close approach, on the part of mere science or philosophy, to the Scriptural view. So convinced was this great thinker that mind is not the result or effect of molecular interaction or of any other physical cause whatsoever, that in his various works he repeatedly gives emphatic expression to this conviction. The physiologist John G. McKendrick in his great work, *A Text Book on Physi-*

ology, apparently also recognizes the soul and consciousness as being altogether different from matter and energy, and not caused by or dependent upon them.

Upon the subject of the origin of thought, a noted lecturer and writer on chemistry expresses himself in the following unambiguous words: "How can any rolling concourse of atoms thrill thought and consciousness into matter? It avails not how complex a system we conceive of flashing atoms and sub-atoms, for our chemistry cannot explain how thought arises from their motions and arrangements. . . . A man is but an aggregate of material atoms—whirling, wheeling, colliding—in ceaseless change. And Science, before she can pretend to have solved the problem of life, must explain how such a mere aggregate of so many pounds' weight of carbon, nitrogen, phosphorus, oxygen and hydrogen atoms can evolve thought and consciousness by the mere relative movement of these atoms" (*Modern Chemistry and Its Wonders,* 1915, p. 22-23). Even Herbert Spencer, the great apostle of agnosticism, could not help but acknowledge that the conscious soul cannot be the fleeting collocation of material particles. Indeed, everywhere, especially in his *Principles of Biology,* he acknowledges that the manifestations of all life are unknown and unknowable, and cannot be explained by mere physical laws.

D Life and Mind Necessarily From An Immaterial Supernatural, or Spiritual, Source

As above shown, life is totally different from matter, and the mind or soul of man is a transcendental entity not sprung from matter. But, as these have not originated from matter, they must come from a source other than matter. Hence, even granted for the moment that matter is eternal, it is evident that this immaterial ultimate source of life and mind or soul—as it also did not come from matter—must also be eternal; and this is contrary to our postulate, that matter alone is eternal. But we are, of course, far from conceding that matter is eternal, as all our argument is against its eternity.

Nor is this immaterial source or cause of the origin of life and mind in conflict with really established science. Nay, rather, it is the only possible explanation to make them in-

telligible. And, without the postulation of some spiritual Cause of life and mind or soul, even science would be found internally irreconcilable. This has also been acknowledged by some eminent scientists. Thus, Lord Kelvin, before the *British Association,* definitely declared that, instead of neither affirming nor denying creative power, as is often asserted, science positively affirms creative power, a fact which science compels as an article of belief.

The same is in substance openly acknowledged by the chemist Robert Kennedy Duncan, as witness the following words: "The supposition that there was a guiding Intelligence working the synthesis of living matter without interfering either with its chemistry or its energetics does not seem to be out of consonance with contemporary knowledge; it seems, indeed, to be the one reasonable, believable, and uplifting theory of the origin of life" (*Some Chemical Problems of To-Day,* p. 104). And St. George Mivart also recognized this need of a spiritual origin of the soul of man, and, from the evolutionist's standpoint, made a somewhat plausible suggestion as to a possible reconciliation between Genesis and science, in the following words: "Scripture seems plainly to indicate this [difference of sources of body and spiritual soul] when it says that 'God made man from the dust of the earth, and breathed into his nostrils the breath of life.' This is a plain and direct statement that man's *body* was *not* created in the primary and absolute sense of the word, but was evolved from pre-existing material (symbolized by the term 'dust of the earth'), and was therefore only *derivatively created,* i. e., by the operation of secondary laws. His *soul,* on the other hand, was created in quite a different way, not by any pre-existing means, external to God Himself, but by the direct action of the Almighty, symbolized by the term 'breathing'" (*Genesis of Species,* p. 300). A man need not go to the length of accepting Mivart's theory in full, especially as to the development of man's body, but that does not invalidate his testimony as to the origin of man's soul. Nay, rather, this testimony should have all the greater weight as it comes from one of the greatest of the advocates of the material evolution of man's body.

Even Charles Darwin himself had to acknowledge the need of some creative Divinity back of the supposed first germs of

life to make his theory of organic evolution workable. And to him a creation of life seemed all the more wonderful as he viewed it as having come from a few directly created primordial germs, endowed with the necessary potentialities for the evolving, by secondary agencies, into a world of developed beautiful flora and fauna. He strikingly expressed this in the closing paragraph of the second volume of his work, *The Origin of Species,* as follows: "There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been and are being evolved" (Sixth Edition).

Thus even the most ardent advocates of the inflexibility of nature's laws and of the scientific doctrine of evolution are compelled to acknowledge that life and mind or soul are totally different from matter, and that they must therefore somehow and at some time have been created by a Divinity. And this is in direct conflict with the necessary implication of this postulate of the eternal existence of matter alone—that energy, life and mind or soul have sprung from matter.

3 THIS POSTULATE IMPLIES THAT THE PHYSICAL UNIVERSE IS INFINITE, WHICH IS CONTRARY TO FACT

To assume that matter alone is eternal is necessarily to assume it also to be infinite, or else we should be assuming the impossible, as already stated; namely, that a finite could be eternal and absolute. A finite is necessarily a caused existence and must therefore have had a beginning. And, of course, if matter is finite it cannot be eternal and absolute. The very idea of finiteness or finitude implies infiniteness or infinitude; limitation or a limit implies a something limiting; dependence implies an independent and absolute. Thus, the very finiteness of matter, or of the universe, points to an infinity, within which, or by which, that finite physical universe has its being, and therefore to another eternal existence. This would be contrary to this postulate, that matter alone is eternal.

But, in order to overcome this difficulty, many men have

therefore contended that the physical universe is infinite in extent, and that it is therefore properly absolute and eternal. As it would, however, be impossible to do justice to this contention, without entering upon a somewhat lengthy discussion, especially also as to the nature of cause, we shall consider this phase of the subject separately.

We have thus seen that this postulate of the eternal existence of matter alone also necessarily implies that life and mind or soul would have sprung from matter. But we have found, on the contrary, that life, mind or soul could not have sprung from matter, and that they must therefore have come from a source that is not material—or that they must have been created by a supreme Will. We have found, moreover, that such an origin is not inconsistent with truly scientific principles, but that it is rather in necessary accord with them. And, as this immaterial source of life and mind or soul cannot, therefore, have been dependent upon, or originated from, matter, nor from itself, it must necessarily be an eternal entity, which is contrary to this postulate, that matter alone is eternal. We have also seen that this postulate necessarily implies that the universe must be infinite, which, as we shall show in our next two chapters, is not the case, and is even a physical impossibility. Therefore this postulate, that matter alone is eternal, must fall. And the necessary conclusion has become apparent; namely, that matter is not only not the only eternal existence, but that it is *no* eternal existence.

III POSTULATE OF ETERNAL EXISTENCE OF SPIRIT ALONE TENABLE AND TRUE

We have now shown that the postulate of the eternal existence of both matter and spirit and that of the eternal existence of matter alone are both untenable. Of the three possible postulates as to a first and necessarily eternal existence, there is therefore only one left; namely, that of the eternal existence of spirit alone. And we might in anticipation say that this is, of course, practically identical with the Christian conception of the eternal existence of God alone. From the foregoing arguments it may, however, be said that this remaining postulate no longer remains a mere postulation. It

now stands out as almost a demonstrated fact, even without further proof.

But there is not only this *negative proof* for the eternal existence of spirit alone. This can also practically be demonstrated by positive ontological and mathematico-physical arguments, as the following chapters will show. Indeed, the whole combined and cumulative evidence from universal nature constitutes a sublime *positive proof.* And, though apostate man should deny this one great fact, in persisting to be an orphan in the universe, and though he should be silent in his praises to the only eternal Being, it would ever remain true that all nature with her myriad voices would continue eloquent in praise to the great Creator, God.

It might almost seem superfluous, therefore, to attempt to add anything on this only remaining postulate, or well-nigh demonstrated fact—that of the eternal existence of spirit alone. Only a few additional words will therefore be said in this connection. The following chapters may, however, be regarded as a *development* of the idea bodied forth in this postulate.

This postulate alone accords with man's own mysterious being. The aspirations and yearnings of the human heart would, without it, forever have to remain unfilled and unsatisfied. Man's longing for life can have no other meaning than as an index-finger pointing to his origin and source, the truly *living One.* Design and purpose in man, of which he finds the correlation everywhere in nature, would be an anomaly, if it did not imply and plainly point to a Designer from Whom all design, both in man and in nature, has its being. Then, too, the very God-instinct, or what may be called the spontaneous God-consciousness, is only the created impress of this great fact upon his very nature. And, to the unbiased mind, the idea of a temporal universe, brought into being by an eternal Creator, is well-nigh intuitive, like the ideas of time, space and causation. And, together with his God-instinct, this may be regarded as a vestige of his creation, left upon him by his God—a trailing cloud of glory in his origin.

The belief in some supreme Being as the cause or author of all things is a universal one. At various times, when new savage tribes of man were discovered, this universality of belief in some Divinity was denied, because there was no such

belief at first apparent among them. But, upon more thoroughgoing investigation, such belief, however crude, has always been found. To quote an acknowledged authority on this point, C. P. Tiele of the University of Leiden made the following very emphatic declaration: "The statement that there are nations or tribes which possess no religion, rests either on inaccurate observation, or on a confusion of ideas. No tribe or nation has yet been met with destitute of belief in any higher beings; and travellers who asserted their existence have been afterwards refuted by the facts. It is legitimate, therefore, to call religion in its most general sense a universal phenomenon of humanity" (*Outlines of the History of Religion,* Tr. Carpenter, Second Edition, p. 6). So, also, David Livingstone and other explorers have testified to the universality of belief in a god or some higher being or beings, as a fact that cannot be denied in the face of the evidence.

This universal belief in a supreme spiritual Being has surely not come by accident or development, but by man's created nature. Like the created instinct for food and other necessities, this God-instinct is a natural and necessary one to lead man to seek his Creator. Indeed, in addition to an inborn instinct, telling him—in language often very unintelligible because of his fallen nature—of the one supreme and only eternal Entity, all nature with overwhelming evidence silently testifies to every man that the emotions of his heart are confirmed by the manifestations of a creative mind in every part of the environing universe. Thus, the evidence within is matched by the evidence without. The human soul and the material universe, perceiver and perceived, are spiritual and material complements. And they both bear witness in this manifest designed relationship, as well as in their intrinsic natures, that they are creatures of a higher Being. And that Being, by His very nature, must be an independent or absolute and eternal spiritual entity. In line with this are the following words by Oscar Kuhns, which, although we need not endorse the author's full application elsewhere, are surely more than mere poetry: "Every being is an epitome of all the rest, and in the understanding of the meanest flower that grows, lies the whole mystery of God and the universe. Man especially is a microcosm; he is placed in the middle of the

universe; in his body related to animals and plants; in his mind related to the celestial planets; and in his soul at one with the angels, and capable of union with God. He is touched with the infinite streams of influence that flow into his soul from all sides; no part of the universe can be touched without the strings of his heart vibrating in unison. And above and about and mingling with all this seething mass of activities is God, who manifests himself in all things, from the smallest flower to man,—who is the crown of creation" (*The Sense of the Infinite,* 1908, p. 190).

It is a noteworthy fact that many eminent men of science who, in the less mature periods of their lives denied the existence of God and the soul, in their maturer periods came back to acknowledge the existence of both. In early life they were apparently led by the sage declarations of leaders who denied the need of either existence to explain nature, and perhaps also by a half-conviction that such an attitude might border on the heroic. But maturer considerations and deeper investigations into the wonders of nature compelled them to acknowledge the manifest absurdity of such a position. Thus, Du Bois-Reymond, Wilhelm Max Wundt, Karl Ernst von Baer and Rudolf Virchow during the earlier periods of their lives were pronounced materialists; but they gradually rose to regard the soul as a supernatural entity, and a supreme Deity back of nature as absolutely necessary to make it intelligible.

Wundt's change of view was especially a radical one. He not only publicly renounced his former position, but he even condemned it as the sin of his youth. So also Du Bois-Reymond in later and maturer life came to renounce his atheistic conception of the universe and to accept a theistic view of creation. Thus, in an address on *Neovitalism,* in 1894, he expressed himself as of the conviction that all matter was created ages ago by one creative act of Deity and then endowed with all the potentialities necessary for its full evolution, crowned in the being of man. It might also be said that even Immanuel Kant largely modified his prejudiced views of earlier life. Even the great botanist Reinke not only rejected the physical origin of species, but he even came to accept the account of creation in Genesis I. in all its wonderful consistency and simplicity. Thus in these, as well as in many

other men, is beautifully illustrated the dictum of Francis Bacon, "A little philosophy inclineth man's mind to atheism, but depth in philosophy bringeth men's minds about to religion" (*Essays: Of Atheism*).

This postulate of the eternal existence of spirit alone is thus not only shown to be altogether tenable, but, in connection with the only other two—but untenable—postulates, it remains as a practically demonstrated fact. In the remaining chapters this will, however, become very much more apparent; namely, that the only eternal entity must be a spiritual being—the God of the Scriptures—and that the universe was by Him called into being *ex nihilo* in time or at time's beginning. We shall, therefore, close this chapter and proceed to our next chapter, in which we shall show that the universe is by nature a finite, and, therefore, a dependent or non-absolute and created existence.

CHAPTER IV

THE PHYSICAL UNIVERSE FINITE AND TEMPORAL AND THEREFORE A CREATURE—EVIDENCE FROM DEPENDENCE

At the close of our discussion of the postulate of the eternal existence of matter alone—in the preceding chapter—we stated that many men contend that the physical universe is infinite in extent, and therefore necessarily eternal and absolute. This is a necessary assumption in the interests of their contention, that the universe is uncreated and eternal, in order to escape the dilemma of contending for an impossibility; namely, that a finite can be eternal and absolute. They would thus also account for a supposedly endless series of successive evolutions and devolutions, alternating like mighty pulse-beats, from nebulæ to star-systems and back to nebulæ again, and so on without end. Thus they suppose the possibility also of numberless planetary systems in eternal cycles. These, in their turns, and partly simultaneously, would supposedly become theatres of life, transmitted both successively and simultaneously from system to system forever.

Thus Ernst Haeckel holds that the ether is boundless and immeasurable, and in eternal motion, causing all phenomena. He embodies his theory of an infinite and eternal universe in his striking "cosmological theorems," as follows: "(1) The universe, or the cosmos, is eternal, infinite, and illimitable. (2) Its substance, with its two attributes (matter and energy), fills infinite space, and is in eternal motion. (3) This motion runs on through infinite time as an unbroken development, with a periodic change from life to death, from evolution to devolution. (4) The innumerable bodies which are scattered about the space-filling ether all obey the same 'law of substance'; while the rotating masses slowly move towards their destruction and dissolution in one part of space others are

springing into new life and development in other quarters of the universe," etc. (*The Riddle of the Universe,* p. 13). In another statement, with equal definiteness he makes energy eternal: "The sum-total of force or energy in the universe remains constant, no matter what changes take place around us; it is eternal and infinite, like the matter on which it is inseparably dependent" (*Ibid.,* p. 231).

Of similar import are the following words by Orlando J. Smith, who holds that all things, even including the human soul, are without beginning and without end: "1. The Universe has in space no boundary; in time no beginning and no end. 2. There is no creation and no annihilation—the essential properties of all things being uncreatable and indestructible. Birth and death, growth and decay, are transformations" (*Eternalism,* 1902, p. 28).

The belief that the physical universe is infinite led Friedrich Carl Büchner also to the natural conclusion that it must be eternal and uncreated, as he thus expressed it: "The Universe of matter with its properties, conditions, or movements, which we name forces, must have existed from and will exist to all eternity, or—in other words—the Universe cannot have been created." And other men, from the same or similar premises, have come to the same conclusion; namely, that the physical universe must be eternal and uncaused.

Similar statements might be quoted from the writings of other men of science; but, as others are found in this work in connection with our discussion of special points, we shall not further multiply citations here. Enough have, however, been given to show the importance of the theory of an *infinite* universe for the related theory of its *eternal* duration and *self-existence.*

So necessary is the idea of an infinite universe to make the theory of its eternal duration workable, that the advocates of eternalism have to assume its infinity as a necessary postulate of reason. This necessity is openly acknowledged by Svante Arrhenius in the following words: "If the world were limited, as people used to fancy—that is to say, if the stars were crowded together in a huge heap, and only infinite, empty space outside of this heap, the dust particles ejected from the suns during the past ages by the action of the radiating pressure would have been lost in infinite space, just as we imagined that

the radiated energy of the sun was lost. If that were so, the development of the universe would long since have come to an end, to an annihilation of all matter and of all energy" (*Worlds in the Making,* p. 209).

This, therefore, is precisely the difficulty that these men have to overcome; namely, that the universe is finite. And, even if it were infinite, would that necessarily be a proof of their theories—which are only theories—built upon very insignificant data? Surely it is a wild stretch of the imagination, from such insufficient evidence as is available from this insignificant corner of the universe to determine how the immeasurably vast universe came to be and what will be its ultimate destiny. But to assume that the universe is infinite is to do so in the face of incontrovertible evidence to the contrary, as we shall now proceed to show and, as we hope, practically to demonstrate in this and the following chapter. Here we shall consider *dependence* as an evidence that the universe is finite. And in our next chapter we shall consider the evidence for its finiteness from the universe as a *cosmic whole.*

What evidence, then, does nature furnish that it is dependent and finite? There are limitations on every side. There is dependence everywhere. This limitation or interdependence may be considered as consisting of two kinds; namely, simultaneous or synchronous, and successive or chronological. And, while there is a sense in which both may be considered as causal, it is the latter that would more commonly be recognized as such.

I EVIDENCE FROM APPARENTLY SIMULTANEOUS OR SYNCHRONOUS DEPENDENCE, PROVING AN INDEPENDENT AND ABSOLUTE UPHOLDER

All things within the physical universe are mutually so interrelated that they are necessarily dependent upon one another. And this is so true that it may truthfully be said that not only the moving of a world, but even the lifting of a pebble, must, by the all-pervading law of gravitation, necessarily affect, however infinitesimally, the whole material universe. That surely shows interdependence. Thus, each af-

fects all and all affect each. And, for the universe to be infinite, there would have to be an absoluteness and independence somewhere, either locally or in the universal aggregate.

In illustration of this truth and fact, as a proof of the finiteness of nature, we shall make use of what we may call an indefinite series of dependences. Upon what is your chair dependent for support? Upon the floor. Upon what is the floor dependent? Upon the building. Upon what is the building dependent? Upon the earth. Upon what is the earth dependent? Upon the sun. Upon what is the sun dependent? Some one might answer, Upon some other sun or star, or perhaps rather upon the centre of gravity of a group of stellar bodies. Upon what then is that supposed body, or group of bodies, dependent? Perhaps upon some other group or groups, or upon their common centre of gravity, as some one might suggest.

I NO SERIES OF SUPPORTS AND DEPENDENCES INFINITE

The above series of questions and answers might be continued indefinitely. For, however great the number in this series of supports might be supposed to be, we should still have the ever-recurring question, "And upon what does that last support depend for its support?" As every chain of individual links must necessarily be finite and must hang from some support not itself, or beyond it, so must this chain of supposed supports be finite and hang from, or depend upon, some ulterior independent support. And, as the universe is composed of an indefinite number of finites or dependents, whatever they be, so in the universal aggregate must it remain finite and dependent or conditioned; for no number of conditioned and finite things can constitute an infinite and unconditioned. Thus nature's finite series of mutually interdependent supports incontrovertibly proves it to be a limited or finite universe. And such a universe, by its very nature, cannot be eternal; nor could it have been self-originated.

Furthermore, this process of reasoning, with its inevitable conclusion cannot be set aside by the contention that not any one thing, from electron to star, is dependent upon any other *one* thing for support, but that every single thing is, in its

last analysis, supported by the universal *whole.*

While this is indeed scientifically true, and would, in a sustained argument like this, make the problem more complex and the successive steps in the reasoning less apparent, it by no means alters the mathematically certain conclusion. The dependence none the less, but rather more so, still exists, only in much greater complexities than in our illustration. Each depends upon all and all depend upon each, thus leaving all its parts mutually interdependent, and, therefore, necessarily relative and dependent in the universal whole.

Upon what, then, must the great whole of these mutually interdependent parts of the dependent universe depend for its support? Or, upon what does the last link of these supposed supports, and, therefore, the whole chain, depend for support? Why not accept the only tenable postulate, that of an infinite, independent, absolute, eternal and almighty Will —that of the God of Scripture? His acknowledged existence alone not only makes intelligible and resolves this complex and perplexing problem, but it alone can fill the otherwise insatiable yearnings of the human heart.

Therefore, the material universe is shown by this line of argument necessarily to be dependent or conditioned and finite, and therefore a temporal existence.

2 ACTION OF GRAVITATION AN EVIDENCE OF FINITENESS AND DEPENDENCE

Another point in proof that the universe is finite, which should be considered in this connection, is based upon the action of gravitation. It will be remembered that the wording of the heading to this subdivision of the present chapter is *Evidence from* ***Apparently*** *Simultaneous or Synchronous Dependence.* By this we foreshadowed what we shall here develop; namely, that the force of gravitation does not act instantaneously, as is rather generally supposed. As in the case of light, heat and electricity, to which it is undoubtedly akin, the element of time enters into its transmission or action. Laplace estimated it as acting with a velocity considerably greater than that of light. But more recent estimates or calculations place its velocity of action in the same order as that of the transmission of light. Thus M. Henri Poincaré

makes its velocity of action about that of light. The mathematician Gerber reached the same conclusion, basing his calculation upon the motion of Mercury in perihelion. This, then, is additional evidence that the universe is finite in extent.

But not only would the action of gravitation in an infinite universe have to be infinite in *velocity,* or instantaneous, but it would also have to be infinite in *extent* or *force.* But as this is fixed and even measurable, its basis or mass of action must also be finite and fixed.

If the universe were infinite, its motions or attractions (if such there could be) would, moreover, have to be in *perfect balance,* by instantaneous action. Nor, as a whole at least, could it even be in motion, as we shall show; and therefore the very presence of attraction and motion, is itself an evidence that it is finite. But, as gravitation is not instantaneous, this, at any rate, indicates that its motions or attractions are not thus balanced, and that there is some universal adjustment of position constantly going on. And this itself is an index of relativity, and therefore of finiteness. Moreover, the very internal attractions and revolutions are local evidences of this great truth, that the universe is in motion everywhere, and hence that it therefore is necessarily a finite entity. Somewhat in line with this is the conclusion of Seeliger, from the apparently *invariable nature* of gravitation, that the universe must be finite.

The fact that a dependent or conditioned existence must necessarily be finite, needs no further proof in this connection. Hence, as we have in the above argument shown the universe to be a dependent or conditioned and therefore finite existence, we hold that this is equivalent to showing that it must have been created, and that it must still be supported or sustained by an independent, absolute, infinite, eternal, and therefore uncreated, spiritual Being—a supreme Will.

II EVIDENCE FROM SUCCESSIVE OR CHRONOLOGICAL DEPENDENCE, NECESSITATING AN UNCAUSED ETERNAL ORIGINATOR

In addition to the simultaneous dependence spoken of above, there is also a successive or chronological dependence. This

might be spoken of as that of so-called *cause and effect,* by which term it will more readily be recognized. This dependence we shall now proceed to illustrate and explain.

I THE LAW GOVERNING SECONDARY CAUSES ILLUSTRATED

In striking the first of a long series of balls, arranged in a straight line one against the other, every ball to the very last is set in motion. The last ball in the series receives the impact of the ball immediately preceding it. Its motion is the effect of the impact of this preceding ball, while that impact is spoken of as the cause of that motion. And, because there is no ball after this last ball, its motion remains an effect without in turn becoming an apparent cause. With the second last ball the case is different. Its motion is the effect of the impact of the third last ball; but it in turn, by its impact upon the last ball, becomes the apparent cause of that last ball's motion. So the motion of the third last ball is the cause of the motion of the second last ball, while it is the effect of the motion of the fourth last ball. The same is true of all the other balls back to the second from the beginning of the series. The motion of the first ball is thus also the apparent cause of the motion of the second ball in the series; but it is not the effect of the motion of a ball preceding it. Its motion comes from a source altogether different. It comes from the impact of the mind-directed blow with which it was struck. And, unless it had been moved by some external force, that first ball, according to the law of inertia, would have remained forever at rest. And with it, all the other balls of the series would also have remained at rest. There would then have been no motion in the whole series, either as cause or as effect. In other words, the motions of all the balls, whether viewed as causes or as effects, were caused by that mind-directed blow. All these motions are, therefore, really effects of the impact of that blow; but, strictly speaking, causes they are not. The only real cause is the director of the blow. To be sure, in logic and in every-day life, we speak of them as causes producing succeeding motions as effects. But when we view them in relation to the mind-directed blow or to the director of that blow, they are effects only, although by com-

parison with the blow or its director as the first cause they may be spoken of as second or secondary causes. It is, of course, readily seen that these motions, considered as also causes of other motions, are totally different from the real cause, the *will* that directed the blow which produced them all.

There is also another point that needs explanation. The impact of the second last ball moved the last ball, that of the third last ball really moved the last two balls, that of the fourth last ball moved the last three, etc. Or, the energy of the second last ball viewed as an *effect* may be said to be greater by the energy of its own simple motion than it is as a *cause*. As an effect of the impact of the preceding ball, its energy includes both its own motion and that of the ball that it moves. As a cause, its energy moves only the last ball. So, the energy of the third last ball as a cause is equal to the energy of the motion of the second last ball as given—which of course includes that of the last ball. Or, in other words, the energy of the motion of the third last ball viewed as a *cause,* is equal to the energy of the second last ball viewed as an *effect.* But the energy of the third last ball viewed as an effect is equal to the energy of the second last ball viewed as an effect plus that of its own simple motion. Or, the energy of any ball as an *effect* is greater by its own simple motion than it is as a *cause*—no more and no less. The energy, therefore, grows less in an arithmetical ratio, as we move from the initial impact toward the last ball of the series. Conversely, as we pass from the last ball toward the initial impact the energy correspondingly increases. The energy of the first ball is, of course, exactly equal to the energy of all the balls in the series plus the energy of its own simple motion. And this is the energy as an *effect* that came from the impact of the blow as a *cause.* Nor has any ball any energy apart from this impact. But how much more energy the one had who directed the blow, and which he might have imparted through a blow to this series of balls or to any number or other kinds of series, is hard to tell. In other words, the measure of the energy imparted to this series of balls is not at all likely the measure of the energy of which the striker was capable or which he possessed. This illustration may seem rather long, but it is so in the interests of clearness.

2 ALL SERIES OF SECONDARY CAUSES FINITE, LEADING UP TO AN INFINITE FIRST CAUSE

If we could thus analyze events, or so-called effects, in nature and inerrently trace them to their immediate causes in all their complexities, and then likewise trace the so-called causes to their complex causes, etc., etc., we should at last arrive at a so-called cause or complexity of causes that was not produced in a similar way. It would be the first of the indefinite series of so-called causes, which itself is caused by an only *real,* because uncaused, *cause*, properly called the *First Cause*. This series of successive causes must be finite, because no number of them could constitute an infinite even as we could have no infinite number in a row of balls. This last point will become more clear in connection with an argument near the end of our next chapter.

That First Cause, arrived at by the above argument, is really the only cause that, in a sense, fully matches the following definition of cause by John Stuart Mill. In treating of causation in connection with sequence in his great work on Logic, he says, "We may define, therefore, the cause of a phenomenon, to be the antecedent or the concurrence of antecedents, on which it is invariably and *unconditionally* consequent" (*A System of Logic,* Eighth Edition, 1888, p. 245).

Of no secondary cause can it be truly said that it is that upon which a phenomenon or an effect invariably and unconditionally is consequent or depends. No secondary cause is a pure cause, itself being conditioned by preceding and concurring causes. Nor is there, therefore, any unconditional connection between such cause and its associated consequent. But of the great First Cause, as indicated above, as a pure and unconditioned cause, and one on which events are therefore unconditionally consequent, this definition of cause by Mill is strictly true.

The whole series of successive secondary causes would thus be found to flow out of the one First Cause, and all the energy, both in the individuals and in the grand aggregate, of the succession, would be found to have been imparted to it by that First Cause—as shown in our illustration. And, of course, it should be remembered that each successive complex cause as we go backward in the series is greater as an *effect,*

by its own simple energy, than it is as a *cause*. So each cause, as we go backwards, as a *cause* contains all the energy of all the succeeding *effects* (or causes) to the very end of the series. What inconceivable energy must there have been then in the first of these ever more and more complex secondary causes! But, as the energy of the first in the series—that of the whole series—is not the measure of the possible energy of the great First Cause, how infinitely great must that power be which that First Cause, or the infinite God, possesses—for the power of an absolute Being must necessarily be infinite!

3 THE EXISTENCE OF ONE ABSOLUTE FIRST CAUSE A NECESSARY POSTULATE OF REASON

That there must be a First Cause back of all secondary causes is so necessary even to the very constitution of the human mind, that most really great thinkers are driven to that Cause as the only possible ultimate explanation of the fleeting phenomena that we call the universe. Although the great philosopher Immanuel Kant (1724-1804) endeavored, by the most subtle reasoning of which even he was capable, to show that a positive proof of a necessary Being was impossible, he was nevertheless driven by an inexorable logic to acknowledge the necessary existence of a supreme or ultimate causality in which alone the mind can rest. He reasoned thus: "We see things around us change, arise, and pass away; they, or their condition, must therefore have a cause. The same demand must again be made of the cause itself—as a datum of experience. Now it is natural that we should place the *highest* causality just where we place *supreme* causality, in that being which contains the conditions of all possible effects, and the conception of which is so simple as that of an all-embracing reality. This highest cause, then, we regard as absolutely necessary, because we find it absolutely necessary to rise to it, and do not discover any reason for proceeding beyond it" (*Critique of Pure Reason,* Translated by J. M. D. Meiklejohn, 1902, p. 442).

This acknowledgment of some necessarily unconditioned or absolute existence—the ultimate Cause of all things—the great Koenigsburg philosopher finds it necessary to make as the logical result of the acknowledgment of any existence whatso-

ever, as expressed in the following words: "If we admit the existence of some one thing, whatever it may be, we must also admit that there is something which exists *necessarily*. For what is contingent exists only under the condition of some other thing, which is its cause; and from this we must go on to conclude the existence of a cause, which is not contingent and which consequently exists necessarily and unconditionally. Such is the argument by which reason justifies its advance toward a primal being" (*Ibid.,* pp. 438-9).

Even Herbert Spencer was driven, by the very necessity of reason, from conditioned to unconditioned existence, which is equivalent to saying, from caused or secondary causes to an uncaused or First Cause—to which matter or the physical universe is, of course, related as an effect. Though that First Cause, according to his philosophy, is unknowable and even inconceivable, such a conclusion, on the part of so great an exponent of the agnostic philosophy, has no little weight. The following confession was made by Spencer: "As on conceiving any bounded space, there arises a nascent consciousness of space outside the bounds; so, when we think of any definite cause, there arises a nascent consciousness of a cause behind it; and in the one case as in the other this nascent consciousness is in substance like that which suggests it, though without form. The momentum of thought carries us beyond conditioned existence to unconditioned existence; and this ever persists in us as the body of a thought to which we can give no shape" (*First Principles,* Sixth Edition, 1900, p. 79).

And, of course, the same inexorable logic that drives us to a First Cause compels us also to acknowledge that that First Cause must necessarily be infinite, absolute and eternal, as we have shown. Therefore, Herbert Spencer was forced also to acknowledge these truths.

These conclusions Spencer reached by a perfectly logical process; and if he had continued to rely upon his own reasoning on this point, he would have been saved from some dilemmas and inconsistencies to which he was led. But he was apparently led astray by Dean Mansel's faulty reasoning as to *First Cause,* the *Infinite* and the *Absolute,* as set forth in that author's *Limits of Religious Thought.*

One of these inconsistencies to which Spencer was led by following Dean Mansel, is, that of contending that the In-

finite and Absolute, the complete and perfect, is totally unknowable. This contradiction was readily recognized by the keen analytic mind of James Martineau, who was moved to make the following comment: "We are told in one breath that this Being must be in every sense 'perfect, complete, total —including in itself all power, and transcending all law'; and in another that this perfect omnipotent One is totally incapable of revealing any one of an infinite store of attributes. Need we point out the contradictions which this position involves? If you abide by it, you deny the Absolute and Infinite in the very act of affirming it; for, in debarring the First Cause from self-revelation, you impose a limit on its nature. And in the very act of declaring the First Cause incognizable, you do not permit it to remain unknown" (*Essays Philosophical and Theological,* 190-1).

The fallacy of Spencer lies in the various contents of the words *knowable* and *unknowable.* We may know with absolute certainty that a thing exists, but such knowledge does not necessarily imply that we know all about the thing itself. Indeed, we may know practically nothing about the thing. Thus we may know with certainty that a light is shining this moment of the night out there on yonder horizon. But, whether that light be that of a lamp, an electric light, a will-o'-the-wisp, or even a star, I might not be able to determine before it disappears. And, even if I could find it definitely to be one or other of these, I might still have but a limited knowledge of it. I may thus be very certain that I see a light, but may know only very little of its real nature. Therefore, in one sense that light is *knowable,* and even *known;* in another sense it is *unknowable.* So in speaking of the Absolute and Eternal—the Creator and Upholder of all—no fact can be more certain than *that* He exists, as all nature ever testifies in myriad forms. And yet, we may be able by searching to find out very little of His real nature and Being. In the former sense He is certainly *knowable;* in the latter sense He may as truly be spoken of as *unknowable,* and in that partial sense at least as *the Unknowable* or *the unknowable One.* It seems passing strange that some great thinkers have thus lost themselves in the bewildering mazes of their own ratiocinations! But they had a preconceived theory to establish in most cases, and therefore allowed their biased views to lead them

to conclusions which they often inadvertently contradicted elsewhere in their writings.

We have thus shown, from the very nature of causality, from the existence of secondary causes, or the very existence of physical phenomena, that there must be a First Cause. We have seen that this necessary existence of a First Cause has its counterpart in the very constitution of the human mind, as a necessary postulate of reason. We have also seen that the existence of such a First Cause is acknowledged by many of the world's greatest thinkers, often apparently in the face of what might appear to be their own preconceptions. And we have shown that that First Cause must necessarily be infinite, while the series of secondary causes must of equal necessity be finite. We shall now further contemplate that First Cause in the light of secondary causes and in the light of what we have already said. And such contemplation, from whatever angle we view that Cause, will not only still further strengthen and confirm conviction as to the reality of His existence and His relation to the universe, but it will also help to a better and more concrete conception of His Greatness.

III SOME IMPORTANT AND NECESSARY DEDUCTIONS AS TO THE FIRST CAUSE

The known universe is, indeed, incalculably vast. But let us for the moment suppose it to be but a tiny island in the mightier archipelago of the great ocean of immensity. Our galactic system with the rotations and complex revolutions of its stars and other bodies—the universe known to man—might then, in comparison with such an immeasurably greater whole, be like an infinitesimal molecule with its atoms and electrons, in ceaseless gyrations; as, indeed, according to our latest science, every molecule is a miniature or infinitesimal universe. The ultimate point of minute visibility to the human eye might perhaps be but a vanishing point from the upper cosmic universe to the nether infinitesimal universe. Thus, like the dividing point of the upper and lower halves of an hour glass, that ultimate point of human vision might then be considered the dividing point between the well-nigh infinite and the so-called infinitesimal

universes, which would constitute the two halves of the great unified whole. And the latter might perhaps relatively be as great and wonderful in its complexities down to its minutest divisibility as the former would be up to its ultimate unity.

But, even if that were so, if we should trace our series of complex secondary causes, from the revolving electron (or perhaps even minuter ultimate unit) up through the cosmic whole of such a supposed immeasurably higher all-comprehensive universe, we should nevertheless come to the point where the First Cause began to operate upon the first of the secondary causes and through it upon all to the end of time. And, at every step, all the more exalted would our conception of that Being become. His almightiness would then appear to the searcher only as greater almightiness; His greatness and ways as past finding out! But, however far we should ascend upwards in space or go backwards in time, we should never get away from this Cause of all. We should rather approach ever nearer, perhaps almost unto the very presence of this eternal Cause.

I THE ABSOLUTE, PARTIALLY KNOWABLE, FIRST CAUSE ONE, CONTINUALLY SUSTAINING ALL THINGS

The further back we should trace secondary causes toward the First or True Cause, as already intimated, the more energy should we meet and the mightier should such secondary causes be found to be. And, again we emphasize, as the number of such regressions must be finite, we should at last have to come to the infinite *First* or *uncaused* Cause. Moreover, such a Cause, instead of being contrary to the idea of a true cause, would be the only Cause that could match that idea. But, as a cause can be known to us partly indirectly by its effects and partly directly as itself an effect, and therefore only partially by its effects alone, it follows that, at least in our present state, we should never be able *fully* to know an uncaused cause, because it would in no sense also be an effect. Therefore, while man exists in a caused and causing order of nature, he can never ascend to, or *directly* and *fully* know, the infinite personal First Cause, God. "Canst thou by searching find out God? Canst thou find out the Almighty unto perfection?" (Job 11:7.) The "I Am That I Am"

can really be known by Revelation alone, and in so far only as He enters into voluntary relation with us—especially in the history of redemption—although He may faintly be traced by His unmistakable footprints upon created nature.

Thus, every present single event in nature may be considered as the last in an intricate indefinite chronological sequence of events connected up together, as causes and effects, with the Great First Cause of them all. And all simultaneous events may be spoken of as the last in an indefinite number of such sequences, synchronously parallel and connected up together with the same Great First Cause of all the sequences. And, thus, that First Cause not only *originated* universal nature, but also *continues to sustain* it; and with the withholding of that sustaining power it would necessarily instantaneously cease to be. That Cause must, therefore, be the ultimate reality of all philosophic search, and the creative and sustaining Deity of Revelation.

If one were to reject this profound truth as to the necessarily eternal and absolute *one* First Cause, he would find himself in an utterly inextricable dilemma of reason. He would either have to assume an impossible infinite chain, or series of infinite chains, of such successive and synchronous integral causes, or he would find his chain, or series of chains, of causes end in some equally impossible nothingness. This reasoning shows the very palpable absurdity of any endeavor to account for the universe by any cause short of a creative non-material Deity.

Moreover, the unity and uniformity of nature, amidst the universality and variety of law, are an incontrovertible evidence also that the inevitable logic of reason as to the impossibility of more than one First Cause is unassailably confirmed by nature. It was a favorite theory of Faraday that the various forces of nature have one common origin, and that they are mutually dependent, so that gravitation, electricity, magnetism, radiant heat and chemical force might be considered as only different manifestations of one great fundamental power. And it is needless to say that this bold theory of the philosophic mind of Faraday the scientist is more and more assuming the nature of an established scientific fact.

As already noted, by the law of gravitation the universal

whole and all its synchronous events are bound together into unity. They are traceable, as has been said above, through long series of sequential secondary causes to one great Cause of all, in Whom all things are thus bound together. Whether the number of parallel secondary causes thus diminishes, as we approach the First Cause, until they end in unity, directly acted upon by that Cause, or whether that Cause simultaneously at the first acted upon an indefinite number of such secondary causes for the conducting of all the operations of nature for all time, matters not. So, it matters not for our immediate purpose whether the First Cause thus at first imparted to matter, after He had created it, all the energy for all its operations to the end of time, as implied in the law of conservation, or whether He imparted only the initial energy requisite for the beginnings of nature and then superadded more energy at special epochs from time to time, or whether He even imposed upon the universe itself the potentialities for the development of more and more energy, as needed. All are indeed possible. One thing must, however, inevitably be accepted as demonstrated; namely, that all physical operations are ultimately from and by the one true Cause, the omnific Will of some supreme Creator and Upholder of all things.

2 WHATEVER THE THEORY OF CREATION, ITS CAUSE A SUPREME PERSONALITY

From the above argument it is seen that, whatever theory one may adopt as to the creation of the universe, whether it be that of mediate or that of immediate creation, or that of these two combined—directly, or indirectly through secondary causes; by an instantaneous, a periodic or an evolutionary process,—he must necessarily postulate a Personality back of it to make his theory intelligible. And, with this truth the truly unbiased physical scientist is even compelled to agree. And among those heartily so agreeing we find no less an authority than the English naturalist St. George Mivart, as he often expressed himself in his various writings, especially in his *Genesis of Species*.

Thus many of the greatest students of nature, whatever

may be their religious, or even anti-religious, prepossessions, find it necessary to admit that back of all material things there is an ultimate immaterial Cause, or that the physical universe, with all its energy and potentialities, is the created product of a supreme spiritual Personality.

Various attempts have also been made by purely philosophico-scientific explanations to set forth the probable nature of such a supreme spiritual Personality and that of the spiritual world and its connection with the physical world. Thus, Frederic Meyers considers the Spiritual universe as in actual relation with, and as being the source of all the energy in, the physical universe. Many very striking passages bearing upon this point might be cited from the very suggestive, even if very speculative, work, entitled *The Unseen Universe,* by Stewart and Tait, among the most eminent British physicists of the latter half of the last century. But all these merely speculative theories are only gropings after, or guesses at, a real objective truth, without the attainment of which the human mind and heart must forever wander about unsatisfied,—even that truth or those truths which the Christian holds are definitely set forth in Revelation alone. And yet these gropings or guesses are themselves indirect evidences of the existence and reality of these truths.

Somewhat similar in its nature to the above theories is a statement by Frank Harris in his ingenious mathematical work on *Gravitation,* as follows: "As a matter of fact, we find ourselves in a three-dimensional 'corner' of the infinite universe; and, as above pointed out, are therefore as machines incapable of motion in the fourth or any higher dimension *relatively* to our immediate surroundings: although we, and the whole of our three-dimensional universe, *are* moving in the fourth dimension; and it is from the energy of this four-dimensional great velocity that all energy now existing in our universe, was ultimately drawn. Thus, being incapable of relative movement in the fourth dimension, we cannot perceive it" (*Gravitation,* p. 90). Statements like the above quotation indicate, of course, a groping after an adequate explanation for the source of the energy of the universe. And, although rather fanciful, they are an evidence for the inadequacy of human reason fully to trace out God in His handiwork.

3 SUMMARY OF CONCLUSIONS AS TO THE FIRST CAUSE OF ALL THINGS

It is seen that the First Cause has been and still is the only real cause. That Cause is still operating through every secondary cause, as we have said. Nor is there any power or force in nature that is not from and by that Cause. Every cosmic world moves majestically with incredible velocity and inconceivable energy by His power alone. Every vibration, whether underlying the phenomena of heat, light, magnetism, electricity or gravitation, is a vibration by His energy. Every blossom at our feet and every human soul is radiant with beauty by His power. His power throbs like mighty pulsations in the intrinsic motions of every atom and beneath every living organism throughout all nature, as well as in the revolutions, individual and united, of all worlds. Truly beautiful and beautifully true are the following words by one of our poetesses:

"God of the Granite and the Rose!
Soul of the Sparrow and the Bee!
The mighty tide of Being flows
Through countless channels, Lord, from Thee.
It leaps to life in grass and flower,
Through every grade of being runs,
While from Creation's radiant towers
Its glory flames in Stars and Suns."

Even His initial creative act did not cease to operate at that great beginning, as plainly shown; but it has continued ever since, and shall do so till He withholds His sustaining power. And this is just as true whether this divine operation be regarded as special providential acts or as acts provided for in His creative and sustaining media in the form of secondary causes. Indeed, as with the Eternal there can not be a past nor a future—no behind and no before—to Him that creative act was not an act *in time*. Viewed from eternity it was an eternal act, while viewed from these shores of time we may speak of it as having been exercised at the beginning, that is, the beginning of our time, and as ending in the completed cosmos—and then almost certainly in annihila-

tion by its withdrawal, thus marking the end of time. We cannot speak of time in the relative sense before creation, nor after it will have ceased to be. Nor can we therefore speak of a creation as late or early in the thought of God. We cannot separate thought or purpose from act in an eternal Being, to whom there are no time relations. Thus, all creation, in all its operations, is the *present act* of the *eternal* God.

How wonderfully secondary causes have been, and are, linked together in preparation for the future of the universe, may be seen in energy stored up ages ago for the use of man. Thus the sun's energy stored up in the beds of coal, like electricity in a battery, now drives the spindles and wheels of industry. Indeed, by searching we might thus trace all our available energy back through indefinite ages to the sun, and thence perhaps still further back into the supposed æons of the provident, developing cosmos. But this, if we could follow upwards and backwards far enough, would lead us also to the Source of all energy, the great Energizer of all. And nowhere throughout our search should we come upon any self-created energy any more than we should come upon any self-created atom of matter.

IV SEVERAL OBJECTIONS ANSWERED

Before closing this chapter it is in place to answer several supposed objections to points involved in our general argument.

1 Because of its connection with the point last discussed above, we shall first consider the objection based upon the apparent difficulty involved in the *relation* of an absolute or infinite Creator to such a dependent and finite creation. The relation of Creator to creature, Sir William Hamilton and some others have held, would limit the Creator. The act of creation on the part of a Creator, it is contended, would necessitate or indicate a change in His Being. Therefore, such an act as is involved in the doctrine of *creation ex nihilo,* is declared to be impossible from the very nature of Deity, unless perchance He created from His own substance. Hence, in the philosophy of these men, creation could mean no more

than an emanation; and the created product would therefore, in a sense, be a part of God.

Thus Sir William Hamilton makes the following statement on this point: "Let us suppose the very crisis of creation. Can we realize it to ourselves, in thought, that, the moment after the universe came into manifested being, there was a larger complement of existence in the universe and its Author together, than there was, the moment before, in the Deity himself alone? This we cannot imagine. What I have now said of our conceptions of creation, holds true of our conceptions of annihilation. We can conceive no real annihilation—no absolute sinking of something into nothing. . . . All that there is now actually of existence in the universe, we conceive as having virtually existed, prior to creation, in the Creator; and in imagining the universe to be annihilated by its Author, we can only imagine this, as the retractation of an outward energy into power. All this shows how impossible it is for the human mind to think aught that it thinks, as non-existent either in time past or in time future" (*Lectures on Metaphysics and Logic,* 1859, Vol. II., p. 406). And, in another connection, the same philosopher expresses himself thus: "The sum of being (actual and potential) now extant in the mental and material worlds, together with that in their Creator, and the sum of being (actual and potential) in the Creator alone, before and after these worlds existed, is necessarily thought as precisely the same" (*Ibid.,* p. 539). This supposed limitation of an absolute Creator is epigrammatically expressed in the following words of Dean Mansel: "A Cause cannot, as such, be absolute: the Absolute cannot, as such, be a cause" (*Limits of Religious Thought,* American Edition, 1860, p. 77).

The error in this reasoning is traceable to an erroneous notion of causation and of the Absolute, into an extended discussion of which it is not our province here to enter. A brief statement to point out its fallacy will, however, surely be in place.

Briefly stated, mere relation of a finite to an infinite cannot limit the infinite, unless it were a *necessary* relation. Finiteness in the extension of matter cannot limit the infinite Cause to whom extension cannot be ascribed. The infinite Creator's finite act in creation cannot limit His infinity in

power, etc., and can therefore not involve any essential or inward change in Him. As the act was not a *necessary* act, but a voluntary one, and as it was, viewed from eternity, an eternal act, which is not separable from the thought of the eternal Actor or Creator, it can in no sense be viewed as a change in His eternal, changeless Being. Indeed, by the very limitations of our minds and of human speech we even cannot here reason without involving other difficulties on this transcendent subject as related to the unconditioned Creator —a fact already spoken of.

Moreover, the very conception of such a relation of the infinite Creator to His creation, like that of these men, implies a limitation of His almightiness. And such would in so far also necessarily make of the infinite Creator a finite Being. And, of course, to speak of an infinite as in any sense limited or finite is a palpable absurdity. Surely, a Deity that could not create worlds, or anything else He chose to create, absolutely or without the use of previously existing materials or even His own substance, could not be conceived of as omnipotent. The reasoning of these men would make of the Creator a Being with imposed limitations, such as we find in ourselves. But, by what or whom imposed? No, the Creator, by the very nature of His infinite and eternal Being, would necessarily have to be unlimited in His power of creation and in any relation whatsoever toward such creation. He would also be free to create or not to create, to annihilate or not to annihilate. Nor would His Being or power be in any way limited in or by such creation. He would be neither more nor less before, during or after creation, than He is in His changeless and eternal Being alone or apart from any such creation or such consideration. His absoluteness, and hence His absolutely free will, necessitates this conclusion.

The question as to whether such a creation as a purely voluntary act of a Deity—a creation to which He sustains no *necessary* relation—can be *understood* or even *conceived* by us, is a very different matter. Such a conception would naturally be beyond our own thus necessary limitations, and therefore beyond the reach of human consciousness. But that would not place it above our reach as a conclusion or deduction of *reason,* nor would it, of course, in the least alter or affect the *reality*. And if Hamilton, and others who have

held to views like his, had thus confined their reasoning to the possibility or impossibility of the mind to *conceive* such creation and such relation of Creator to creature, their conclusions might be accepted in a general way upon their face value. But, in applying their reasoning to the reality itself and drawing conclusions as to that reality, in virtually identifying the limited conceptions of the human mind with external reality, or in measuring infinite reality by man's finite capacity to grasp reality—which capacity is necessarily limited to the finite and can therefore not grasp the infinite—these thinkers have inadvertently been led to limit the omnipotent, infinite and eternal God. The invalidity of their reasoning, and the consequent inconclusiveness of their conclusions will therefore be self-evident. Hence, this objection as to a limitation in the Creator, both as to substance and as to time, has no weight whatever, and may therefore be passed over without further argument at this time.

2 Another objection to the necessary existence of a great First Cause as the Creator of all things is this; namely, that *sufficient time* joined with *infinite space* might constitute a sufficient background for the *development* of all things. This, certainly, it would seem, should require no answer, as it is too superficial to bear investigation. It surely should be sufficient to say that no amount of time can of itself produce either previously non-existing energy or non-existing matter. Time and space are expressions of relations, in which secondary causes operate, the one in succession and the other in extension; or both in succession, the one chronologically and the other synchronously. But they cannot be or become even secondary causes. They may barely be spoken of as conditions.

Because of the many erroneous conceptions of time, a word of further explanation is necessary in this connection. Time, as we know it, or time relative, is that wherein which something that has, or consists of, a succession of changes, exists, and to which it is related. We know it only by its successions and not by itself. It may be called the measure of the duration of that which has a beginning and an ending. Such an existence must necessarily be finite, as an infinite cannot change nor have such beginning and end. The changing universe is such an existence, and this is that wherein it exists—or to

which it is related in its changes—as the measure of its existence and of its changes. Hence, the changing universe must be finite. From this it is readily seen also that eternity, or time absolute, is that wherein that exists which has no succession of changes, no beginning nor end in duration, and, of course, with reference to that which has no beginning and no end in extension. Thus, eternity is that wherein an eternal and infinite has its existence. Such an existence must, therefore, be changeless and absolute; and that changeless, infinite, absolute and eternal entity is what the Christian knows as God, the Creator of the universe.

3 And, as to so-called *chance,* that is only a word behind which to hide one's ignorance. For, if we could understand what men call chance we should find back of it all unmistakable secondary causes, as really as behind any event whose causes are manifest. But more of this later (Chapter VIII).

4 And, as to *law,* it should be said that law is only the method of operations in nature, or the expression of these methods; but a cause of these operations it is not. This distinction between law and cause could be shown by many illustrations, both in the operations of nature and in the actions of man. But, surely, it is so self-evident as to need no further explanation in this connection (see Division V of Chapter VIII).

5 It has been contended, moreover, that only *material causes* can act upon matter, and that thought can neither affect matter nor direct energy. But this is in direct conflict with the better knowledge and experience of even the objector. He well knows that thought in his own life precedes and determines action. Indeed, as already noted, nothing but *will* can constitute a real cause, all so-called material causes being the media or secondary causes through which *will* operates. Thus, when I strike a ball with a hammer the ball is moved. The real cause of which the ball's motion is the effect is not the hammer, however, nor its blow, nor even my hand or my arm that wields the hammer. It is my mind that directs my arm and hand to wield the hammer so as to impart energy to the ball, resulting in its motion. The arm and hammer are simply the media or secondary causes through which my *will* operates to move the ball. Therefore, we do not ascribe to these secondary causes any morality in the act,

for that can be ascribed to the directing *will* alone. If it was right for the ball to be moved, it is the *will* that is commended. If it was wrong, it is the *will* that is blamed. But these secondary causes can neither be blamed nor commended for the act. My *will* in this case may, therefore, be regarded as the first cause of which the arm, hand and hammer are the secondary causes. These are only the instruments of my *will,* which is the agent and, therefore, totally different.

So in the whole mighty universe it is *Will* that is back of all secondary causes, and these secondary causes are the media or instruments or methods of operation, or the expressions of that *Will.* Thus the First Cause must be a living, and free, Personality, and, therefore, altogether different from the secondary causes which are His instruments of operation for the conduct of His mighty works.

With this ultimate or first, and only real, Cause of the origin and continuance of the existing universe—this absolute, free personal *Will*—science as such has in reality nothing to do. This is beyond its legitimate sphere; for science has to do only with the universe as *existing,* and therefore with the laws or modes of its existence, a fact of which we shall speak more fully later (Chapter X). This is even acknowledged by eminent scientists. On this point the learned Dr. William B. Carpenter, who could surely speak with authority, in several connections expressed himself in no uncertain terms. He called attention to the importance of science confining itself to its own distinctive sphere, and not presuming to enter the domain of theology by setting up nature's laws as self-acting, and as either excluding or rendering unnecessary the Power which alone can give them effect. Some other men of science have come to the same definite conviction. However, as this matter will be discussed in our closing chapter we shall not further discuss this point in this connection.

Therefore, let no one say, in the light of all the evidence from nature for God's existence, that *He* does not exist; for He is the only real existence, as He is the only real Cause. No secondary cause without Him; no other existence except from Him! To remove Him, the only Cause, would be to remove all cause, all energy, all existence. Electrons and atoms would cease to move and combine; all vibrations would stop; light, heat, electricity, gravitation, would no longer oper-

ate; stars would instantly cease to revolve and shine. And, indeed, in the very moment when God's power would be withdrawn all energy would cease and the elemental matter of the universe would vanish into nothingness, as we shall show it *will* vanish. Thus, as by the power of God all matter was created *ex nihilo,* and then endowed with the requisite energy for a universal cosmos, so by the removal of that power all would again be resolved or dissolved *in nihilum.*

We have thus showed, from its inherent dependence, both simultaneous and synchronous, that the physical universe is necessarily finite and therefore temporal, and that it must therefore be a creation. But there is further additional evidence in nature, and to many minds, we believe, even more convincing and conclusive, that it must have been created by an absolute and eternal Being. In our next chapter we shall consider the matter of the extent of the universe from another point of view and show that, when considered as a *cosmic whole,* the evidence is no less convincing, but rather more, if that were possible, than when considered from *dependence,* that it must necessarily be a finite entity and therefore a *creature.*

CHAPTER V

THE PHYSICAL UNIVERSE FINITE AND TEMPORAL, AND THEREFORE A CREATURE—EVIDENCE FROM NATURE AS A COSMIC WHOLE

In our last chapter we showed from its inherent *dependence* in every part, from ultimate particle to flaming star, that the physical universe must necessarily be a finite entity, and that therefore it must have been created. We shall now proceed to consider the universe as a *cosmic whole,* to see what further testimony it affords as to its extent.

We are, of course, here especially confronted with the philosophic objection, that this whole matter of a universe as beginning or as not beginning in space, as well as in time, is totally inconceivable. The implication of this objection is, that the very transcendental nature of this idea precludes the possibility of arriving at any definite conclusion on this point. We give the substance of this philosophic objection in the words of Sir William Hamilton, as follows: "Existence we cannot but think,—cannot but attribute in thought; nevertheless we can actually conceive neither of these contradictory alternatives,—the absolute commencement, the infinite non-commencement, of being. As it is with Existence, so is it with *Time.* We cannot think time beginning; we cannot think time not beginning. So also with *Space.* We are unable to conceive an existence out of space; yet we are equally unable to compass the notion of illimitable or infinite space. Our capacity of thought is thus peremptorily proved incompetent to what we necessarily think about; for, whilst what we think about must be thought to Exist,—to exist in Time,—to exist in Space,—we are unable to realize the counter-notion of Existence commencing or not commencing, whether in Time or in Space" (*Lectures on Metaphysics and Logic,* 1859, Vol. II., p. 525).

It is indeed true, as Hamilton contended, that the human mind is incapable of conceiving of space and time either as beginning or as not beginning, or of the universe either as limited—as having a beginning and as having an end—or as unlimited. But this would not in the least invalidate our argument. It is not a question as to whether the mind can *conceive* of such finiteness or infinity; but it is a question of *fact.* As the universe does not have its existence within the mind of man, its inconceivability by the mind either as finite or as infinite would in no way affect the reality. The limitation of conception, of course, exists in the *mind,* which is by nature limited.

Moreover, even if the universe could actually be conceived as infinite, but could not be conceived as finite, this could not alter our conclusions, as the limitation would exist alone in the ability of the mind to *conceive.* It is therefore not a question as to whether the universe can be *conceived of* as finite, but as to whether finiteness is *testified to* by the *universe itself.* And the contention of Kant that the universe can be proved both finite and infinite, both as to space and as to time, we leave to the reader's judgment, in the light of the evidence presented in this chapter. However, it is interesting to find that *some* of the greatest thinkers have actually come to the *conviction* that the physical universe is finite.

I GREAT THINKERS ON THE EXTENT OF THE UNIVERSE

While it is true that the mere opinion of great thinkers, that the universe is finite, does by no means prove it to be so, yet, as their opinion is based upon careful considerations of an accumulation of data, it should have some weight. And, as the tendency among many men of science (Haeckel, Arrhenius, etc.) is more and more to regard the universe as infinite and eternal, the testimony of some of the greatest masters among them should have no little weight with those open to conviction. And this should appear all the more convincing when it is seen that the evidence of nature unmistakably corroborates their testimony, as we hope to show.

Among those eminent men of science who came to the definite conviction, from the evidence from the universe itself,

that it is finite in extent, was America's greatest astronomer, Simon Newcomb. In his last contributions on this subject he definitely announced his conviction that the physical universe is finite. At one place he expressed this conviction as follows: "The universe, so far as we can see it, is a bounded whole. It is surrounded by an immense girdle of stars, which, to our vision, appears as the Milky Way. While we cannot set exact limits to its distance we may yet confidently say that it is bounded" (*Side-Lights on Astronomy,* 1906, p. 74; also reprinted in Elliot's *Five Foot Library,* Vol. 30).

And, in another chapter of the same work, this author expressed the possibility that the boundary of the universe may even be definitely determined by astronomers of the future, thus opening all creation for human contemplation. He says: "It is a great encouragement to the astronomer that, although he cannot yet set any exact boundary to this universe of ours, he is gathering faint indications that it has a boundary, which his successors not many generations hence may locate so that the astronomer shall include all creation itself within his mental grasp" (*Ibid.,* p. 6).

That the universe is finite is also regarded as the preferable idea by Carl Synder, as witness the following words: "We are undoubtedly obliged to make option between the two possibilities, and to the writer it has always seemed that the idea of a finite universe was preferable" (*The World Machine,* 1907, p. 448).

Among other men of science who arrived at the same or similar conclusions as to the bounds of the physical universe, was the late Alfred Wallace. One of the conclusions to which he was led in his astronomical studies to answer the great question discussed in one of his greatest works, was, "That the stellar universe forms one connected whole; and, though of enormous extent, is yet finite, and its extent determinable" (*Man's Place in the Universe,* p. 313).

Lord Kelvin, in his maturer period of research and investigation, also arrived at the inevitable conclusion that the physical universe, as far as can be determined, must necessarily be finite.

To quote Kelvin against this position of his maturer period, by citing certain earlier statements made by him, will not lessen the weight of his authority. Those earlier statements were

not in the nature of direct declarations upon this point; but they were made in connection with his discussion of the nature of light and other subjects, where the question of the actual extent of the universe was not directly involved.

It may also be said that, in spite of his contention that the universe could not be conceived of either as finite or as infinite, even the philosopher Sir William Hamilton seems personally to have held it to be finite. Thus, in a letter to Henry Calderwood, dated 26th Sept., 1854, he said, "The created universe is, and you assert it to be, finite" (*Lectures on Metaphysics and Logic,* p. 533). And, again, he said, "Finally, let us suppose the created universe (which you do not) to be infinite; in that case we should be reduced to the dilemma of asserting *two* infinites, which is contradictory, or of asserting the supernal absurdity, that God the Creator is finite, and the universe created by Him is infinite" (*Ibid.,* p. 533).

Thus many of the world's greatest thinkers have been forced to the conviction that the physical universe is finite. And, while there have been many other and perhaps equally great thinkers who have held the opposite view; namely, that the universe is infinite, this does not invalidate the testimony of those whom we have cited, or might cite, as holding or having held, that the universe is finite. And, of course, the direct evidence which we shall now proceed to present in proof of the finiteness of the universe, could in no way be affected by mere numbers of witnesses against such finiteness.

II THE PHYSICAL UNIVERSE, REGARDED AS A UNITARY SYSTEM, NECESSARILY FINITE

To get some idea as to the possible extent of the universe, or as to whether it is finite or infinite, it is necessary to consider its general structure. In this connection, we shall, however, consider only the general outlines of several theories of the universe; and afterwards we shall consider the evidence for finiteness from its structure more in detail.

A very facinating theory as to the structure of the sidereal heavens was one that gradually arose during the latter part of the eighteenth century, and was more and more fully developed during the nineteenth century, during the greater part of which it held sway.

According to this theory, in its more developed form, the universe consists of an almost infinitely complex cosmic unity of revolving satellites, planets and stars, of revolving systems within revolving systems—wheels within wheels—all moving around some common centre. Thus, satellite systems, like that of our own earth and moon and like those of other planets known to be accompanied by satellites, have their own revolutions, amid their individual rotations, around their common centre of gravity close to or within their ruling planet. A number of these satellite systems in turn revolve around their central sun (star), or rather around their common centre of gravity, thus constituting a planetary system, like that of our own solar system. Several of such planet-systems were supposed to revolve around their common centre, constituting what might be called a sun- or star-system. And this is undoubtedly illustrated in the many physically double stars, triple stars, quadruple stars and even more complex multiple stars, some of which have been found actually to revolve around their common centre. Of notable double stars may be mentioned 61 Cygni, with the second largest known parallax, the two companions of which perform their revolutions around their centre of gravity in a period of about 450 years, each supposedly attended by a retinue of revolving planets with revolving satellites. A number of these sun-systems (binary stars, etc.), according to this theory, supposedly revolve about their common centre, thus constituting a system of a still higher order, sometimes spoken of as a group-system. Then, a number of these group-systems were supposed to form a still larger star-neighborhood, all revolving around their common centre. And star-neighborhoods of this latter order were imagined to revolve around other similar star-neighborhoods, or around their common centre of gravity; and groups of these latter, around still other groups; and so on, until the whole mighty universe would revolve around its ultimate centre of gravity.

The higher systems that formed the ultimate universe, which were of course supposed to be either immense nebulæ or groups of nebulæ—and which were then supposedly so many mighty universes of stars like our galactic or Milky Way system—would thus have one major revolution. The next below this order, in addition to this major revolution, would have another revolution. The next below this order would have

another revolution, in addition to those already mentioned. The next lower order would have still another revolution. And thus the lowest order, the satellites, would have a complexity of revolutions and rotations incalculably intricate and wonderful.

By many it was even believed that the ultimate centre is some great central sun. This central sun Mädler held to be the bright star Alcyone of the Pleiades, which was estimated to be many thousand times as large as our sun. And this belief was shared by many writers. Moreover, as it became more and more definitely established that the sun with its retinue of planets, accompanied by their satellites, is in motion through space, this added its apparent evidence to this theory of a mighty unitary revolving universe. By some it was held that the sun itself is describing a gigantic orbit around Alcyone; by others, that it is revolving, with its revolving planets, around a more subordinate centre, itself in motion around a higher centre or around the ultimate central Alcyone. Lambert even held that, instead of one central sun, there should be many; and inasmuch as these could not be seen or definitely located, he believed them to be non-luminous, or at least not self-luminous. But, assuming a possible unitary revolution of the starry universe, it would be far more likely that the ultimate centre would be an immaterial one, the real centre of gravity of the whole. Indeed, this would seem to be the only centre possible, as that centre would itself necessarily have to be motionless, itself the balancing point of all the motions and forces of all the bodies of the starry universe.

Thus, the whole universe would have to be in motion around its ultimate centre of gravity. And, of course, to the Christian speculator this naturally suggested that that ultimate common centre might be the abode or throne of its ultimate Cause, the universe's almighty Ruler, by Whose power it exists and is thus energized with mighty revolutions, rotations, etc. Many truly eloquent passages on this point could be cited from the writings of astronomers and popular scientific lecturers of the period—for the theory became almost common property among even matter-of-fact astronomers—as well as of Christian apologists.

It is certainly a facinating theory to the imaginative mind; and even as a scientific hypothesis it is indescribably grand.

What complexity of revolutions within revolutions, and these again within higher revolutions, up to that all-comprehensive revolution of the great universal whole! What imagination could conceive it and what mathematics could resolve its marvelous problems! If the direct solution of even the well-known problem of three mutually attracting bodies is beyond the power of our present higher mathematics, what to us transcendental functions and numerical tables of a mathematics of a transcendently higher order, would be required to solve the inconceivably more complicated and profounder problems of such a well-nigh infinite universe of mutually attracting stars with their multitudinous revolutions within revolutions! Such might be conceived of as a delightful occupation and exercise for glorified men and seraphic intelligences,—

To wander up and down the heavens of space
With flight of thought and with an angel's sight
To read creation's story, and to trace
God's plans for æons through those realms of light!

It is thus readily seen why this theory so strongly appealed to the scientific imagination of a former generation. And, even though somewhat materialistic in its nature and tendency, what could give the Christian apologist a sublimer conception of the greatness and power of his God, than such a theory of the structure and God-controlled operation of His mighty handiwork!

Great clockwork of the stars, in one grand whole
Revolve with myriad motions, then, and nod
Each unto each, and all to His control,
Sublimely moving round the throne of God,

And beating seconds, seasons, cycles, e'er,
Till time is o'er, when He will touch your spring
Again, and from the heights of heaven declare:
"Eternity! Again let angels sing!"

Ad Astra (L. F. G.)

It might be said that, though this theory has some things apparently in conflict with some established facts of science,

yet it would be rather difficult even now altogether to refute it. We are surely unable, from the few established data as to the sun's path, definitely to state that it is moving in a *straight* line. Moreover, the period of astronomical observation would certainly as yet be far too short to have gathered sufficient data to determine whether the observed path is a straight line or an infinitesimal arc of a mighty curved orbit around some far off centre. Of late years, much attention has been devoted to the proper motions of the stars by the Dutch astronomer J. C. Kapteyn and others. And, upon the basis of their observations, it has been found that there are apparently two drifts of stars, as far as their motions have been quite definitely determined, and that these drifts or concert motions appear to be in almost opposite directions, or nearly toward opposite points on the celestial sphere. No apparent cause has yet been discovered; but these motions may be just what we should expect from the known or local stellar system if it were a connected whole. And may these motions not also suggest a mighty revolution of stars somewhat even like that referred to, parts of the opposite orbital paths of a lesser or greater stellar revolution of a higher order being perhaps here marked by these two opposite drifts? At any rate, these drifts open up a great problem for solution.

There is, however, a bare possibility that, as the sun's way will more and more definitely be plotted out or located through space and its velocity determined with greater accuracy, this might itself in some way afford a sort of measure, or a greater astronomer's foot-rule, with which to measure parallaxes and determine star-distances and star-motions. In such a way the problem as to whether star-motions describe curved orbits, and as to whether there are gigantic stellar or universe revolutions that we do not yet know of, may be solved. But all that has thus far been established is that our solar system is moving at the rate of about ten to fifteen miles a second in the direction of some point in the constellation Lyra, perhaps its star delta, as some calculations indicate, or perhaps, according to one calculation given by Newcomb (*The Stars,* p. 91), its brilliant star Vega. And as to the real paths of the other stars our data are, of course, equally inadequate to make any dogmatic statement.

However, if our stellar universe be regarded as having

somewhat definite bounds, it would seem that it should almost necessarily also have a somewhat definite centre of gravity somewhere. And it would also seem necessary for its stellar motions, by the very nature of the action of gravitation within such a stellar organism, to describe curves rather than straight lines. And, whether this is true or not, it should not take many more generations of astronomical observation to determine. For, if it be regarded as fairly well established that the present apex of the sun's way is, let us say, the star Vega, then, if in the future it should be found that successive other points mark that apex, its curved path, even apart from other data, would apparently be established. But, if the centre of such orbit, or one of its foci, were marked by an enormous star, it would be only a matter of chance; for surely no one star could be conceived of as in any sense such a controlling gravitational centre for the whole sidereal universe as is the sun for its retinue of planets. Hence, the definite conviction that, even if the whole stellar system revolves about some ultimate centre, it must almost necessarily be an immaterial one, and, of course, necessarily the real centre of gravity.

Even Charles Young was not altogether averse to the belief that there might be a universe-revolution around some centre, similar to that of the planets around our sun, as is evident from the following words: "A favorite idea has been that the mass of stars which constitutes our system has a slow rotation like that of a body on its axis, the plane of this general revolution coinciding with the plane of the galaxy. Such a general motion is not in any way inconsistent with the independent motions of the individual stars, and there is perhaps a slight inherent probability in favor of such a movement; but thus far we have no evidence that it really exists—indeed, there hardly *could* be any such evidence at present, because exact Astronomy is not yet old enough to have gathered the necessary data" (*General Astronomy,* pp. 512-513).

It is almost needless to say that, upon the basis of this theory of the structure of the starry universe, it must necessarily be finite in extent. And this was also the implied, and in some cases the expressed, conception of those who held to this view. The very idea of such a universal *revolution,* or perhaps even better *rotation,* of the universe, implies finiteness

as a unified whole. It even implies successive beginning and returning points in rotation. Moreover, no multiplication of necessarily finite revolutions of equally finite systems, within such revolution, could even constitute an infinity of such revolutions or systems; and, therefore, they could in their aggregate not make an infinite universe. Then, too, the very notion of such a universal revolution or rotation would necessarily imply something within which it would have to be taking place, and therefore a something more extended and therefore greater. And, as it would be self-contradictory to speak of an infinitely-extended universe as revolving within a something of greater extension, this *supposedly* infinite universe must necessarily be *finite*. Indeed, as elsewhere noted, an infinite could in no sense be conceived of as in motion, as such motion, like any motion whatsoever, would imply a fixed or relatively fixed *containing something* beyond it. Hence, in accordance with this theory of the structure of the universe—as it regards it as a *moving* entity—it must be *finite*.

And this would also be true of any other theory of the universe as a unified structure, that acknowledges the presence of revolutions within it, whether in whole or in separated parts. And thus, the very presence of motion—as an evidence of finiteness—would also contradict the conception of its infinity upon any other hitherto proposed theory. We might also say, in passing, that the very conception of *form* as attached to the universe, according to this theory, would also imply its finiteness; for, whatever has form has bounds or limits, and can therefore not be an infinite entity. And this, also, would apply to any other theory whatsoever that would body forth the universe as an existence with any form whatever—or as a unified entity.

But the theory of the structure of the universe as a *revolving* unitary whole is no longer seriously maintained by most men of science. According to the present more generally accepted theory of the structure of the stellar universe, it is still regarded as a system, or in a sense a unified organism, both as to its constituent materials and as to some general structure. But, according to it, the stars within it are related to one another somewhat like bees in a swarm. In other words, they would form what may be called a star-

republic, as contrasted with a monarchy like that of our solar system with its sun as practically absolute ruler. While their motions must be somewhat affected by their star-neighbors, the nearest of which would be from three to eight light years away from them, they might nevertheless be spoken of as practically independent, as compared with those of our planets.

Upon this theory, according to which the stars still constitute a system and yet are relatively independent, Charles Young expressed himself thus: "That the stars are organized into a system or systems *of some sort* can hardly be doubted, for this seems to be a necessary consequence of their mutual attraction. But that the system is one at all after the pattern of the solar system, in which the different members move in *closed orbits,*—orbits that are permanent except for the slow changes produced by perturbation,—this is almost certainly impossible" (*General Astronomy,* p. 512). Of course, this must not be taken as contradicting another statement by the same astronomer, quoted above, on the bare *possibility* of a revolution of the stellar universe as a unitary whole. This latter statement is made in the light of established data. But, whether the future will establish data to overbalance present indications, can only be guessed at at this stage of astronomical research.

But the points we made above with reference to the theory of the universe regarded as a revolving unitary whole, as there also indicated, are applicable also to the universe as here considered. It must, upon its very *face,* necessarily be considered *finite.* And, from the following consideration of the evidence for its finiteness from several fairly well-known details—largely upon the basis of this latter view of its structure—its finiteness will become practically a mathematical certainty.

III EVIDENCE OF FINITENESS IN THE GENERAL DISTRIBUTION AND APPARENT NUMBER OF THE STARS

Among the direct evidences that the number of stars in the universe is limited, is their well known arrangement or distribution. Taking the Milky Way as a belt with an axis

perpendicular to it, the poles of this axis are known as the galactic poles. Now, it is a well known fact—partly even to the casual observer, but much more so to the astronomer with his telescope—that the numbers of stars for equal sky areas increase as we proceed from these galactic poles toward the star-belt of the Milky Way, their number being of course least around the galactic poles. This fact was early observed by astronomers, and later formed the basis for the so-called grindstone theory of the universe, given to the world by Thomas Wright of Durham, in his work, entitled, *An Original Theory or New Hypothesis of the Universe,* published in 1750. According to this now rather generally accepted theory, the universe of stars, presumably nearly equally distributed, is in the form of a grindstone or millstone, with a diameter about eight to twelve times its thickness, our solar system being situated near the centre. This general form of the galactic system has also been described as lens-shaped, or bun-shaped. While several slightly modified forms of this theory have been suggested, this statement will be sufficient for our present purpose.

The stars, as we pass from the galactic poles toward the Milky Way, would thus naturally appear more and more numerous, because, from the greater distances through which we look, more and more stars would be projected against the surface of an all-containing imaginary sphere. This fact of the apparent distribution of the stars is itself already suggestive of some definite system in the telescopically visible starry universe, and, of course, of its probable finiteness. As toward the poles there are less stars, and especially less telescopic stars, the apparent evidence is that in that direction its outposts are nearer to us, and that they are relatively only farther and farther away as we approach the galactic belt.

It should, of course, be said that, according to Kapteyn's researches, the evidence is, that, while the stars in the Milky Way system are apparently nearly evenly distributed—apart from the apparent star-girdle itself—there nevertheless is a really denser belt or ring of stars, though somewhat irregular in form, etc., in the plane of the system. This star-belt is probably somewhere beyond what might be spoken of, in a general way, as the galactic locus of the tenth to the fifteenth magnitudes of stars, but not likely extending to the bounds

of the whole system. E. C. Pickering has come to the conclusion that the density of stars in the Milky Way belt is about two times as great as that in the other regions of the galactic system. This would give the galactic system somewhat of a Saturnian, or wreath-like, appearance, if viewed from without its plane and beyond its bounds. But, apart from that galactic wreath or belt of stars and the lesser local groups, the stars are undoubtedly quite evenly scattered up and down the depths of space. But, even apart from that galactic belt, there is an *apparent* increase of stars from galactic poles to galactic equator, thus indicating that the diameter of the galaxy is greater than its thickness. And, of course, the very appearance of the universe from this standpoint of the apparent distribution of its stars, is naturally that of a limited unitary whole.

Now, let us consider the stars as distributed into magnitudes according to the relative amounts of light they give. Upon this basis it is found that the numbers for about ten or eleven successive magnitudes vary according to a geometrical ratio of nearly four. Thus the number of stars of any magnitude up to about the tenth or eleventh is from three to four times that of the magnitude next preceding it. But after about the tenth or eleventh magnitude this ratio gradually decreases; in fact, it apparently more and more tends to approach zero. We are not now, however, including the *wreath* of Milky Way stars. Nor are we here considering the fact that the maximum density is farther away in the plane of the galactic system than toward its poles.

In line with this are also the conclusions of Chapman and Melotte, that the total number of stars for fainter magnitudes is smaller than had formerly been supposed, thus considerably reducing the number of stars in the universe below the number assumed by some exaggerated former estimates.

All these facts that the density of star-distribution is less and less as we pass outward, etc., constitute a remarkable bit of evidence for the finiteness of the sidereal universe. And these facts have also been accepted as such by some noted astronomers. Thus A. S. Eddington, Professor of Astronomy, University of Cambridge, England, writes as follows: "The decrease of density at great distances from the sun rep-

resents the fact that the stellar system is limited in extent, and as it is notorious that the limits are very much nearer towards the galactic poles than in the galatic plane, a representation which did not include a variation with galactic latitude would be very imperfect" (*Stellar Movements and the Structure of the Universe,* 1914, p. 202).

And, of course, the total amount of light received from all these stars of the successive magnitudes should also afford us some evidence as to their number. Thus, according to Newcomb, the amount of light received from all the stars of one magnitude is about twice that received from those of the second magnitude above it. That is, the light from the stars of the fifth magnitude is about twice that from those of the third magnitude. This is due to the fact that, while the light of the stars of successive magnitudes varies as about two and one-half to one, the number of stars varies as about one to three and one-half. Or the rate of increase in light received from successive magnitudes is about 1.4 to 1.5. But after the tenth or eleventh magnitude this light ratio also decreases, as we pass outward from magnitude to magnitude.

This fact is also referred to by Young in his *General Astronomy,* page 468, where he, however, apparently makes Newcomb consider the amounts of light received from successive magnitudes to be equal. And, in another connection, Young makes the following statement: "Beyond the tenth magnitude the number of small stars does not increase proportionately fast, so that if we could carry on the account of stars to the twentieth magnitude, it is practically certain that we should not find the total light of the aggregate stars of each succeeding magnitude increasing at any such rate as from the seventh to the tenth" (*General Astronomy,* p. 475).

In fact, the maximum of increase in the sum total of light received from the different magnitudes of stars is reached with about the tenth and eleventh magnitudes. And from those magnitudes the ratio of light per magnitude decreases. This, of course, means that the stars themselves increase in number or distribution up to about the tenth or eleventh magnitude, according to a certain ratio, and that from that point this ratio gradually decreases. And the implied conclusion seems to be that their number may approach the zero point at some distance beyond the twenty-first or the twenty-second magnitude.

Thus, our starry system may at least not extend far beyond the bounds of what might be considered the apparent equivalent of the twenty-first or the twenty-second magnitude.

We realize, to be sure, that in this consideration we are treating star magnitudes as proportionate to, or almost synonymous with, star distances. While this does by no means altogether correspond to actual facts, it is close enough as an approximation, and therefore as a basis for reasoning. Nor would our general conclusions from these assumed data be materially altered by the actual data of fact. And, of course, we are not now taking into consideration the undoubtedly denser ring or wreath of stars in the galactic zone, that forms the real nucleus of the otherwise only apparently denser Milky Way. But even this would not invalidate our arguments.

Moreover, the increase in definition and power of the telescope, as improved from decade to decade—as well as the improved application of photography to the charting of stars—does not result in a proportionate increase in the number of new stars discovered. Thus, if the distribution of stars continued indefinitely with approximately the same density, we should naturally expect that, with a doubling of telescopic magnification and proportionate increase in its light and definition—in other words, with twice its former reach of distance—the number of stars visible should be increased eight-fold. The new sphere of vision with a radius twice as long as the old, should thus naturally include eight times the number of stars in the old, as similar volumes vary as the cubes of their like dimensions. This is, however, found to be far from the fact, as we pass beyond the approximate magnitudes already mentioned. Indeed, equal successive improvements in our instruments result in ever less and less added new stars.

Assuming now the highest power and definition of the telescope yet attained to be equivalent to an increase, in our radius of vision, of fifteen hundred times, then, all other things being equal, we might expect the number of stars visible to be 3,375,000,000 times those visible to the unaided eye. And, taking the approximate number visible to the naked eye to be about 6,000, this would make the number of telescopic stars—upon the basis of an indefinite and even distribution of stars, and of course under ideal conditions—to be 20,250,000,000,-

000. But, it is needless to say that this is probably upwards of a hundred thousand times as many as could actually be visible through the most powerful telescope yet constructed, and even if assisted with photographic apparatus.

It may, of course, be objected, that this theoretical magnification does not express the actual possibility of the telescope, because of its too great magnification in comparison with the amount of light admitted by the field lens. We indeed used a magnifying power of thirty-seven and one-half times the diameter of a forty-inch object glass, whereas the normal magnifying power used should be only about twenty times that of the diameter of the object glass in inches. And yet, under ideal atmospheric conditions, a power of one hundred times the aperture in inches could be used, though this would by no means be the power used in trying to resolve stars. We shall therefore assume a basis of observation that cannot be objected to.

Let us assume the pupil of the human eye to be one-fourth of an inch in diameter, which is probably exaggerated, even when the observer looks at the stars. Then, a forty-inch object glass of the telescope would be a hundred and sixty times as large in diameter, and should, therefore, under ideal conditions, admit the square of one hundred and sixty, or twenty-five thousand six hundred, times as much light as the human eye. Then, even if the magnifying power of the eye-piece were only as great as the diameter of the object glass is greater than that of the eye (an abnormally low magnification), the number of telescopic stars—if evenly distributed to the farthest reaches of space—should be the cube of one hundred and sixty times the number visible to the naked eye, or 160^3 times 6,000, or 24,576,000,000. And even this would be several hundred times as many as the telescope would reveal under abnormally favorable circumstances. This should therefore be very convincing proof that the density of star-distribution must very rapidly decrease as we pass outward from a certain spherical zone—probably that which we have indicated above—and that this decrease in ratio of number and density rapidly even approaches zero. Hence, the probability almost certainly is, that our instruments have already nearly exhausted the depths of space, and resolved the number of its existing stars.

Thus the evidence from this consideration is almost unan-

swerable, that the number of stars of our star-system is limited. Indeed, all discoveries with the telescope, assisted by photography, seem to indicate that their number is probably not greatly over several hundred millions. Other evidence, such as that from proper motions, it might be said, however, point to a greater number—probably to as many as at least several hundred millions more. But even if their number could be shown to be 1,000,000,000, as is estimated by some authorities, that would not be infinite. And very many more than 1,000,000,000 it is almost certain do not exist in our system, unless perchance many millions of them are very minute as compared with our sun.

It must, of course, be conceded that there are probably many dark stars—not to speak of possible planets and satellites, revolving around other stars or suns—that cannot be detected by our instruments. But that these cannot be so numerous nor so large as in any great degree to affect our general conclusions as to the extent of the universe, is altogether probable even from general principles; while it is practically certain from the known motions of the nearest stars—with but few well known exceptions—as well as also from other applications of the law of gravitation. Although Sir Robert Ball estimates the combined mass of these dark bodies as possibly *very great,* there is no real evidence to warrant such a conclusion. And hence other astronomers are not inclined to follow him in this line of speculation. Indeed, if their number and mass were considerable, there would be a measurable obstruction of light from even the visible stars, especially from the great swarm of those whose light travels to us from the very distant parts of the Milky Way.

Moreover, if there were any large number of dark bodies of stellar magnitude distributed through stellar space, observable occultations would necessarily have to be very frequent. But as this is not the case, their number must, of course, be comparatively small. The variable stars of the various types, of some of which the variation is due to occultation, would surely not constitute a very large number. And, as to some hypothetical clouds of light-absorbing particles floating in space, especially in line with the denser part of the Milky Way, the evidence from the light actually *received* should be sufficient proof that, if such dark matter exists, it interferes but very

little with the light or visibility of the stars. Therefore, astronomers quite generally consider this point as of but very little consequence.

So far we have considered star-distribution in a general way as an evidence that their number is finite, and that therefore the universe is limited in extent. We shall now proceed to consider the extent of the universe from the probable *density in distribution* of the stars.

According to Eddington's calculation, based upon the latest astronomical data available, the star-density is such that there are probably between 30 and 40 stars within a radius of five *parsecs* from our solar system. This unit of measure, suggested by Hunter, corresponds to a parallax of one second of arc, and is equivalent to 206,000 times our distance from the sun (astronomical units), and is therefore about 19×10^{12} miles. And as for the higher magnitudes the density has been determined apparently to be considerably less, as we have already noted, let us assume the average density throughout to be 27 stars for a sphere with a radius of five *parsecs*. Let us now assume the total number of stars in the universe thus far explored to be 1,000,000,000, as all the evidence at hand is against assuming their number to be much greater. Following a simple method suggested by Newcomb, it is readily seen that, as like dimensions of similar volumes are to each other as the cube roots of their contents, the radius of a sphere having 1,000,000,000 stars would be to the radius of a sphere having 27 stars as 1,000 is to 3. Or, since a sphere containing 27 stars would have a radius of 5 *parsecs,* a sphere containing 1,000,000,000 stars would have a radius of 333 1/3 $\left(\frac{1000}{3}\right)$ times 5 *parsecs,* or 1666 2/3 *parsecs,* or approximately 5,400 light years. Hence, even if their average density of distribution (in number of stars) were such that there would be 27 stars to a sphere with a radius of 5 *parsecs,* assuming the universe to be spherical in form with our solar system near the centre, its bounds in every direction would be only about 5,400 light years away from us.

Moreover, even if the starry universe had eight times 1,000,000,000 stars—a number of times as many as are known to us with the aid of the best modern instruments—upon the same

basis of distribution, it would have a radius of only twice that of a universe of 1,000,000,000 stars, or about 10,800 light years. And we need not comment that such would be a very finite radius—a very finite universe.

All these figures are, of course, based upon the supposition of an equal distribution or density of stars. However, as we pass outward toward the confines of the universe, the density of stars grows less and less, as already noted. This would, therefore, somewhat lengthen the radius of our universe-sphere. Nevertheless, as the number of stars known to us with the aid of the best instruments, for reasons already given, may nearly exhaust the actual number of stars in our galactic sidereal system, it is not probable that its radius can much exceed 5,000 light years, if indeed it is that great.

Nor would the basis of the millstone shape of the sidereal heavens very materially alter the above conclusions. It would only extend the bounds more in one direction, etc. Moreover, it may be said that, whatever be the number of the stars and the shape of our stellar system, it would nevertheless have to be finite in extent. Indeed, why say *shape,* for *shape* itself implies *boundary,* and therefore *finiteness?* And the same is true even of *number* and *distance.*

IV EVIDENCE OF FINITENESS IN THE STELLAR MOTIONS

Another line of evidence against an infinite universe of stars is found in the motions of the stars. It has long been a well established fact that the sun with its retinue of planets is in motion, as evidenced by the apparent separation of the stars in one part of the heavens, their apparent coming together in the opposite part, and the apparent drift of the stars along the zone between these parts. This apparent displacement of the stars, due to the sun's motion through space, is called their *parallactic motion.* This point is well illustrated by the drifting of a boat on a lake entirely surrounded by woods, from which the persons drifting can easily determine their general course, as they observe the apparently relatively moving trees on all sides. Moreover, the spectroscope also adds its testimony to this evidence for the locus of the sun's motion among the stars. Thus the lines in the spectrum of the stars in the gen-

eral apparent neighborhood of Lyra and Hercules shift toward the violet end, which, according to a well known principle (Doppler's), indicates that we are moving in that general direction. So the lines in the spectrum of the stars in the opposite direction on the celestial sphere, shift toward the red end, indicating that we are moving away from that part of the heavens. Nor does the sun apparently ever twice occupy exactly the same point of space, even though its course be some gigantic orbit, as no orbit is itself really closed; for every known orbit is of a spiral nature. This is true of the moon's orbit around the earth, as it accompanies the earth around the sun. And this is true of the orbits of the planets as they journey with the sun through space.

As already noted, the latest determination places the point, toward which our solar system is at present moving, in the constellation Lyra, probably at or near the brilliant star Vega. And, the approximate speed, according to the more recent calculations, is from twelve to fifteen miles per second. Further explanation of this point is not needed here.

What is true of our sun is found to be equally true of the stars in general, among which our sun's size and velocity are by no means among the greatest. In fact, it is certain that there is no star in the heavens above absolutely at rest, any more than there is any planet at rest—or even any atom or electron, of which we shall speak in a later chapter. By the combined observations of many astronomers in different lands, data have been collected, from which the approximate average velocity of all stars observed has been found to be about twenty to twenty-one miles a second. But, of course, the *proper motions* are the real motions only when they are perpendicular to our line of vision. And this assumes that the distances are practically known. But, as probably in nearly all instances there is also a partial motion either away from or toward us, the average real star-motions are undoubtedly greater than the proper motions. The *real motions* may be called the resultants of the proper motions and the motions toward and away from us called the *radial motions*. But more and more even these radial motions are being approximately determined with the use of the spectroscope equipped with a camera, so that the real motions of the stars will probably more definitely be known. And as to whether these motions are apparently

straight lines or describe curved orbits, the data are as yet lacking, owing to the necessary time element in such observations for the determination of even the minutest arc of such a gigantic orbit.

It will thus also be seen that from millennium to millennium the configurations of the constellations are undergoing changes —though very slowly—by these proper motions. And thus we really see the very constellations of heaven different from what the ancient world saw them. And, for that matter, on account of the time element in the transmission of light, we really do not see the constellations as they are to-day, but as they looked from a score of years to many hundreds of years ago, however small the changes in their configurations may have been. And, if any star were blotted out, we should not miss it until after the lapse of time required for its last rays of light to reach us. Surely, there is nothing permanent even in the starry heavens. There is "change and decay in all around I see"—in ourselves, in every part of the surrounding world, and in the very heavens.

Now, upon the basis of the generally estimated extent of the Milky Way system, and the estimated number and average size or mass of the stars, the average velocity that we should expect is an approach to the average calculated velocity of the stars. And where velocities are less than this average, they may be accounted for by a lesser density or mass of the neighboring stars. And where this average velocity is exceeded, it may be accounted for by a greater mass and number of the surrounding stars. Moreover, even the velocity of Arcturus and that of the seventh magnitude star 1830 Groombridge—which are probably around 200, or even more, miles per second —need not be accounted for by supposing that these stars are injected visitors from another universe beyond that of our Milky Way system. Their larger velocity may be due to several things. It may be due partly to greater numbers and masses of surrounding stars, and partly to stars closer to them than the average assumed distance. Moreover, the number and average size or mass of the stars in our system—counting also dark bodies—is considerably greater than used to be estimated, while the extent or general density of their distribution may also differ somewhat from that of theory.

At any rate, it should be noted that this very *average velocity*

proves the universe to be both finite in extent and finite in mass of matter. And, for that matter, this would undoubtedly be true upon the basis of any other average velocity. It might be stated in this connection, that, in an infinite universe, gravitation would have to be infinite at any one point. And, either stellar velocities would have to be immeasurably greater than the actual fact, or, as elsewhere noted, there would be no motion at all, as all the lines of force would be balanced at every point. This latter seems rather to be the correct conclusion—upon the assumption of an infinite universe.

A word should here be said as to the so-called *critical velocity,* as determined by Newcomb; namely, twenty-five miles a second, any exceeding of which should supposedly carry a star beyond the bounds of the known universe (*Popular Astronomy,* p. 487, sqq.). Upon the basis of this calculation, stars like 1830 Groombridge and Arcturus, whose velocities are probably upward of 200 miles a second, have been supposed to have come into our galactic system from an infinite distance or from some ulterior system and to be bound on their long journey outward into space toward or through another ulterior system. The velocities of these and some other stars have therefore been used as an argument for an infinite universe, or for the supposed necessary existence of so-called universes of stars beyond our own.

It is, of course, seen that the implied supposition in such a calculation of stellar velocities is that they are *wholly* due to, or caused by, mutual attractions among the stars. This leaves out of consideration what is absolutely necessary to account for any motions whatsoever; namely, some initial motions not due to their own attractions but impressed upon the stars by a power other than that of mere mutual stellar attractions. If this were not the case, then the motions of stars at or near the centre of the stellar system could not be accounted for except upon the supposition that the universe is very lopsided in matter or in star-distribution. If present motions were due merely to stellar attractions operating through indefinite ages, then, if the universe were finite, there would necessarily have to be a balance of forces and therefore no stellar movements at or around its gravitational centre. That this is not the case is evident from the great known velocity of the stars, and even of our own sun, near the apparent centre of the known uni-

verse. And if the universe were infinite, there would be infinite attractions from every direction, and therefore perfectly equalized or balanced, *at every point;* and hence there would be *no* stellar motions. As the latter alternative is altogether contrary to fact, the universe can not be infinite, as also explained elsewhere. Hence, we are compelled by the former alternative to regard the present motions of the stars as the resultants of some initial force or forces impressed upon them in some primal condition plus the force of gravitation operating since that primal origination of them.

Newcomb even at places also implies the possible existence of some to us unknown force or forces operating. And, in speaking of such an apparent runaway star arriving at the boundary of our known system after several million years, he also makes the possible existence of such forces an alternative to hold such star within the bounds of our system as against that of continuing "straight forward forever." Indeed, as we elsewhere prove, all the motions in the universe must necessarily come from initial motions or position of potential, from the potentiality of forces impressed upon it by an external transcendent Power. But it is not necessary here further to discuss this phase of the subject.

Let us now consider Newcomb's calculation apart from the consideration of any original or initial imposed force or power. He based his calculation upon the estimate of 100,000,000 stars, averaging five times the mass of our sun, and a galactic diameter of 30,000 light years (radius of 15,000 light years). In the light of more recent data it will be seen that his critical velocity of twenty-five miles a second is very much too low. If the number of stars in the actual universe would be the same as that in Newcomb's assumed universe, the radii of the two universes in terms of their respective star distances (if equal in both) would be the same. But, as Newcomb's assumed universe-radius (15,000 light years) is approximately three times the probable radius (5,000 light years), as pointed out above, the average distance between the stars in the actual universe would be about one-third as great as in Newcomb's assumed universe.

The above, however, assumes the number of stars in the actual universe to be the *same* as that in Newcomb's assumed

universe (100,000,000). But, as we have already shown, the probable number of stars, not even considering dark bodies, is about 1,000,000,000, or about ten times as great. Hence, by the principle indicated before, the distance between the stars would be only $\frac{1}{\sqrt[3]{10}}$, or about $\frac{1}{2.15}$, as great as in our former case with 100,000,000 stars. Therefore, the probable distance between the stars of the actual universe (radius 5,000 light years, and number of stars 1,000,000,000), would be about $\frac{1}{2.15}$ of $\frac{1}{3}$, or $\frac{1}{6.45}$, of that of Newcomb's assumed universe (radius 15,000 light years, and number of stars 100,000,000). The above is, of course, based upon an average uniform density of distribution, etc. Hence, as gravitation varies inversely as the squares of the separating distances, the probable gravitation between the stars, if equal in size, would be the square of 6.45, or 41.6025, times as great in the actual universe as in Newcomb's assumed universe; and so of gravitation in the aggregate, as could readily be shown. Thus, this far greater density of distribution would be a very important factor in a star's velocity, and all the more so, away from the universe-center and within its bounds.

It is true that "to give eight times the velocity [of twenty-five miles a second] would require sixty-four times the attracting mass" of the stars, according to Newcomb's calculation. But the actual aggregate mass of the stars is undoubtedly very much greater than Newcomb's assumed mass. He assumed his 100,000,000 stars indeed to average five times the mass of our sun (exclusive of planets); and this is probably considerably greater than the actual mass of the stars. But, even assuming the actual average mass of the stars to be only half that of our sun, even then the 1,000,000,000 stars would be equal in mass to the combined star-mass of Newcomb's figures. In a general way, it might then be said that the question of star-mass might almost be eliminated as a factor in our problem of approximate *aggregate* gravitation for a star supposedly coming from an infinite distance (the gravitation between *individual stars,* due to the mass-factor, being, upon this supposition, however, much less than in Newcomb's calculation). But, even eliminating the mass-factor, gravitation within the universe, upon the basis of actual distribution, would

be very much greater than upon Newcomb's assumed data. However, this gravitation would be considerably increased by the probably much greater average mass of the stars than that we assumed above, as well as by the possible number of dark bodies, whether stellar or planetary. As gravitation varies directly as the *product* of the masses, this greater average mass of the stars would, however, also greatly increase the relative gravitation between any two stars.

It might be said that, if the average star-mass were only as large as that of our sun, the gravitation between individual stars *within* our system would be four times as great from the mass-factor alone as if it were only half as great. And, upon this basis (1,000,000,000 stars, each as large as our sun), the universe-gravitation for a body approaching it from a supposedly *infinite distance,* or from an *ulterior system,* would be twice that of Newcomb's data (100,000,000 stars, each five times as large as our sun).

This greater attraction due to the undoubtedly greater aggregate mass of the universe, added to the far greater attraction due to the far greater density of star-distribution, than in Newcomb's assumed universe, would give us the equivalent of an attraction, within our universe bounds, greater than Newcomb's calculated amount of "sixty-four times the attracting mass" of his assumed universe, necessary to hold such a supposed runaway star from passing out of our stellar system.

Thus, surely, the velocities of Arcturus and 1830 Groombridge afford no evidence that these stars came from, and are bound for, space beyond the confines of the universe we know, whether from a supposed infinity of space or merely from some ulterior system. Other and more recent data thus make such velocities within, and confined to, our system, easily possible. These velocities should, therefore, afford no suggestion for a supposedly possible infinite universe.

An interesting calculation as to the extent and density of distribution of the stars, based upon the law of gravitation as the cause of stellar motions, was given by Lord Kelvin in the *Philosophical Magazine,* January, 1902. He showed that, in a universe with a radius of 3.09×10^{16} kilometers, or nearly 3,300 light years, with matter equivalent to 1,000,000,000 times the mass of our sun, uniformly or proportionately distributed throughout its extent, a stellar velocity of 108 kilometers

(about 67 miles) per second, in the case of a body originally at rest at the outer surface, would result from gravitation after a lapse of 25,000,000 years. Hence, in the case of a universe of 1,000,000,000 suns, originally at rest, and uniformly distributed, after 25,000,000 years many of them would now have a velocity of from 20 to 30 kilometers (12.4 to 18.6 miles) per second, while some would have as high as 108 kilometers a second. Or, if thousands of millions of years ago they would have been so distributed as now to be equally spaced throughout the supposed sphere, their mean velocities would now be about 50 kilometers (about 31 miles) a second. And, as this virtually corresponds to fact, this learned investigator concluded that there are perhaps 1,000,000,000 stars within a radial distance of about 3.09×10^{16} kilometers. Moreover, from the fact that if there were 10,000,000,000 stars within the same space the mean velocities would be much greater than those actually known, he concluded that the number of stars must be a great deal less than that number.

This calculation thus affords us another bit of evidence against the theory that the known velocity of any star indicates that it might have come from and be bound for space beyond the bounds of the stellar universe we know, especially upon the data we have given above, and making due allowance for dark bodies. Of course, as the stars are not distributed with entire uniformity, velocities more than the above average would result in the denser portions of the universe; and velocities less than this average in the portions less dense, upon the assumed basis of this calculation.

Moreover, if the extent of the universe of stars were assumed to be greater and the number of stars proportionally more numerous, or if its duration of existence had been longer, than the assumed figures above, this supposed gravitational velocity would necessarily have to be very much greater. But, as no such greater stellar velocities are known, it would be evident that, upon such a basis of reasoning, either the extent of the universe and its apparent cosmical age should approximately correspond to these assumed figures; or that if the extent were greater the age should be less, or *vice versa*. And, indeed, the age or life of a star or sun has variously been estimated to range from 20 to 100 million years. And, in what is to follow, we hope to show that the *extent* of the universe

also nearly matches the above figures. From this evidence it is thus readily seen that the starry universe is, almost without the shadow of a doubt, limited both as to space and as to time, or in other words, that it is both finite and temporal.

Thus the very existence of finite velocities of the stars is an evidence that the universe must not only be finite as to space, but also as to time. A universe eternal in duration, as also one infinite in extent of space, should have developed infinite velocities (if such there could be). Of course, from points already made, finiteness in space necessarily implies finiteness in time. Hence, from any proof of the finiteness of the universe as to space its finiteness as to time must necessarily follow. But, not only for the reason here given, but also for a reason previously given, the universe, it would seem, must be finite as to space; namely, because even *any* velocities or motions imply finiteness. Hence, as the universe must be finite as to space, according to this line of reasoning, so also must it be finite as to time, or temporal. Therefore, we have added another line of evidence that this finite temporal universe must have been *created.*

V EVIDENCE OF FINITENESS IN THE AGGREGATE LIGHT OF THE STARS

We come now to the development of a point which has to some extent also been treated by several writers, and notably by Lord Kelvin and Simon Newcomb. It is that of the amount of light received from the stars.

In an address before the *British Association* at Glasgow, 1901, by a line of reasoning based upon the actual amount of light received from the stars, Lord Kelvin gave it as his definite conviction that the starry universe cannot be infinite.

So Newcomb held that if the universe of stars were infinite, the "whole heavens would be filled with a blaze of light as bright as the sun" (*The Stars,* p. 230). The very fact that such is not the case, he held as manifest negative proof that it is not infinite. On the next page, referring to this evidence from the light received from the stars, he says, "The evidence seems to be against the hypothesis that the stars we see form part of an infinitely extended universe" (*Ibid.* p. 231). Prof. Newcomb thus came to the definite conclusion, based upon a

simple mathematical induction, that, as the whole heavens are not filled with a blaze of light as bright as the sun, the number and distribution of stars cannot be infinite.

The principle involved in this evidence for a limited universe from the amount of light received from the stars, was also recognized by A. Cowper Ranyard, the editor of Proctor's last work, *Old and New Astronomy,* 1892, as witness the following words: "If we reject as abhorrent to our minds the supposition that the universe is not infinite, we are thrown back on one of two alternatives—either the ether which transmits the light of the stars to us is not perfectly elastic, or a large proportion of the light of the stars is obliterated by dark bodies" (p. 690, Ranyard's addition).

It would, of course, only naturally follow that an infinite number of stars—if we could speak of such—would give forth an infinite quantity of light. But it might be contended that this would not prove the light at any one point, or to any one body like our earth, to be infinite. It would, however, prove an infinite amount of light distributed through an infinite extent of space. All it might be contended, therefore, actually to prove is that that light would be uniformly distributed up and down the realms of an endless space. But as to its actual intensity on any one body, that would be another question. At any rate, one star at an infinite distance—if such there were—would give no light at infinity. The variation of the light being inversely as the square of the distance, it would follow that, as the square of an infinite distance is necessarily infinite, the inverse ratio would be one divided by infinity. And, as this would in effect be *nothing,* the light of that star at an infinite distance would be truly infinitesimal; that is, it would be *nothing.* Now, as to the intervening stars, or the stars between these two supposed infinities—that of a star and that of its supposed observer—if one could speak of intervening stars between two infinities, the question of the accumulated intensity of light would again be a complex one. But this contention, upon its premises, is undoubtedly correct for all practical reasoning.

Indeed, this argument proves far more than appears upon its face. It is indeed true that, if the number of stars were infinite, the whole heavens would thus necessarily have to be one blaze of light. And, of course, an infinite number of stars

would have to be distributed over, or extended through, an infinite space. But the number of stars and the space of their distribution would not need to be infinite in order to cause the heavens to shine with the brightness of the sun. For the universe to blaze with the brightness of our sun, all that would be necessary would be to have the number of stars so great and so distributed as completely to fill, by their projections upon it, the apparent surface of the whole celestial sphere with stars. And this would be the case when every line of vision from the observer outward would meet with, or be intercepted by, some star, either comparatively near or remote. Thus all the stars, of various distances, would seem to be projected upon, and completely cover for the observer, the inner surface of the imaginary sphere that marks the outermost stars. And, the stars, by such an ideal arrangement, would not need even to be equal to the number necessary actually to cover the whole surface of that supposed outer sphere. The nearer stars would, to the observer, cover far more than the actual area of their cross-sections, projected upon that spherical background—and this, of course, inversely in proportion to the squares of their distances from the observer.

I EXTENT OF UNIVERSE FOR NUMBER OF STARS TO BE EQUAL TO NUMBER OF STAR CROSS-SECTIONS IN SURFACE OF BOUNDING SPHERE

Let us now suppose the stars to be equally distributed according to a ratio of distribution (near our system) we have already noted; namely, 30 to 40 stars to a spherical space having a radius of 5 parsecs, or say, one star for every space equivalent to a sphere with a radius of about 300,000 times our distance from the sun. Such a star-density would, however, be somewhat greater than is the case. Upon this basis it would require far less than infinite space to contain a number of stars so great as to be equal to the number needed completely to cover the inner surface of that far-off sphere that would mark the last outposts of such a starry universe. And that *number* of stars would also be far from infinite. Such a sphere-surface covered with stars would, of course, also present a solid wall of light, each point as brilliant as each individual star or sun. And, then, what of the effect of the aggregate light upon the

individual observer!

We have said that the number of stars for a universe under such conditions of distribution, either only apparently to cover the whole heavens or to be actually equal to the number that could be placed upon its outer sphere, would in either case be far from infinite, and that the space of their distribution would also be far from infinite. What, then, would have to be that number and the bounds of that universe? Let us, then, determine the number of stars of a universe so great that that number would be equal to the number required actually even to cover the whole surface of its outermost containing sphere.

Let us now conceive space to be divided into concentric spheres, with our sun at their common centre. And let the first sphere have a radius of 300,000 times our distance from the sun. Then, let the radius of the second sphere be twice that radius; that of the third sphere, three times that radius; and so on indefinitely.

As already noted, accepting the average density of distribution of stars, as far as determined, there would approximately be one star for what we shall call a star-space unit; namely, a sphere with a radius of 300,000 times our distance from the sun. It should be noted here, however, that in case of our central or initial sphere, there would be two stars, our own sun at the centre and alpha Centauri not very far from its surface. This star is somewhat less than the assumed radius of the first sphere away from us, its distance being only about four light years, as against approximately five light years of the radius of this first sphere. But this does not affect our argument, as we are assuming a uniform density of distribution, upon the basis of the ascertained average, given above. We might almost have taken the distance of our first neighbor alpha Centauri—somewhat above twenty trillion miles distant—as the radius for this star-space unit, which would probably make allowance for an underestimation of the number of fainter stars, and for the greater density in the Milky Way wreath. But, as already noted, beyond the locus of the Milky Way wreath of stars the density of stars apparently becomes less and less with the distance outward. We shall, in these calculations, therefore, use the radius of star-space unit indicated; namely, 300,000 times our distance from the sun. But, for that matter, whatever radius we should assume as the basis of

our calculations, it would equally prove our point; namely, that the universe of stars is finite, both as to number of stars and as to space of distribution. And this is equally true of other assumed data to be used below.

Now, upon the basis of a uniform distribution of stars throughout space, the numbers of stars for successive spheres (inclusive of stars in preceding spheres) would increase as the cubes of their like dimensions. But the surfaces of these spheres would increase only as the squares of their like dimensions. Therefore, as the spheres succeed one another, the numbers of stars within the spheres would multiply much faster than the areas of the surfaces of the containing spheres. And, therefore, the total light effect would steadily increase as we should pass outward. And it would, of course, approach infinity as our sphere would approach infinity—if, indeed, we could speak of an infinity of light and an infinity of space.

We shall now assume the average radius of a star to be 500,000 miles. And, as already noted, the average calculated distribution of stars is approximately one star for a sphere with a radius of 300,000 times our distance from the sun. The radius of this one-star sphere would then be 300,000 times 93,000,000, or 27,900,000,000,000, miles.

Now let r = the radius of a star (500,000 miles),
and a = the area of the cross-section of a star;
then $a = \pi r^2$.
So let R = the radius of a one-star sphere (27,900,000,000,000 miles),
and A = the area of the surface of a one-star sphere;
then $A = 4\pi R^2$.
Again, let p = the number of star cross-sections in the surface of a one-star sphere;

$$\text{then} \quad p = \frac{4\pi R^2}{\pi r^2},$$

$$= \frac{4\,R^2}{r^2}.$$

Now, as already noted, the numbers of stars for successive spheres would vary as the cubes of their radii, and the sur-

faces of those spheres would vary only as the squares of their radii. Therefore, the numbers of the contained stars would vary faster than the containing sphere-surfaces (or star cross-sections upon them) directly as the radii. But, upon our basis of reasoning, a one-star sphere would contain only one star. Therefore, this star, if placed upon the surface of its sphere (which would, however, not be the case in a uniform distribution), would occupy one star cross-section upon it. But completely to cover an outer sphere with the projections upon it of the star cross-sections of a one-star sphere, would require all its star cross-sections. But we have seen that the surface of a one-star sphere would contain $\frac{4R^2}{r^2}$ star cross-sections (or, $\frac{4R^2}{r^2}$ times as many as the number of stars—which is one—upon its surface) to be projected. Hence, according to the above law of increase for successive spheres, a sphere whose surface would be completely covered with the projections of a one-star sphere's star cross-sections upon it—upon the basis of a uniform density of stars, etc.—would have to have a radius equal to $\frac{4R^2}{r^2}$ times that of a one-star sphere. This radius would, therefore, be $\frac{4R^2}{r^2} \times R$, or $\frac{4R^3}{r^2}$ (by substituting values of R and r, we could directly get universe-radius in miles).

Now, let $R' =$ the radius of a universe-sphere, such that the area of surface in star cross-sections would be equal to the number of stars within it,

$A' =$ the area of the surface of this universe-sphere,

and $p' =$ the number of star cross-sections in this universe-sphere;

then $A' = 4\pi R'^2$.

Substituting $\frac{4R^3}{r^2}$ for R',

$$A' = 4\pi \left(\frac{4R^3}{r^2}\right)^2, \text{ or } \frac{64\pi R^6}{r^4}.$$

But πr^2 = the area of a star cross-section,

therefore $p' = \frac{\frac{64\pi R^6}{r^4}}{\pi r^2}$, or $\frac{64R^6}{r^6}$ (star cross-sections in the surface of universe-sphere).

Substituting values of R and r (27,900,000,000,000 and 500,000),

$$p' = \frac{64 \times 27{,}900{,}000{,}000{,}000^6}{500{,}000^6},$$

$$= \frac{64 \times (279 \times 10^{11})^6}{(5 \times 10^5)^6},$$

$$= \frac{64 \times 471{,}655{,}843{,}734{,}321 \times 10^{66}}{125^2 \times 10^{30}},$$

$$= 1{,}931{,}902{,}335{,}935{,}778{,}816 \times 10^{30}$$ (the number of star cross-sections on universe-sphere).

But the number of star cross-sections (p′) on the surface of the universe-sphere, in this case, is equal to the number of stars in this ideally star-distributed universe. Hence, a universe whose number of stars would be equal to the number of stars necessary completely to cover its outer surface (p′) upon the ideal basis of an equal distribution throughout, with one star for every star-space unit having a radius of 300,000 times our distance from the sun, would contain $1{,}931{,}902{,}335{,}935{,}778{,}816 \times 10^{30}$ stars.

But our proposition calls for one star upon the surface of the first or initial sphere, with uniform equivalent density throughout. Therefore, as similar dimensions of similar volumes are to each other as the cube roots of their volumes, it follows that the universe-radius (R′) would be $\sqrt[3]{1{,}931{,}902{,}335{,}935{,}778{,}816 \times 10^{30}}$, or $1{,}245{,}456 \times 10^{10}$, times the radius (R) of a one-star sphere. But, as R is equal to 279×10^{11} miles, this universe-radius would be equal to $347{,}482{,}224 \times 10^{21}$ miles, equivalent to about $59{,}182 \times 10^{12}$ light years.

This universe-radius may also be deduced from the surface area.

This number is then the radius (R′) of a universe-sphere whose number of stars would be equal to the number of star

cross-sections (p′) upon its sphere-surface, upon the basis of an equal distribution of its stars, with one star for every star-space unit having a radius of 300,000 times our distance from the sun. That is, the surface of the containing sphere, or of the sphere marking the outermost stars of such a universe, would be $347{,}482{,}224 \times 10^{21}$ miles, or about $59{,}182 \times 10^{12}$ light years, distant from our sun—or $1{,}245{,}456 \times 10^{10}$ times the radius (R) of a one-star sphere (or $\frac{4R^2}{r^2} \times R$).

We may also briefly state another very simple method of determining the above facts.

Let n be the number of concentric spheres of this imaginary universe of stars. As the areas of the surfaces of the successive concentric spheres vary as the squares of their radii, the numbers of star cross-sections must vary as the squares of the successive sphere-numbers. Hence, one star upon the surface of a one-star sphere would cover n^2 star cross-sections upon the nth. sphere. And, to cover all the star cross-sections in the surface of the nth. sphere, it would require an equivalent of the projections of all the star cross-sections upon the one-star, or first-star, sphere. Therefore, the number of star cross-sections upon the surface of the nth. sphere would be the number of star cross-sections upon the surface of the first, or one-star, sphere, times n^2. But, the number of star cross-sections in the surface of a one-star sphere is $\frac{4\pi R^2}{\pi r^2}$ (as already determined), or $\frac{4R^2}{r^2}$, R being the radius of this one-star sphere and r that of a star. Hence, the number of star cross-sections (p′) in the surface of the nth. sphere would be $\frac{4R^2n^2}{r^2}$.

Thus $p' = \frac{4R^2n^2}{r^2}$.

But, as there is one star for the first sphere, and as the numbers of stars vary with the cubes of the like dimensions, in a sphere with a radius n times as great there would be n^3

stars. But, by the conditions of our problem, this number (n^3) of stars is to be the same as the number of star cross-sections (p') in the surface of the outer sphere.

Hence, $n^3 = p'$.

Substituting n^3 for p' in our equation above,

$$n^3 = \frac{4R^2n^2}{r^2},$$

or $$n = \frac{4R^2}{r^2}.$$

Substituting values of $R(279 \times 10^{11})$ and $r(5 \times 10^5)$,

$$n = \frac{4(279 \times 10^{11})^2}{(5 \times 10^5)^2},$$

$$= 1{,}245{,}456 \times 10^{10} \text{ (concentric spheres)}.$$

But, as the distance between the concentric spheres is equal to R, or 279×10^{11} miles, the universe-radius (R') would be equal to $347{,}482{,}224 \times 10^{21}$ miles.

But the number of stars, by the conditions of our problem, would be n^3, or $(1{,}245{,}456 \times 10^{10})^3$, or $1{,}931{,}902{,}335{,}935{,}778{,}816 \times 10^{30}$. And as the number of stars (n^3) is to be equal to the number of star cross-sections (p'), there would also be $1{,}931{,}902{,}335{,}935{,}778{,}816 \times 10^{30}$ star cross-sections.

Or $p' = \frac{4\pi R'^2}{\pi r^2}$, or $\frac{4R'^2}{r^2}$. Substituting values of R' (as above) and $r(5 \times 10^5)$,

$$p' = \frac{4(347{,}482{,}224 \times 10^{21})^2}{(5 \times 10^5)^2},$$

$$= 1{,}931{,}902{,}335{,}935{,}778{,}816 \times 10^{30} \text{ (star cross-sections)}.$$

It should need no explanation or *proof* that, according to our theorem, the number of stars in such a universe-sphere, upon our basis of distribution, would be thus equal to the number of star cross-sections in its surface area. But an additional paragraph will make our point still more clear, while it will also definitely verify our conclusions.

We found the radius (R') of this universe-sphere to be

$\frac{4R^3}{r^2}$. That is, it would have a radius of $\frac{4R^2}{r^2}$ times that (R) of a single-star (or one-star) sphere. And, as the numbers of stars (s′ and s) in these spheres would be to each other as the cubes of their like dimensions, a sphere with a radius of $\frac{4R^2}{r^2}$ times that (R) of a one-star sphere would contain $\left(\frac{4R^2}{r^2}\right)^3$ times one star, or $\frac{64R^6}{r^6}$ stars, which, as noted above, is also the number of star cross-sections (p′) in the surface of said sphere—the thing to be proved.

Or $V' : V :: \left(\frac{4R^3}{r^2}\right)^3 : R^3$.

But $s' : s :: V' : V$.

Therefore, $s' : s :: \left(\frac{4R^3}{r^2}\right)^3 : R^3$;

or $s' : s :: \frac{64R^6}{r^6} : 1$.

But $s = 1$;

therefore, $s' : 1 :: \frac{64R^6}{r^6} : 1$;

or $s' = \frac{64R^6}{r^6}$. And this again is the number of star cross-sections (p′) in the surface of the universe-sphere, as it has to be, according to our proposition.

The distance to the surface of that containing universe would thus be $347{,}482{,}224 \times 10^{21}$ miles, or $59{,}182 \times 10^{12}$ light years. And yet, while this distance would be inconceivably great, it would nevertheless not be infinite.

This would also rather imply, that, if the universe were that great in extent of space, it would also supposedly have to be at least that old in years of duration in time. For, if the light of the star-outposts were visible in this aggregation of star light, as we have shown, it would have required that many years to travel that distance. And therefore, if seen, we should see that light of those stars as they shone that many years ago.

But that is no more an infinity of time than the extent of space is an infinity of space. Nor, even if they had existed long enough for their light to have made its journey a multitude of times, would even that be an eternity of time, any more than that extent in space, multiplied by any number whatsoever, would make an infinity of space.

If it would be contended that the distribution of stars throughout space is denser than our assumption, we should answer that the greater the average distribution of stars, the lesser in extent would the universe have to be thus to blaze with light, upon the basis of a uniform distribution. And, even if their average distribution were less dense and their average size smaller, this would only extend the bounds of the universe; but upon no assumption whatever would it need to be infinite in order thus to blaze like a solid sun-studded sphere.

We are, of course, aware of the fact that in a universe of ideally uniformly distributed stars, such as we assumed, the stars would not really be thus upon the surfaces of the successive spheres. If that were so, the stars upon the same surfaces of successive spheres would be nearer together than we assumed and those upon different succeeding surfaces would be farther apart than those upon the same surface. And this fact must also be borne in mind in the calculations that are to follow. However, in such a case *approximation* is exact enough. Nor would any other arrangement very materially alter our conclusions. Hence, we are assuming such a somewhat abnormal arrangement in the interests of clearness and greater simplicity.

2 APPROXIMATE EXTENT OF UNIVERSE FOR STARS (DENSITY AS IN KNOWN UNIVERSE), WITHOUT OCCULTATIONS, COMPLETELY TO COVER CELESTIAL SPHERE

According to the above calculation, the number of stars in our imaginary universe would be equal to the number of star cross-sections in its outer surface. But, in order to have the whole heavens blaze like a solid wall of light, only every line of vision would need to be met by some star. Now, according to our arrangement above, there would be 1 star for the first

sphere with a radius equal to 300,000 times the distance of our sun from us; 8 stars (inclusive of the star in the first sphere) for the second sphere, with radius twice as great; 27 stars for the third sphere, etc. That is, if we assumed all the stars to be located upon the successive sphere-surfaces (which could not be the case, as already pointed out), there would be 1 star upon the surface of the first sphere, 7 stars (8-1) upon the surface of the second sphere, 19 stars (27-8) upon the surface of the third sphere, 37 stars (64-27) upon the surface of the fourth sphere, 61 stars (5^3-4^3) upon the surface of the fifth sphere, . . . 30,301 stars (101^3-100^3) upon the surface of the 101st. sphere, . . . 3,003,001 stars (1001^3-1000^3) upon the surface of the 1001st. sphere, etc.

Again, at the second sphere-surface 1 star will give $\frac{1}{4}$ as much light as 1 star upon the surface of the first sphere. That is, one star cross-section upon the surface of the second sphere would be equivalent to one-fourth of a star cross-section upon the surface of the first sphere. But, as noted above, there would be 7 stars upon the surface of our second sphere. Hence, those 7 stars upon the surface of our second sphere would be equivalent to $\frac{7}{4}$ stars upon the surface of the first sphere. So, 1 star upon the surface of the third sphere would be equivalent to $\frac{1}{9}$ of a star upon the surface of the first sphere; and the 19 stars upon the surface of the third sphere would be equivalent to $\frac{19}{9}$ stars upon the surface of the first sphere. So, one star upon the surface of the 101st. sphere would be equivalent to $\frac{1}{101^2}$ of a star upon the surface of the first sphere; and the 30,301 stars upon the surface of the 101st. sphere would be equivalent to $\frac{30,301}{10,201}$, or 2.97+, stars upon the surface of the first sphere. Likewise, one star upon the surface of the 1001st. sphere would be equivalent to $\frac{1}{1001^2}$ of a star upon the surface of the first sphere; and the 3,003,001 stars upon the surface of the 1001st. sphere would be equivalent to $\frac{3,003,001}{1,002,001}$, or 2.997+, stars upon the surface of the first sphere. The stars upon the 10,001st. sphere would be equivalent to 2.9997+stars; and for successive spheres, 2.99997, 2.999997, 2.9999997, etc., stars.

Thus, according to our assumed distribution of stars, the stars upon the surface of the second sphere would be equivalent to $\frac{7}{4}$ stars upon that of the first sphere; those upon the third sphere would be equivalent to $\frac{19}{9}$ stars upon the first sphere; and for successive spheres, the number of stars would constantly approach the limit of an equivalent of 3 stars upon the first sphere, as, for example, 2.97 for the 101st. sphere, 2.997 for the 1001st. sphere, etc. Or, as we are here considering a universe of stars with an almost inconceivable number of concentric sphere-surfaces, and as the numbers of stars upon the successive sphere-surfaces approach ever nearer to an equivalent of 3 stars upon the surface of the first sphere, we might say, as a close approximation to the actual facts of such an ideal universe, that every concentric sphere-surface would add an equivalent of 3 stars upon the surface of the first sphere.

Let us now assume the stars to be distributed in every direction in such a way as to have each star appear as a star-projection upon the celestial sphere, that is, without any star-occultations. Then, for the whole heavens to blaze with light at every point like the sun, there would have to be only enough successive sphere-surfaces to make an equivalent, by their additions of stars, to cover the whole surface of the first sphere. But the surface of the first sphere in star cross-sections, as already determined, is $\frac{4R^2}{r^2}$, R being the radius of the first sphere (279×10^{11}) and r the radius of a star (5×10^5). Hence, if each successive sphere-surface would add an equivalent of 3 stars (or star cross-sections) upon the surface of the first sphere, the number (n) of successive sphere-surfaces to make an addition of stars equivalent to cover the whole surface of the first sphere would have to be one-third as many as that of the star cross-sections upon the first sphere.

Thus, $n=\frac{1}{3}$ of $\frac{4R^2}{r^2}$.

Substituting values of $R(279\times10^{11})$ and $r(5\times10^5)$ in this equation,

$$n = \tfrac{1}{3} \times \frac{4\,(279\times10^{11})^2}{(5\times10^5)^2} = 415{,}152\times10^{10}$$ (concentric spheres).

Hence, if the stars were so distributed as not to occult one

another, for the whole heavens to blaze with light like that of the sun, the universe would have to extend approximately only one-third as far as in our former calculation. Or there would have to be only about one twenty-seventh as many stars, while the number of star cross-sections in its outer surface would be only about one-ninth as great, as in our first imaginary universe, with stars equal to the number of star cross-sections in its outer sphere.

Our former calculation, under *ideal* conditions would, therefore, allow for the occultation of all the stars beyond one-third of the distance toward the surface of the containing universe-sphere. That is, upon such ideal conditions, there could be 26 occulted stars to every unocculted (or occulting) star. Or there would be 26 times as many stars occulted as unocculted. Thus, there could be even a considerable promiscuous or haphazard arrangement of the stars, within our former universe boundary—as long as the approximate average density would remain the same—and still leave enough stars unocculted to cover the celestial sphere and therefore to cause it to blaze with light like that of our sun. And, indeed, with almost any such promiscuous arrangement conceivable, the heavens would necessarily have to blaze *well-nigh* at least like a solid wall of light.

3 NO INFINITE EXTENT OF UNIVERSE THUS NECESSARY UNDER ANY CONDITION OF DISTRIBUTION

If now, however, we should extend the universe-bounds so as to have a radius ten times as great as in our first imaginary universe above—10 times $1{,}245{,}456 \times 10^{10}$ concentric sphere-surfaces, 279×10^{11} miles apart—we should have a universe with the number of stars $10^3 \times 3^3$, or 27,000, times as many as would be necessary, under our more ideal arrangement (without occultations), to cause the heavens at every point to blaze like the sun. This, surely, would be a sufficient number of stars, with almost any conceivable arrangement of them, thus to blaze. With almost any distribution, only retaining our approximate *average* density, there would be thousands of stars occulted for every unocculted star and still leave the celestial sphere entirely covered with stars like one solid sun.

But even such a universe of stars, it is needless to say,

would not be infinite either in extent of space or in its number of stars. Much less so would the universe of our first—or of our second—calculation above be infinite either in space, matter, or its number of stars. And, in order to make every allowance for *any promiscuous* arrangement of stars, for any multiplicity of occultations, our imaginary universe might be conceived of as extending *any number* of times the distance we arrived at above; and even then it would still continue to remain finite, however far supposedly extended.

Under any such circumstances, the number of stars not eclipsed would always remain very many times less than the number thus eclipsed. Nevertheless, the number of stars eclipsed could not be infinite as against the number not eclipsed, as it would be *less* than the total number of stars. And, of course, the number of stars not eclipsed would be finite. Hence, the number of stars eclipsed (finite) plus the number not eclipsed (finite), or the total number of stars, could not be infinite, as no two finites could together constitute an infinite. Hence, also, there could be no infinite *extension* of the universe. Our contention, therefore, is that even a distribution of stars, such as we actually know, would not require an infinite extension of the universe to make the heavens blaze like a solid wall of light. With the stars arranged as we know them, the universe should not need to extend much beyond the bounds of our first imaginary universe, with the number of stars equal to that of star cross-sections in its containing sphere-surface, thus to blaze with light. And, it should, surely, not extend beyond the bounds ten times as far extended, as above noted. And, at least long before bounds a hundred times as distant would be reached, the universe would necessarily blaze like the sun at every point and thus still remain *finite*.

But, needless to say, we do not actually receive any such amount of light from the stars. This assumed amount is to that of the light actually received somewhat like that of the sun to that of even a very faint telescopic star, which can only feebly tremble into visibility through a mighty telescope. This fact surely reduces the *actual* universe almost to an atom compared with our imaginary universe, and especially when compared with that of our *former* calculation, almost *necessarily* blazing like a sun-studded sphere. And, if even such an imaginary universe would not be infinite, it surely should not need

any further argument to prove the *actual* universe *finite*—especially in the light of the amount of light actually received from its aggregation of stars.

4 ACTUAL AND COMPARATIVE AMOUNT OF LIGHT RECEIVED FROM ALL THE STARS

It will now be in order to take a comparative measure of the extent of the universe from the actual amount of light received from both its visible and invisible stars.

By a calculation based upon carefully ascertained data, Simon Newcomb placed the total amount of light received from all the stars at about $\frac{1}{90,000,000}$ the amount received from our sun alone. And, of this light, according to an estimate of Charles Young, only one twenty-fifth comes to us from stars visible to the naked eye (and even this relative amount has been found to be apparently much too great). Thus it would require 90,000,000 times the total light actually received from all the stars to be equivalent to that received from the sun.

But our sun occupies only a small space or area against the surface of the celestial sphere. Let us now conceive of a sphere (which we shall call the *solar-sphere*) having its centre in the earth, with its surface passing through the sun. From this we can readily determine the number of such suns, at the same distance, that it would require completely to cover the heavens.

Now let R = the radius of this apparent solar-sphere (93,000,000 miles),
r = the radius of the sun (433,250 miles),
A = the area of this apparent solar-sphere,
and a = the area of the sun's cross-section.
Then $A = 4\pi R^2$,
and $a = \pi r^2$.
Now let c = the number of cross-sections of the sun in the area of this apparent solar-sphere;

then $$c = \frac{4\pi R^2}{\pi r^2},$$

$$= \frac{4R^2}{r^2}.$$

Substituting values of R (93,000,000 miles) and r (433,250 miles),

$$c=\frac{4(93,000,000)^2}{433,250^2},$$

$=184,310$ (nearly), the number of solar cross-sections in the solar-sphere.

That is, it would require 184,310 suns like our own, and at the same distance, completely to cover the heavens like a solid wall or vault of light—and, therefore, to blaze with light like that of the direct blaze of the sun. Hence, for the whole heavens to be ablaze with light like that of the sun, it would require $184,310\times90,000,000$, or 16,587,900,000,000, times the light actually received from all the stars visible and invisible.

Let us now assume the actual number of stars in the known universe to be 1,000,000,000, as a close approximation to the estimated number. It would then require $16,587,900,000,000\times1,000,000,000$, or $165,879\times10^{17}$, stars, promiscuously arranged in 1,000,000,000 star-groups of 16,587,900,000,000 stars each and confined within the bounds of the known universe with a radius of approximately 5,000 light years, to blaze at every point like the sun. That is, in each case where before there was one star, there would now be 16,587,900,000,000 stars like itself. Or, in other words, there would be 1,000,000,000 star-groups of 16,587,900,000,000 stars each, the star-groups being distributed exactly as are the single stars now. Thus this multiplied number of stars would be such as to be equivalent to having approximately 16,587,900,000,000 stars (instead of one) upon the first star-sphere with radius of 300,000 times our distance from the sun.

Now, as these star-groups take the places of single stars in a former similar calculation, we can here treat them as though they were single stars with an intensity of light 16,587,900,000,000 times as great as that of a single star before the multiplied increase. And, as they displace 1,000,000,000 stars approximately so uniformly distributed as to have one star upon the first concentric sphere-surface, there must be 1,000 such concentric sphere-surfaces. But as the stars (single stars instead of star-groups) upon each of the successive spherical shells would be equivalent to approximately three stars upon the initial sphere-surface, the stars (single stars instead of star-

groups) of the 1,000 spherical shells would be equivalent to approximately 3,000 stars upon that first sphere-surface. Hence, as single stars are here displaced by star-groups of 16,587,900,000,000 stars each, or as there would be 16,587,900,000,000 stars (instead of one) upon the initial sphere-surface, all these star-groups for the 1,000 spherical shells would be equivalent to 16,587,900,000,000 × 3,000 stars, or 49,763,700,000,000,000 stars, upon the first sphere. Therefore, the 16,587,900,000,000 × 1,000,000,000, or $165,879 \times 10^{17}$, stars (causing all heaven to blaze like the sun), distributed in star-groups, as indicated, and confined within the bounds of the known universe of approximately 5,000 light years, would give a light-equivalence of $497,637 \times 10^{11}$ stars upon the first star sphere-surface of 300,000 times our distance from the sun.

Now, as already noted, the approximate amount of light added by each of the successive spherical shells in a universe of ideally uniformly distributed stars, would be three times that of one star upon the first sphere-surface. But here we have an equivalent of $497,637 \times 10^{11}$ stars upon the first sphere-surface. Therefore, for stars, uniformly distributed so as to have one star upon the first sphere-surface, etc., to produce the same light-effect at the universe-centre—namely, to blaze at every point like the sun—as these $165,879 \times 10^{17}$ stars, distributed in star-groups and confined within the radius of 5,000 light years, it would require one third of $497,637 \times 10^{11}$, or $165,879 \times 10^{11}$, concentric spheres.

Therefore, the radius of this imaginary universe-sphere, determined from the actual amount of light received from the stars, would be approximately $165,879 \times 10^{11}$ times 279×10^{11} miles, or $46,280,241 \times 10^{22}$ miles, that is, $462,802,410 \times 10^{21}$ miles. This is approximately $78,845 \times 10^{12}$ light years (about $157,690 \times 10^{8}$ times the radius of the known universe). And the approximate number of stars would be $(165,879 \times 10^{11})^{3}$, or $4,564,300,461,446,439 \times 10^{33}$, that is, $4,564,300,461,446,439,000 \times 10^{30}$.

Let us now go back to our first imaginary universe with the estimated density (in stars) of our galactic system, so extended as to cause all heaven to appear like a *solid wall of light,* or at least *well-nigh* so, even after making allowance for a considerably promiscuous arrangement with associated occultations.

We found that it would have a radius of $347,482,224 \times 10^{21}$ miles, or $59,182 \times 10^{12}$ light years (about $118,364 \times 10^{8}$ times the calculated radius of the known universe), and that its approximate number of stars would be 1,931,902,335,935,-778,816 $\times 10^{30}$.

The closeness between these figures, or sets of figures, and the parallel ones arrived at above from the light of the stars in the known universe (the radii being as close to each other as 3 to 4), is so remarkably striking as to need no comment. These two sets of figures so nearly match each other that if all the exact data—as to number of stars and total light of the sun and of the stars—could be determined, and if, instead of our theoretical *ideal* arrangement for easy computation, the calculation could be based upon the *actual* distribution of stars, they would probably *fully* match each other—as indeed they should. And, for that matter, even if one or other of the factors should, by further investigation, be found to be larger than what we used in our calculations, it would undoubtedly also be found that some other factor or factors would be smaller than what we used. Thus one factor, by being smaller or larger, would probably compensate for any deviation from fact of any other factor or factors. It is thus seen that the remarkable closeness between these parallel figures indicates that the astronomical data—as to the extent (radius, about 5,000 light years) of our galactic universe and its number of stars (1,000.000,000), etc. —used in our calculations, must closely match the *actual facts* of the universe, and that to a great degree astronomy is truly an exact science.

Hence, these facts of our latter calculation from the actual amount of light received from sun and stars, add their tremendous weight of evidence to our contention; namely, that the actual universe of stars is not only finite, but that it is measurably so. These facts should, therefore, vastly strengthen our several arguments above for a very *limited* universe. These astonishing facts should also constitute an unanswerable evidence that at least comparatively very little, if any, light is lost by some hypothetical light interference in its transmission from very distant stars through the ether of space, except such as is intercepted by other large or small bodies in space—a quite recently developed objection, which we shall presently more fully answer.

Though we should not anticipate the overwhelming conclusion from the evidences for a finite universe, we may yet here say that, as they show the universe to be finite, they also imply that it must be temporal and that therefore it must have been created. And, needless to say, such creation must have been *out of nothing* by a transcendent supreme *spiritual Personality*.

5 OBJECTION FROM HYPOTHETICAL LIGHT INTERFERENCE ANSWERED

In his recent work, *The Universe and the Atom,* 1916, Mr. Marion Erwin, C. E., has developed a theory of light interference in its transmission through space, that, upon its surface, *seems* to have some foundation in the *theory* of light, if not in *fact*. But, this objection will be found to be far from a conclusive argument against the proof from the light of the stars, given above, for a finite universe. In fact, even if there were some direct interference of light, that would only push farther outward the confines of the universe. But it would not push them beyond even measurable distance. The rays interfered with or intercepted, instead of being lost altogether, would only, like a multiplicity of echoes, be reflected, or at least diffused; and thus, long before a limiting infinity would be reached, they should cause the whole heavens to blaze with light like that of the sun. But, of course, we could not even speak of a *limiting* infinity, as such phraseology would be self-contradictory. A supposed limiting infinity would necessarily imply bounds, and would therefore be a non-infinity.

But, that the actual facts as to light transmission do by no means match Mr. Erwin's theory of interference, is only too manifest from what, in anticipation of this objection, was said above. This evidence against any such supposed considerable light interference, is very much strengthened by the fact of the actual addition of new stars with continued improvements in our optical instruments. And this is, of course, also evident from the great amount of light received from even invisible stars—at least 96% of the whole amount received from all the stars. Surely, if Mr. Erwin's theory of light interference were matched by fact, it should to a great extent apply already in the case of the first stars seen with the unaided eye, and

of course much more so before we should reach the ordinary telescopic stars, and surely altogether so before we should reach those distant stars that only faintly vibrate into visibility through the largest equatorial. But the fact that the light from even those far-off telescopic points in space reaches us without any marked interference—not to speak of the fact that the sensitive plate of the camera reveals others still farther beyond—should be sufficient proof that light transmitted through the spaces of the ether, is, as has always been held, practically, and perhaps entirely, uninterfered with or unhindered.

That the light of the stars is not interfered with to any *appreciable* extent, *if at all,* is also evident from the fact that the light of even the very faint distant stars is transmitted through the ether as a compound of all the colors of the spectrum. If there were interference, it would undoubtedly be of the nature of selective absorption of the light waves of different lengths, a fact which would readily become apparent from the light-spectrum. This objection has therefore no validity.

VI THE AGGREGATION OF ANY INDEFINITE NUMBER OF SO-CALLED UNIVERSES ALSO FINITE

In order to offset the force of this cumulative, and what should be an altogether convincing, argument, that the physical universe is finite, it may be contended that it refers and applies only to *one* stellar system, or to a *continuous* system of stars.

Thus men will insist, in spite of evidence to the contrary, that the universe is infinite. And the most popular argument resorted to as a final defense of their position, is that of a possibility of numberless stars or star-systems beyond our own galactic system. Thus Mr. Erwin says, "If we had only a one Galaxy system, and all the outside space be void, all the suns in that system would have long since radiated all their heat into space, and by loss of kinetic energy the entire system would be non-luminous and dead. If there are processes going on which will inevitably bring the entire physical universe to a kinetic death at some definite time in the future, since time in

the past is unlimited, the human mind cannot escape the conclusion that the death event should have happened long ago. Nor does it aid us to imagine a beginning of the process, unless we assume that we have under consideration only one system of a still larger universe, and that in this endless universe there is going on by operation of natural laws, an endless cycle of birth, life, death, and resurrection of systems. If one system is going to its death, as it must be, because of the gradual loss of kinetic energy through radiation outward into space, there must be another system in process of building elsewhere" (*The Universe and the Atom,* pp. 119-120).

This is, of course, avowedly a development of Arrhenius's theory of repeating or successive universes, whose choice passages he quotes as evidence. Of this theory, according to Arrhenius, we shall speak in a later chapter. For the present it is sufficient to say of Mr. Erwin's statement of it, that it of course *assumes* time in the past to be unlimited and the processes of nature to have had no beginning, which, however, are the chief questions at issue. It, moreover, *assumes* also the multiplicity of star-systems—as it merely assumes the above—because of the necessity of these assumptions to save existing nature from a certain death and dissolution. And, of course, an endless universe with one system being born while another is going to its death—as indeed an endless cycle of the whole—supposedly comes out of these assumptions. We must, therefore, measure the conclusion by the value of the assumed premises.

A preconceived theory that requires proof, has thus often led to rather strange conclusions upon the basis of premises that had necessarily to be assumed to make such theory work. What, then, is the value of such theory as a whole? Such objections are, therefore, totally valueless as proofs against the actually demonstrable finiteness of the universe, as seen above.

It was, indeed, held by many astronomers of the past that the stellar system to which our sun belongs is only one, and perhaps but a comparatively small one, of the indefinite, perhaps infinite, number of such systems distributed throughout a supposedly infinite space. Thus, some of the fainter star-clusters used to be considered by some as far-off systems of suns like that of our own galaxy, the Milky Way system. And,

while, before the telescope resolved them into stars, the supposition might have been regarded as a plausible one, surely upon their resolution there should have been no excuse for so regarding them. Their very resolution into stars should have been a sufficient proof that they belong to our galactic system. That fact should have proved that the locus of distribution of their individual stars is of the same order as that of individual stars elsewhere, belonging to our system. And even in cases where the resolution has been but very partial or indefinite, the evidence now is all against regarding them as other star-systems beyond our own, and of course resisting all attempts to measure their parallaxes. All these fainter clusters, no less than the Pleiades, etc., are now definitely known to belong to our galactic system of stars, in the direction of, or within, whose wreath-like denser portion they are the most numerous. And as to their component stars, these apparently are of all various sizes—and often even within the same cluster—although some clusters consist mostly of comparatively larger, and some of comparatively smaller, stars. In some clusters the component stars appear to be on an average of a considerably lower order of size than in others. These are probably of the order or actual magnitude of our large planets, rather than of stars like our sun. But, as long as their parallax can not be determined with anything like exactness, the actual sizes of these component cluster-stars must remain very indefinite.

On this point Charles Young had this to say: "Forty years ago the accepted view was that the stars composing the clusters are no smaller than ordinary stars, and that the distance of the star-clusters is immensely greater than that of the isolated stars. . . . It is now, however, quite certain that the other view is correct,—that star-clusters are among *our* stars and form part of *our* universe. Large and small stars are so associated in the same group in many cases, as to leave us no choice of belief in the matter. It is true that as yet no parallax has been detected in any star-cluster; but that is not strange, since a cluster is not a convenient object for observations of the kind necessary to the detection of parallax" (*General Astronomy,* p. 503).

What is true of the star-clusters is equally true of the many nebulæ scattered up and down the zones of space with increasing number, as we follow them from the galactic equator

toward the galactic poles. The distribution of these is the reverse of that of star-clusters. While the clusters are more frequent in the galactic belt, the nebulæ are most numerous toward the galactic poles.

These nebulæ used to be considered as different from star-clusters only in being much farther away from us. And the fact that they could not be resolved into stars, as some clusters even then were being resolved, was considered as a definite proof of their being beyond star-clusters, and therefore of being universes still further in the infinite stellar spaces beyond our corner of the greater universal whole. The evidence of the spectroscope has, however, precluded all possibility of ever resolving them into separate stars, as they are proved *not to be* stars. While some have somewhat solid nuclei, the spectroscope shows them to be of a highly heated gaseous constitution. And so their frequent association with distinguishable stars, to whose environs they unmistakably belong, proves them also to belong to our system. And, therefore, astronomers have also quite generally abandoned the idea of associating them with regions beyond our own galactic system.

On this point also we shall quote Dr. Young: "Attempts have been made to measure the parallax of one or two, but so far unsuccessfully. Still it is probable, indeed almost certain, that they are at the same order of distance as the stars. The wisps of nebulosity which photography shows attached to the stars in the Pleiades (and a number of similar cases appear elsewhere), the nebulous stars of Hershel, and numerous nebulæ which have a star in the centre,—these compel us to believe that in such case the nebulosity is really at the star" (*Ibid.*, p. 509).

Thus the later and maturer conclusions of astronomers, instead of enlarging the bounds of our universe beyond the calculations based upon its earlier and more fragmentary discoveries, have rather greatly lessened its bounds.

But is it not possible then that there may be stellar systems beyond our own galactic system? What we are denying is not their *possible existence,* but the existence for us of any *positive evidence* for their existence. There surely is not even any circumstantial evidence anywhere up and down the depths of space in proof of other stellar systems, or outer universes. The

coal sack theory, or any theory of supposed discernible ulterior systems, any theory of dark or invisible systems, can surely not truthfully be said to afford such evidence. Indeed, supposedly dark universes would even be scientifically impossible, according to the very theories which men of science universally accept. Therefore, if stellar systems beyond our own do exist, unless altogether isolated from all almost infinitely distant association with our own system, their apparent optical concentration upon a space almost like a point, should surely make their aggregate light sufficiently strong for transmission into and through our system.

But, even if this were so, it would not alter our conclusion. For, then, each of the far-off universes, appearing like a veritable concentrated point of light, might be treated in a further development of our argument from even *its* light for a finite universe, as though it were a *single star* of an immeasurably higher order. And then, by applying to such supposed widely separately stellar systems—or *apparent* single stars or points of light—our argument above for *one continuous* stellar system, it should readily be seen that it would by no means require an infinite number and extension of such *stellar systems* to make the whole heavens blaze even from *them* like a solid vault of light.

The above argument would even be equally applicable to any number of even such supposed superior universes. Hence, no matter what number of even still *higher* universes of such superior universes there might be, that number would still be finite, when, at any one point within it, it would blaze like a solid ensphering sun. Hence, as the heavens do not thus blaze with light, the ulterior universe of such a supposed multiplicity of higher universes—or of any number of successive *orders* of them, one within the other, or constituting one another in their order—however regarded, could not be infinite, either in its number of stars or in its extension.

However, of such transmitted light from such far-off stellar systems, or systems of systems, we have no evidence whatever. But, it might be contended that between such stellar systems there might be no transmitting medium like our ether. But, then, this would seem to be contrary to all our conceptions of some ultimate unity in all existence. Moreover, the very conception of an empty void unfilled even by ether, or

something analogous to it, is almost as abhorrent to the mind of man as it used to be thought to be abhorrent to the nature which that mind contemplates. Such absolute space vacuity is as impossible to human conception as it is totally contrary to nature. Surely, no one should seriously consider the possibility of such a void of space. Nor have men of science and philosophers taken to such a view. As this point has therefore no significance, we need not further discuss it.

Suppose, however, that there were such stellar systems, or universes of them beyond our own, either so far away that even their mighty expanse would be to us mere points of light too small ordinarily to become perceptible from our far-away system, or that they be totally isolated from our own system and from one another by the absence of a light transmitting medium between the systems, even that would not invalidate our conclusion, that the universe must be finite. Even though the universe were so much greater and more wonderful than is apparent from our insignificant corner of it, and even inconceivably greater than man's wonderful mind could grasp if it were multiplied myriad-fold in its powers, even then such systems in their aggregate could not be infinite. However numerous, separately mighty and widely separated, such systems, or systems of systems, or universes within universes of succeeding orders, might be, together constituting what would then have to be called *the universe,* even these could not fill an infinity, any more than they could constitute an infinite. But, why speak even of *filling* or *constituting* an infinite? An infinite could no more be spoken of as *constituted of parts* than it could be spoken of as being *filled,* as an infinite could surely never be filled.

Indeed, the mass of what we call matter of such an ulterior universe would still be almost inconceivably less in extent than the space it would occupy, as we shall show. And, what is equally to the point, no *number* of such *system-spaces,* any more than any number of such systems of stars, however many and however extensive each one might be, could constitute an infinite. And, therefore, our conclusion still stands secure; namely, that however great the universe might be or might even be *conceived* as being, it would still have to be finite. And thus we arrive at the same conclusion at which

we arrived several times before by different lines of reasoning; namely, that the universe cannot be eternal, and that therefore it must have been created.

We have thus seen that the physical universe must necessarily be finite, however inconceivably vast might be its mighty stretches of multitudinous contiguous or vastly separated component systems or so-called universes of stars. And, if the universe were thus vast beyond all human comprehension, while it must yet remain finite and therefore a creature, who could comprehend the greatness of its supreme Creator! Indeed, as the universe must thus, however conceived, necessarily be finite, the greater, mightier and more wonderful it might be conceived as being, the more imperative, if that were possible, would, in a sense, be the need of an absolute spiritual Personality back of it as Creator and Sustainer. And thus every argument for an extension of the universe on the part of some men who would deny the existence of its supreme Creator, is inadvertently an emphasizing of the *necessity* of His existence and, at least in a tangible manner, a magnifying of His greatness. Thus, the very attempts, on the part of such men, to reason God out of existence, is overruled to the glorifying of His sublime Being.

And yet, as we have seen that that Creator must necessarily be eternal and absolute, and infinite in power, wisdom and all other attributes, such a conception of Him as would be afforded by even such a vastly greater universe than the one we know, would not be an exaggeration of His true greatness. Indeed, it would no more afford even a real measure of Him than any finite unit of measure could be made to be the measure of the infinite and eternal, as already seen.

And, for that matter we do not altogether deny the *possible existence* of such star-systems or so-called local universes beyond the one known to us, as we can surely not measure or set limits to the possible creation of an infinite God. Indeed, we have even assumed their *possible* existence elsewhere in this volume. And, to be sure, their existence would only enhance our wonder before such unspeakable magnitudes and complexities of the stellar systems that would thus constitute the ultimate universe. And it would naturally only enhance our admiration, and instinctively impel us to even profounder

adoration, of its infinitely more wonderful and infinitely greater (if that were possible) Designer and Creator than we had supposed—whose existence, from these very considerations, must be more certain than that of the universe itself.

What, then, would man be in the presence of such vast magnitudes of creation and before such an infinite Being! His existence is indeed but a point, both as to space and as to time, in the presence of the existence in time and space of the mighty vistas of the wonderful universe of which he is but an infinitesimally small part. And in the presence of the only infinite and eternal Being Who created that universe, man is as *nothing*. The Russian poet G. R. Derzhavin (1743-1816) beautifully and reverently expressed a comparison between man and the universe and their infinite Creator God, as follows:

"Yes! as a drop of water in the sea,
All this magnificence in Thee is lost;
What are ten thousand worlds compared to Thee?
And what am *I*, then? Heaven's unnumbered host,
Though multiplied by myriads, and arrayed
In all the glory of sublimest thought,
Is but an atom in the balance, weighed
Against Thy greatness—is a cipher brought
Against infinity! What am I, then?—Naught!"

And, indeed, if mere magnitude were the only measure of man, he would truly be a totally negligible quantity in the universal whole of existence. But there is another element that enters into the measure of man's being, and this gives him a stature of truly sublime greatness. And, thus, as if to correct the conception of man as expressed in the verse already quoted, in the light of this element that makes for his lordship over nature, Derzhavin continues, as follows:

"Naught!—But the effluence of Thy light divine,
Pervading worlds, hath reached my bosom too;
Yes! in my spirit doth Thy Spirit shine,
As shines the sunbeam in a drop of dew.
Naught!—but I live, and on hope's pinions fly
Eager toward Thy presence; for in Thee

I live, and breathe, and dwell: aspiring high,
Even to the throne of Thy Divinity.
I am, O God, and surely Thou must be!"
(*Translated by Bowring.*)

Thus man, in spite of his apparent littleness before the universal whole of creation and its Creator, is in another sense greater than the universe of matter which he as yet only feebly tries to contemplate. He is a conscious personality, in faculties even more wonderful than his universe environment. Even apart from the Scriptural conception which inspired the words of the Russian poet—of a being with a soul created in the very image of his Creator—man's existence is in a sense even more wonderful than the universe. He is, even after the order of nature—as far as our observation extends—the crown of nature, or, we might say, nature's uncrowned lord. In his mental grasp he seems destined well-nigh to hold the universe. His mental and spiritual potentialities who can measure! What intellectual conquests he will yet make who can even conceive! Suggestive, indeed, are the following words of one whose appreciation and measure of man, although viewed as a being in ruins, are second to none, "What a piece of work is man! How noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god!" (Shakespeare: *Hamlet,* Act II., Scene II.)

We shall now pass on to the consideration of another point in our demonstration of the finiteness of the physical universe; namely, the necessary finiteness of its aggregate matter.

VII THE AGGREGATE MATTER OF THE UNIVERSE NECESSARILY FINITE

The material universe, in its last analysis, is, according to the prevailing testimony of scientists, composed of infinitesimal particles, called molecules, atoms, electrons. These, however small, are nevertheless integers; and, however many, their number must necessarily be finite. There can be no *infinite number* of integers, for such would be a contradiction in terms.

A number, however great, always remains finite. So there can be no infinite aggregate of individuals or integers, however large the individuals or integers. An integer or individual (or any number of them) times any number, or number of numbers, of them, can never produce an infinite. And this is as true of stars or suns as of atoms and electrons, as stars or suns are themselves only aggregations of atoms and electrons; and no *number* of such aggregations of individual atoms or electrons can constitute an infinite any more than the individuals themselves.

Furthermore, if the number of integers or of the ultimate infinitesimal particles, were infinite, there would be an infinity of different compounds. And, in the light of the electronic division of matter, or any further possible subdivision, there would then also have to be an infinite number of the so-called elements. And the same would be true if the *divisions* of matter were infinite, or if matter were *infinitely divisible.* But this, again, would involve the manifest contradiction that the infinite number of compounds—or elements—would necessarily have to be less in number than the infinitesimal particles that composed them. An infinite number less than another infinite number would not only be a contradiction, but it would be a mongrel absurdity! And if this number of compounds or elements were not infinite, while the number of infinitesimal particles were infinite, we should have a finite composed of an infinite in combination, which would also be an absurd impossibility. Hence, the number of infinitesimal particles that enter into combinations to form the material universe, as also the divisions of matter, must necessarily be finite also upon the basis of this evidence, and even measurably limited.

Again, if the material universe were infinite, there would have to be an infinite number of stars, as well as an infinite number of electrons or ultimate infinitesimal components. Or, as both their numbers would be infinite, there would have to be as many stars as electrons. But this is so manifestly contrary to fact that it requires no argument to prove it to be so. Hence, even though there were an infinite number (if that were possible) of infinitesimal component particles in all the stars, there would necessarily have to be a finite number of stars, as their number would be inconceivably less than that of their com-

ponent particles. But, if the number of stars is thus necessarily finite, so also must be that of their component infinitesimal particles, as the constitutive particles of a finite can no more be infinite in number than they can be infinite in aggregate mass. Hence, the material universe must be *finite in mass, in number of stars, and also in the aggregate number of infinitesimal constitutive particles.* The above reasons, as also others given in this volume, not only prove the material universe *by nature* to be a finite entity, but they also prove that to assume it to be infinite would involve contradictory absurdities. Indeed, a finite universe alone finds its complementary counterpart in human reason. Thus observed *finite* material nature alone matches the observer's *finite* mind, with which it is in *necessary correlation;* and both must therefore be the necessarily finite creatures of the same transcendent infinite creative Mind, or Spiritual Personality.

It is true that we cannot conceive of a number above which no other number could be conceived, nor any space or magnitude beyond which no other space or greater magnitude might be imagined. Nor can we conceive of any divisions of space or number beyond which no other divisions might be conceived as possible. But to say that this mental concept of possible space or magnitude and number is necessarily a proof that these must therefore in themselves be unlimited or infinite, is far from proving them to be so, as already indicated. Thus, in the old problem in so-called *Infinite Series,* "If a crab should crawl half the distance back to his pond in one hour, and half the remaining distance the second hour, and half the distance still remaining the third hour, etc., would he ever get there and when?" surely no one would be ready to declare that, as a practical fact, he would never get back. And yet, theoretically one might contend that one-half of the remaining distance would forever remain. And, indeed, theoretically one might almost go to the extent of contending that, as there would be apparently an infinite number of these successive halves, their sum, or the entire distance back to the pond, would itself be infinite. Thus, theory must not be stretched to the absolute nullifying of facts. And, in the light of what has already been shown as to the probable limits of the physical universe, our cumulative proof for its finiteness makes that finiteness practically a physically verified fact.

Moreover, to try to explain away space, as well as time, as only subjective conceptions, and therefore only appearances, as was attempted by Kant, is to do so in the face of that other source of knowledge; namely, experience. Though we know space only by relations, those very relations necessitate its postulation. But more of this later.

We have now considered the extent of matter as an entity by itself, and have shown that, by its very nature, it must be finite in quantity. Nor does the extent of space directly concern us in this connection. As far as it affects matter, space might be either finite or infinite. But when we compare the extent of matter with that of space, it will become at once very apparent that matter at least must be finite. Indeed, the very fact that matter occupies space, proves it to be less in extent than space, whether space be regarded as finite or as infinite. And thus, if space be finite, it should need no proof that matter must be finite, as its extent must be even less than that of space. And, for that matter, even if space were infinite, matter would have to be finite, as otherwise we should have two infinite extensions, one of which would be less than the other—a manifest impossibility or even absurdity. But, for the present, we shall not assign limits to space, so that our argument for the finiteness of matter may not even be open to any objection along this line.

It seems somewhat strange that even some otherwise clear thinkers apparently overlook, or ignore, the manifest contradiction between the conception of infinite space and that of an infinite quantity of matter or of an infinite number of stars or systems. And yet, unqualified contradictory statements as to these two entities are very frequently met with, in the writings of men who hold to the theory of an infinite and eternal universe. In quite a recent work, after giving an elaborate argument for an infinite universe, with an unlimited number or an infinite distribution of stars throughout infinite space, the writer closes his chapter on the *Extent of the Physical Universe* with the following words: "The writer has deemed it necessary to make this brief review of the evidential facts in favor of the view that there is no limit to the distribution of the stars through space, because it is upon the assumption that there is such an unlimited distribution, that

the hypothesis for the genesis of matter, which he proposes to present, is predicated" (Erwin: *The Universe and the Atom,* pp. 121-122). And yet, this author takes up at the very beginning of the next chapter, the discussion of space and matter within the bounds of our solar system, saying that the space of our solar system "would be 174,000 [which should be 174,000,000,000] times greater than" the volume of its matter.

An unlimited number of stars, or an infinite *distribution* through infinite *space!* How could there be a *distribution* of an *unlimited* or an *infinite* within an infinite. How could there thus be two infinites, the one almost infinitesimally smaller than the other! Moreover, if matter and space were both infinite, they would even be mutually exclusive—either all empty space or all space-filling matter. At any rate, a theory according to which an *unlimited number* of stars, or an infinite quantity of matter, would supposedly be *distributed* through an *infinite* space, must surely imply a strange conception of what constitutes an infinite!

We have just stated that the conception of an unlimited number of stars—or an infinite mass of matter—distributed throughout an infinite space, would mean the placing of an infinite *within* another infinite. And yet, that contained supposed infinite would then be almost infinitesimally smaller than the containing infinite.

Let us now go back to our conception of the universe as composed of concentric spheres around our sun, and let us consider the average density of distribution of the stars to be such that a space equivalent to that of a sphere with a radius of 300,000 times the distance of our sun from us, or 27,900,000,000,000 (279×10^{11}) miles, would contain one star. Let us also regard the average star to have a radius of 500,000 (5×10^{5}) miles.

Now, let V = the volume of a single-star sphere,
R = the radius of a single-star sphere (279×10^{11} miles),
v = the volume of a star,
and r = the radius of a star (5×10^{5} miles).

Then, $V : v :: R^3 : r^3$;

or, $r^3V = R^3v$.

Hence $V = \frac{R^3v}{r^3}$

Substituting values of R and r (279×10^{11} and 5×10^5),

$$V = \frac{(279 \times 10^{11})^3 v}{(5 \times 10^5)^3}$$

$$= 173{,}741{,}112 \times 10^{15}\ v.$$

Hence, the approximate average space that is inhabited by one star, upon the basis of the uniform distribution indicated, is 173,741,112,000,000,000,000,000 times that of the volume of the star itself. This would, of course, also be approximately the number of times the space that constitutes the habitation of our solar system is greater than the volume of our sun with all its planets. It is thus readily seen, upon the basis of the approximately determined distribution of the stars, and allowing for a good size for a star, that the universe of space for our whole galactic system would be $173{,}741{,}112 \times 10^{15}$ times the volume of the condensed universe of ponderable matter. And this assumes even that such *average* distribution of stars continues as far as their bounding space, which is contrary to fact, as already noted. How much more vastly greater, therefore, the space itself of the known universe is than the matter it actually contains, it would be difficult to estimate. What vast volume of space is thus unoccupied by ponderable matter!

What vaster volume of space would that then have to be that could contain as many stars, upon the *same basis of distribution,* as would be equal to the number necessary to cover every point of the ulterior sphere of stars and cause all heaven to blaze with light like that of a solid sun-studded globe! However, that space would also be $173{,}741{,}112 \times 10^{15}$ times as large as the space occupied by the aggregate mass of all the stars. But even this imaginary universe-space would still be finite. Then, surely, again we say, if the universe-space inhabited by stars, however numerous and far extended, must be inconceivably greater than the mass of all the stars, and yet is not infinite, much less so could the number and aggregate mass of all its contained stars be infinite.

And, of course, upon the supposition of an indefinite number of mighty star-systems beyond our own galactic system—if such existed—the relative difference between the mass of the *combined* systems and the *continuous* space occupied or inhabited by them all, would be even immeasurably greater than the relative difference between the mass of our (or one) system and the space it inhabits, as determined above. For, upon the very hypothesis of such existing systems, there would have to be vast stretches of void spaces between them, even inconceivably greater than that actually occupied or inhabited by the relatively small multitudinous systems of stars like our galactic system, which constitutes the known universe. And, if the amount of containing space of our galactic system is approximately $173{,}741{,}112 \times 10^{15}$ times its contained matter, how immeasurably many times relatively greater would the containing space of these supposed vastly multiplied, and even much more vastly separated, star-systems, have to be than the aggregate mass of all the systems contained within what would then constitute the universal whole!

It should, therefore, surely require no further argument to prove that—even though it were granted that space is infinite—the number and distribution of the stars, and therefore the amount of their aggregate mass, can certainly not be infinite—whether there be one or many systems, or so-called universes, contiguous (or continuous) as to space, but enormously separated as to unitary star-systems. And, of course, upon the basis of many systems, this supposed infinity of mass would relatively even be immeasurably reduced. What, then, becomes of the supposed infinity! *Matter, therefore, is finite in extent.* How about *space?*

VIII THE EXTENT OF THE CONTAINING SPACE OF THE UNIVERSE

We are not ready to concede that even space is infinite. On the contrary, we cannot conceive of a *void* in outer space. Surely, if space were infinite, we might well suppose that, in accordance with the old adage, it would no less abhor a vacuum beyond the stellar universe than within it. Here it is at least totally filled with ether—as every evidence indicates—where it is not occupied by ponderable matter. And

thus we are forced to the conclusion that beyond the universe of stars, as far as space extends—if indeed it extends any considerable distance beyond—all space must also be occupied by either ponderable matter or ether, or something analogous to them. And, therefore, even if there were ulterior so-called universes, occupying a supposed continuation of space, the immense stretches of space between our universe and them, as well as between one another, would also be thus occupied. Hence, their existence would have to be manifest to us by some light transmission, as we have also shown above, unless perchance their history did not extend backward over a period sufficiently long for such light transmission. This is, however, contrary to the very contention of men who hold to the belief in an infinite universe, for they as strongly affirm it also to be eternal. And thus such an argument for an infinite universe, namely, that the light from such supposed far-off universes of stars could not yet have reached us, would be tantamount to an acceptance of our conclusion, that the universe is not eternal and that it must therefore have been created.

But, even if there were any number of such universes beyond our own, whether knowable to us or not, the space occupied by them would not be infinite, as we have shown. And, moreover, if there were any conceivable or inconceivable stretches of ether-filled space beyond the universe of stars, or even beyond the bounds of any succession or multiplication of universes, even such stretches of space would not be infinite. For, such ether can by nature not constitute an infinite, because of its necessarily granular nature, as we shall show in our next chapter; and, therefore, the space it would occupy could also not be infinite. Hence, it must follow also that even such ether-filled space beyond all possible universes of stars or matter, together with the space occupied by such universes of matter, could not together constitute an infinite entity. As such totality of space would yet be filled with matter and ether *together,* and as neither matter nor ether can be infinite, so space as occupied by them cannot be infinite. Surely, two finites cannot together constitute an infinite.

But it may be contended that we have ignored the vast aggregate of the interspaces between the particles of the ether that pervades the universal whole of space. To this we can calmly reply that this would not alter the above conclusion,

as the aggregate of these interspaces must also be finite. This finite aggregate of supposedly unoccupied interspaces between the ultimate particles of the universal ether, would only add a third element in the totality of space, which would then have to be conceived of as occupied by, or made up of, the finite space occupied by the aggregate of ponderable matter, the finite space occupied by the aggregate of the ether particles and the finite aggregate of interspaces between the ultimate particles of the ether. And, hence, the totality of space would yet remain finite, as no three finites can constitute an infinite. And this, again, conversely, should be an added proof that neither matter nor the ether nor the interspaces between the ultimate ether particles can alone be infinite, as they together occupy space. And this would even be true if space itself were actually infinite, as any one of them must necessarily be less in extent than the space they together occupy.

After all, however, as elsewhere noted, space is not itself an independent separate entity; but it is rather the expressed *relation* between material bodies. And, as for spirit or mind, to such there can be no space occupancy or space relation, such as we speak of with reference to matter. But, even regarding space as an existing separate reality, would it, even, considered apart from matter and ether, necessarily have to be infinite? Thus, even if space thus conceived extended indefinitely beyond the universe of stars, or even beyond the supposed all-comprehensive universe of universes, all beyond unfilled with either matter or ether, or even anything analogous to them—if such were conceivable, or, for that matter, if such were inconceivable—could even such *extra*-universe space added to the aggregate universe-space be infinite? Even the argument above would here also in its essential elements be applicable, that such aggregate space would have to be finite. It is indeed true that we cannot conceive of it as having an *end*. But, then, no more can we conceive of it as having *no* end. And, for that matter, our conception of space, or our ability or inability to *conceive* of it either as ending or as not ending, does in no way affect or determine the *reality* or *truth* of this matter.

The old Euclidean conception of an absolutely three-dimensional space has for a long time been called in question. Our minds are so constituted that, for our thinking, three-dimen-

sional space seems to be a necessity. But, then, does that limit space to these dimensions? Are not our minds correlated to the part of nature in which they operate, and may not this part of nature but faintly illustrate nature's greater and far more complex whole? As, to a man without the sense of sight there would be no light and no color, and to a man without the sense of hearing there would be no sound, so to any being without the corresponding sense-organs there would in so far be no physical environment. Thus, the environment is known in a natural way only in so far as it is met by the necessary attuned or adjusted sense-organs. And, as these physical sense-organs must necessarily be matched by their counterpart in nature, so must they be adapted also only to their locus in nature. And, where there are realities that do not constitute, either in whole or in part, the locus of our sense-organs—or to which these are not adjusted or attuned—these realities upon a merely natural plane of contact—if indeed there could be such—would, for a person without these necessary organs or senses of apprehension for such to him transcendental realities, have no existence.

Moreover, who can *deny* the existence of space-dimensions, or other space-realities, other than those for which our physical sensorium has senses of apprehension, because not necessary for our existence and activity in the little confines of nature in which we have our present natural transcient being? And, of course, where there are no senses of apprehension, there can be no experience or contact with such transcendental realities. And, where there is no experience, there can not even be a consciousness of them. And, where experience, and through it consciousness, can afford us no data for such realities, there even the true *conception* or *imagination* of such realities would by nature be impossible, as even these ultimately go back to experience. Hence, such realities of space-dimensions, if they do exist, can have no natural existence as far as we are concerned.

Moreover, as Jules Henri Poincaré so suggestively pointed out in his two works, *Science and Hypothesis* (1905) and *The Foundations of Science* (1913), there is a real sense in which even the axioms of geometry are only conventions for practical use. He showed that Euclidean geometry is no more absolutely true than any of the non-Euclidean systems of

geometry, but that it is the one in practical use because it is better adapted to us in our present physical environment. Thus, Euclidean geometry best fits in with developed human experience. By this, the great French mathematician implied that ancestral experience might have been such as to have made present human experience equally fitted to some other system. And, indeed, he contended that it is quite possible to conceive of a world so constructed or constituted that Euclidean geometry would not be the simplest and most advantageous. Thus, an indefinite number of logical and self-consistent systems of geometry have been shown by Reiman and others to be possible, as also altogether different conceptions of space and space-relations.

Among other eminent men of science who were inclined to accept the possibility of a multidimensional space was the astronomer Simon Newcomb. In discussing some of the conclusions of non-Euclidean geometry, he makes the following statement: "Although two straight lines, when continued indefinitely, do not appear to converge even at the immense distances which separate us from the fixed stars, it is possible that there may be a point at which they would eventually meet without either line having deviated from its primitive direction as we understand the case. It would follow that, if we could start out from the earth and fly through space in a perfectly straight line with a velocity perhaps millions of times that of light, we might at length find ourselves approaching the earth from a direction the opposite of that in which we started. Our straight-line circle would be complete. Another result of the theory is that, if it be true, space, though still unbounded, is not infinite, just as the surface of a sphere, though without any edge or boundary, has only a limited extent of surface" (*Side-Lights of Astronomy,* p. 159). He then proceeds to show that, according to this theory, if the earth were conceived of as growing larger and larger in all directions with a velocity millions of times that of light, it would at length fill all existing space, as it would be closing in upon and meeting itself—which would, of course, have to be true of it on all sides.

It is interesting to note that the astronomer Sir Robert Ball came to similar conclusions. His statement upon this point is as follows: "I may . . . say that it can be demonstrated

that all known facts about space are reconcilable with the supposition that if we follow a straight line through space—using for the word straight the definition which science has shown properly to belong to it—then, after a journey which is not infinite in its length, we shall find ourselves back at the point from which we started" (*In the High Heavens,* p. 250). Again, he says: "Space is thus clearly finite; for a particle travelling in a straight line with uniform speed in the same direction is never able to get beyond a certain limited distance from the original position, to which it will every now and then return" (*Ibid.,* p. 251).

Our point here, then, is, that if the principles of hypergeometry, or so-called non-Euclidean geometry, are true—and surely they cannot positively be disproved—then our conclusion that space is finite, and therefore all the more so also that the universe of matter is finite, must stand. One of the deductions from *multidimensional* space is, of course, that such space itself is finite.

But, even if the *three-dimensional* space were the only space-reality, even that would not necessarily make space infinite. And, of course, whatever theory of space we adopt, the *universe of matter,* as already shown, is necessarily, and only too evidently, *finite.* Space can be conceived of as added and subtracted, divided and multiplied, as having a before and an after, as divided into concentric spheres—as we have done for the presentation of some of our proofs for a finite universe. And reason would demand that any such entity cannot be infinite. That which can be added and subtracted, multiplied and divided, cannot be infinite; for, as already seen, no addition or multiplication of parts can make up an infinite. Nor can an infinite be subtracted or divided; for, if so, each part, as it would necessarily have to be less than the whole, must be less than infinite. And thus, after such division, we should have left a number of finite parts which together would supposedly constitute an infinite. This, of course, is impossible, or contrary to ascertainable fact or truth. And this reasoning would, of course, apply to the universe as divided into concentric spheres, as we conceived of it. Indeed, what can truly be *conceived* of as divisible or subtractible cannot be infinite; for no number of such conceivable divisions or subtractions can constitute an infinite.

Thus, if space were conceived of as infinite, we should have an infinite number of its parts, which is impossible; or an infinite *before* and an infinite *behind,* an infinite *above* and an infinite *below,* thus multiplying infinites, which would be contradictory. Hence, even containing space is no more infinite than is contained matter. Indeed, the very nature of *relation between* material body and material body, no less than the very nature of *materiality,* is itself a definite proof of finiteness. Therefore, *the physical universe of both space and matter, no less than matter or space considered separately and alone, is finite.*

Thus, as we believe we have proved in this and the preceding chapter, the physical universe is a *finite* and *dependent* entity, as indeed no physical entity could be infinite and absolute. And, for that matter, finiteness and dependence are necessary correlates, so related that the one, in the nature of the case, implies or involves the other. Thus, what is finite must be dependent, and what is dependent must be finite. And as the physical universe is finite and dependent, it cannot be self-existent and absolute. Hence, it must necessarily have been brought into existence by a preexistent cause, and can therefore not be eternal.

Some entity must, however, necessarily be eternal and self-existent; and indeed only an eternal entity can be self-existent or uncreated. Hence, such a self-existent, or uncreated, and eternal entity must have existed before the universe. And an eternal and self-existent entity must of necessity also be infinite and absolute. And only such an infinite, absolute, eternal, and therefore necessarily self-existent, entity could be an omnipotent cause. And as, in the very nature of the case, there could be only one such entity or omnipotent cause, that alone could have been the ultimate creative cause of all other existence, and therefore of the physical universe. And that absolute, eternal, infinite, self-existent and omnipotent cause that created it, with all its potentialities, must necessarily thus either directly, or indirectly through the agency of those imposed potentialities, still sustain it.

But, for reasons already cited, such a cause could not be a material or physical entity, as a material or physical entity, as also conclusively proved, would necessarily have to be finite,

and could therefore not be self-existent, eternal and absolute. Hence, such an omnipotent cause must necessarily be an immaterial, or what we call a *spiritual,* entity. And, indeed, to such a spiritual entity alone there can be no *before* and no *behind,* etc., as, for that matter, no space relations whatsoever. A spiritual entity alone is indivisible.

And, moreover, as will even more clearly appear in the later chapters, that infinite, eternal, absolute, self-existent and omnipotent spiritual entity that is the ultimate cause of the physical universe—which is the same as saying, *the one and only Supreme Being*—corresponds to God the Creator and Sustainer of all things, revealed in the Scriptures. And Him therefore both the man of science and the man of faith alike should worship. And, as that infinite creative cause revealed in nature and the God of the Scriptures are one, so ought also the man of science be a man of faith.

It can, therefore, truly be said, as will become even more apparent from what is to follow, that the unanswerable testimony of science, instead of making against a supreme creative Deity, really establishes the necessity of His existence. In the words of the eminent man of science and Christian apologist, Dr. G. Frederick Wright, as found in his discussion on *Genesis and Science,* "From every quarter, unexpected light is breaking in upon us from apparent darkness. The strength of the evidence of the truth of the historical statements in the Bible is, therefore, not diminished, but rather is increased, by modern scientific investigation" (*Scientific Confirmations of Old Testament History,* 1906, p. 385). There is thus a real sense in which established science is the unconscious handmaid of religion. But without further anticipating our later and fuller discussion upon this point, we shall proceed to the consideration of additional evidence; namely, that from the physically temporal nature of the universe.

CHAPTER VI

EVIDENCE FROM THE PHYSICALLY TEMPORAL NATURE OF THE UNIVERSE THAT IT HAD A BEGINNING AND THEREFORE THAT IT WAS CREATED

In the last two chapters we showed, from the inherent dependence of the material universe, in part and in whole, and from its very nature as an aggregate of individuals and as a cosmic whole, that it must be finite and therefore temporal, and therefore that it must also be a creature. We shall now proceed to show also from its nature as a *cosmic unity of gradually declining forces,* that it is not an eternal existence. The establishing of this fact will still further add to the unanswerable cumulative evidence that the physical universe is not self-existent, and that it must therefore have been *created in time out of nothing.*

I A UNIVERSAL PARALYSIS IN NATURE IMPENDING

As science attaches great importance to the doctrine of the so-called dissipation of energy, amid its correlation and apparent conservation, let us see how this scientific doctrine throws light upon our subject.

1 APPARENT DISSIPATION OF ENERGY AND ITS INEVITABLE RESULT

It is now generally held by scientists that all forms of energy have a tendency to be converted into heat, and that this heat, either directly or indirectly through applied power or work, is as constantly radiated into space, and is therefore apparently lost. Clausius, in his mechanical theory of heat given to the world in 1850, considered this radiated and dis-

tributed heat energy as *turned inward,* which suggested to him the name *entropy.* As this tends toward a maximum, real energy, or energy available for further work, as we know it, would reciprocally tend to cease. Thus, as the total heat in the solar system is necessarily finite, it must finally become wholly equalized or apparently lost. And, therefore, the sun itself must grow dim with age until it will be extinguished in endless night, while all life and motion must end in irrevocable stagnation and death.

And, what is true as to our solar system must necessarily be true as to any other system, because all are finite. And, as the total heat in each finite system is finite, the sum total of the heat of all systems must also be finite. As already shown, no number of finites, either of systems or of their quantities of heat, can constitute an infinite. Thus, what is true of our solar system and of every other system, must also, by interstellar radiation and apparent dissipation, be true of the universal whole. It, too, after countless ages of dissipation and equalization of cosmic energy, must end in irrevocable paralysis and death.

The inevitable result of this dissipation and equalization of energy is acknowledged even by many scientists who nevertheless hold to the theory of an eternal universe. Svante Arrhenius, in order to escape this altogether natural conclusion as to the end of the present order of nature, however, suggests his theory of the degradation and elevation of the supposedly ever divided energy of the universe, as follows: "The way out of this difficulty which I propose comes to this: the energy is 'degraded' in bodies which are in the solar state, and the energy is 'elevated,' raised to a higher level, in bodies which are in the nebular state" (*Worlds in the Making,* Preface, p. XIII).

That this is only an assumption, need not be emphasized. Moreover, in what follows will be seen its total invalidity as an argument for an eternal and uncreated universe.

We are, of course, reminded, that, according to the law of conservation of energy, no energy is supposed to be really lost. The apparently lost energy is supposedly only being transmuted into heat; and as heat it will presumably still be equivalent to the sum of all the forms of energy thus transmuted. It will supposedly still theoretically exist as energy;

but it will be dissipated for further work, as far as can be known. In quantity, it is held, it will still be the same, but only in serviceability or availability will it supposedly have vanished.

And yet, even this would nevertheless mark the end of at least the *present* physical order, when, like a mighty clockwork, it will have come to a final stop upon being run down —from which, according to the law of inertia, it can not start nor rewind itself. And also as to the universal whole must this be true. When all the higher available forms of energy will have been transmuted into the lower or unavailable forms, there will be no energy left available to retransmute this at least apparently lost energy back into actual or available energy again.

This important truth was apparently clearly seen by Peter Guthrie Tait—an authority on the conservation of energy—as is evident from the following words: "Thus the energy of the universe is, on the whole, constantly passing from higher to lower forms, and therefore the possibility of transformation is becoming smaller and smaller, so that after the lapse of sufficient time all higher forms of energy must have passed from the physical universe, and we can imagine nothing as remaining, except those lower forms which are incapable, so far as we yet know, of any further transformation" (*Recent Advances in Science,* p. 20).

Even Herbert Spencer could not avoid reaching practically the same conclusion. His words, in virtual accord with those of Tait just quoted, have therefore also considerable weight, as further strengthening our point. He expressed this probability of an end to the present physical order, as follows: "In all cases, then, there is progress toward equilibrium. That universal co-existence of antagonist forces which, as we before saw, necessitates the universality of rhythm, and which, as we before saw, necessitates the decomposition of every force into divergent forces, at the same time necessitates the ultimate establishment of a balance. Every motion, being motion under resistance, is continually suffering deductions; and these unceasing deductions finally result in the cessation of the motion" (*First Principles,* p. 447). And on page 471 of the same work he definitely declares that the fact that the end of all transformation must result in quiescence, "admits of

a priori proof."

Moreover, even if this apparently lost energy should be regarded as the resultant of the ultimate transmutation of all kinetic energy into potential energy, it might with considerable suggestiveness be asked, With reference to what would that potentiality be? This would necessarily suggest an infinite and absolute entity outside the physical universe. But, for all we know, the law of conservation may here break down, the kinetic energy being perhaps in part at least *used up* in "work," instead of being converted or transmuted without loss. This would, of course, mean temporality. Indeed, some phenomena of radioactive substances leave virtually no room for doubt that this is the case. Of this we shall, however, speak later.

2 THIS CONCLUSION NOT ALTERED BY THE THEORY OF STELLAR CONSOLIDATIONS

It has even been held by a limited number of men of science that not only is the energy being equalized by radiation, and therefore practically dissipated, but that even the whole material universe tends in the course of countless ages towards consolidation. Thus, the earth and other planets are supposed to be imperceptibly retarded in their velocities around the sun, by friction in the ether, or by some other cause of some loss of energy in the revolution, so that they are spirally approaching the sun, for further fuel, dissipation of heat and final reconsolidation. So, also, similarly consolidated *systems* are supposed to be drawn toward other systems, until the whole starry universe will have been consolidated and its available energy, for the time at least, equalized or stilled. However, during the process of reconcentration of suns and systems, their successive collisions, it is also contended, are converted into heat for further radiation and for the development of other successive local universes, according to the nebular theory.

Of course, we need hardly say that this is only theory, for which we cannot expect any proof in our present limited state and environment. Whatever data are supposed to be afforded by the researches of physical astronomy or astronomical physics, are after all only isolated facts, for which we may

not yet have any reliable interpretation at all. Moreover, after once the available energy of the universe would be equalized or stilled, if left to itself, the universe could not begin a new cycle of existence and operation. Then, according to this theory, whence the energy or power to revivify, rejuvenate or reenergize a quiescent universe? Here, too, a transcendent power, an absolute Being, must be postulated to make such a theory workable. Herbert Spencer apparently wished such a theory could be established, but he was at least frank enough to declare, "The question whether there is an alternation of evolution and dissolution in the totality of things is one which must be left unanswered as beyond the reach of human intelligence" (*First Principles,* p. 506).

Had Spencer stopped here, he would have remained within the bounds of consistent reason! But then he leaps forward in scientific imagination, or scientific faith, to the declaration that evolutions have filled an immeasurable past and evolutions will fill an immeasurable future, and that the universe must be conceived of as not to have an end and as having had no beginning. Thus, where reason stops or fails, scientific faith or imagination is invoked to fill out blanks in preconceived theories that would make the universe eternal and uncreated, and that would therefore eliminate from it the need of the eternal God.

But, nevertheless, even accepting such a theory of successive evolutions and devolutions, this process, however long continued and however often it might be repeated, would at last spell stagnation and death to universal nature, as no number could measure off an eternity. And, as already intimated, as potential energy and kinetic energy alternate each other in these supposed successive universes, they might ultimately both be lost in the descending work of equilibration, thus ending in a final universal paralysis.

The foregoing should be convincing argument to show that, when all energy will have been stilled, or lost, the material paralyzed cosmos would undoubtedly have to disintegrate, even as the body does when life departs from it. And disintegration would undoubtedly mean annihilation, as we shall show. The energy gone, we could conceive of no necessity for the existence of matter, nor perhaps even of its *possibility,* as we know matter only by its resistance or energy.

3 THE LAW OF THE CONSERVATION OF ENERGY EXAMINED

Even if the sum of all the various forms of energy in a closed or isolated system could be proved to be unchangeable, this would not prove it to be so throughout the whole universe. But, it might be said that the very fact that energy even in a closed system becomes less and less available, would almost certainly indicate that it is being spent in its very work of transmutation and equalization. Thus, the law of the conservation of energy might hold for an isolated system for all *practical* purposes during the comparatively short centuries, but eventually in such a system, as well as in the cosmic whole, break down. As a law it would be applicable in practice within its proper sphere; but beyond that sphere it would not hold.

There is, indeed, a growing feeling among some eminent scientists that the law of the conservation of energy has been accepted upon no better evidence than until recently were the scientific doctrines that matter is divided into some eighty totally different and absolutely untransmutable elements, and that their so-called atoms are indivisible. These once universally accepted scientific doctrines, together with that of the conservation of energy, as also that of the conservation of matter, as great working hypotheses, subserved a great purpose in the development of science. But to allow them to stand unchallenged in the face of evidence to the contrary, would tend seriously to hamper scientific progress.

As far as science had penetrated into the mystery of matter up to less than a quarter of a century ago, there was no evidence against the supposed indivisibility of the atom and the immutability or indestructibility of the great variety of chemical elements. But no longer do men of science think of the atom as the ultimate unit of matter, nor of the so-called chemical elements as necessarily composed of totally different substances. The electron as a common constituent of all atoms, and the monistic nature of matter, have already been elevated above mere theory. We are not, however, now thinking of the Haeckelian monism as the explanation of all existence.

Indeed, our former definitions of matter and energy, especially as distinct entities, according to the latest pronounce-

ments of philosophic scientists, are no longer strictly correct. If the electron is only an electric charge, then so-called matter is nothing but energy. Thus, matter would be only a manifestation of energy, and the variation of the one would be a variation of the other. The cessation or destruction of the one would be the cessation or destruction of the other. Thus, if the very structure, or even the existence, of the atom itself depends upon its electronic motions or its intrinsic energy, then the quiescence of these would mean the ultimate dissolution and annihilation of matter.

A number of authorities have thus come to the conclusion that energy is not indestructible. According to them, the law of conservation of energy is not an established fact, but rather an almost necessary postulate for practical reason. Both science and mechanics imply the application of this law, at least locally for their sphere of operation. But such application for practical purposes in our very limited *here* and *now,* would not make it universal in the greater stretches of space and time. Among those who have not accepted the doctrine of the conservation of energy as absolute are such eminent physicists as M. Bernard Brunhes, M. Sabatier, M. Henri Poincaré and Gustave Le Bon, the first named emphatically rejecting it. Le Bon expresses himself unequivocally as not accepting this scientific doctrine, in these words: *"Energy is not indestructible. It is unceasingly consumed, and tends to vanish like the matter which represents one of its forms"* (*The Evolution of Forces,* p. 99).

However, retaining, for the present, our idea of matter as an apparently distinct entity, is not energy, after all, due only to the moving of matter? Or is not so-called energy only matter in motion? We might thus regard all energy as probably, in its last analysis, nothing but motion or the effect of motion. It is more common to regard energy as that which produces motion rather than as the effect of motion. In a sense, it is really both. So-called energy might be regarded first as having come from the primal arrangements of matter in its elements. Then, by adjustment, there would naturally result motion or energy; and this in its turn would, of course, produce or reproduce motion or energy in related bodies, and so on. But this reasoning at once throws us back upon some ulterior or first cause of both matter and energy.

Whence the primal arrangements of matter by which so-called energy first had its origin? And whence the matter for such arrangements? The only possible answer to these questions must be evident and needs not here be enlarged upon. But can we really separate energy from adjustment and adjustment from matter, chronologically? We may do so logically, but to do so chronologically is impossible.

Thus, a great deal depends upon how a phenomenon in nature is viewed; and important scientific results at times depend upon such view. This possibility of viewing phenomena in different ways is strikingly expressed by Professor Aliotta, as follows: "Had researches into heat been made first, there would have been a tendency to write books entitled: *Motion Considered as a Form of Heat,* instead of those bearing titles such as that of Tyndall's work: *Heat Considered as a Form of Motion.* Hypotheses are the perishable part of science, there is, however, something which lives on as a lasting acquisition; namely, the laws which express the relations between the magnitudes of experience. *Naturgesetze sind dauernd, Hypothesen sind verganglich*" (*The Idealistic Reaction against Science,* Tr. by Agnes McCaskill, 1914, pp. 357-8).

But, to return to our view of energy, we should say that we shall here regard energy, known to us in physical nature, as essentially the effect rather than the cause of motion. Thus, upon this basis, as is readily acknowledged, so-called physical energy is the result of moving molecules or masses. Chemical energy is undoubtedly the moving of electrons from atoms to atoms, and similarly for any conceivable form of energy. Therefore, stagnation or cessation of motion, toward which the universe is unmistakably tending, would mean a real dissipation or loss of energy.

Much confusion as to the nature of energy is no doubt due to a quite current misconception that it is some subtle entity in itself, somehow associated with matter as though it were some mysterious fluid flowing through or among the multiform divisions of matter. From this conception of energy has arisen the somewhat indefinite notion that there is a circulation of energy throughout the universe, now appearing under one form and now under another form, and that these various forms are changeable and transmutable, one into another.

Thus, the ideas of the correlation and conservation of energy took their forms from such a supposed correlation and conservation of matter, as seemed apparent from the nature of matter as far as it was formerly known. But, even this, as we shall see, by a better understanding of the ultimate nature of matter, can no longer unqualifiedly be accepted.

From what we said about energy and motion as now operative in nature, it becomes apparent that, as there must be a cause for the same in physical nature, even after some necessary ultimate or first cause that produced such secondary physical cause, it appears altogether probable that it is due to an adjustment of equilibrium. This is very apparent in the case of energy from the equalization of heat, chemical energy, electrical energy, etc., and as is more and more believed to be the case in gravitation. Thus, when an equilibrium will have been reached, the energy caused by the tendency toward equilibrium will have been spent. And, where equilibrium exists, there can be no energy present until such equilibrium will have been disturbed. And such disturbance must necessarily come from another source. Thus, the tendency toward equilibrium, which is so distinctly manifest throughout nature, would ultimately necessarily end in the actual annihilation of all its energy.

In accordance with this definition of energy, what becomes of so-called potential energy? Has it any existence in reality? Thus, a ball suspended above the earth is in a position, upon being released from which it will produce energy by the force of gravitation. But, while it is suspended and motionless, it has no real energy; and upon its being released, its energy is due only to its position with reference to the earth. The energy developed by its fall is due to the adjustment of equilibrium between it and the earth. And, but for the force of gravity it would even then develop no energy. Moreover, if it could be conceived as dropping to the centre of the earth, or if the earth could be conceived of as a concentrated point, it would eventually come to absolute rest in equilibrium with the earth's gravity. The same reasoning would apply to the solar system, or to the universe as a unitary whole. All energy in the universe being ultimately due to adjustments of positions toward equilibrium, when that final equilibrium will have been reached, all energy will have ceased. A finite uni-

verse in space must therefore necessarily be a finite universe in time.

This, then, brings us to the question as to the primal source of all energy. Suppose we were, for the moment, to accept the theory that in the evolution of the cosmic ether into atoms, etc., all energy was stored up, so to speak, for the evolution of all worlds. Then, all energy, after that primal storing of energy, would be due to a ceaseless adjustment of position toward universal equilibrium. So-called cosmic evolution would thus be due to this *process of adjustment.* In other words, as the so-called kinetic energy in this *process* of adjustment would approach its maximum, due to the releasing of elemental matter in its long process of adjustment, its impulse might be supposed to develop cosmic nature. And with that maximum of kinetic energy the maximum of the evolutionary process would also be reached. Then, as the kinetic energy would again decrease in the *consequent adjustments,* the opposite of evolution, or devolution, would set in and would necessarily be accelerated until, in the final dissipation of energy, the material cosmos would be resolved into its primal ethereal state. The kinetic energy would decrease with these final adjustments. As motion would approach zero, this energy would approach zero. The kinetic energy being $\frac{1}{2}mv^2$, when the v became zero, the kinetic energy would be equal to $\frac{1}{2}mo^2$, or zero.

And, if the theory that so-called matter is nothing but energy, or that matter is only energy cognizable by the senses, were true, or that energy and matter are so related that the one varies directly with the other, then, as v would approach zero, m also would approach zero. Or, as energy would decrease, so-called matter would decrease. Our formula, $\frac{1}{2}mv^2$, would thus eventually become $\frac{1}{2}oo^2$ (equal to zero); or both energy and matter would disappear or pass away. In other words, if all things were only modes of motion, as is held by some physicists, then the resultant equilibrium, or rather quiescence, would mean annihilation of both energy and matter, even without any destructive fiat of a transcendent Deity.

Thus, then, whether energy is really or only apparently lost in transmutation, there will be a final universal paralysis, which in either case will therefore mean the end or death of

the present order of nature, and its undoubted annihilation. The wheels of nature in revolving and rotating suns and planets will cease to move; the mechanical, chemical and vital forces of all worlds will be balanced in mortal equilibrium; and with this stagnation the universe will be dissolved into its elements. And, then, with the disintegration of its atoms by their intrinsic energy, the ultimate energy of the universe will apparently be spent, and its material substratum will undoubtedly pass away. Thus, limitation as to the future is written clear and large over universal nature.

4 THE THEORY OF AN INFINITE QUANITY OF ENERGY CONSIDERED

Upon the basis of a theory that energy is a separate real entity, some men—for example, Herbert Spencer—have suggested that the total energy itself might be infinite, and that this would make possible an endless or eternal dissipation. If that were true, it is contended, then the universe could have no end, nor, of course, could it have had a beginning.

As so-called matter is, however, finite, as already shown, regarding it as the basis or passive substance in which energy operates or acts, that energy for which this finite matter would be the basis would also necessarily have to be finite. This would follow also from the law of secondary cause and effect, as developed in the fourth chapter. Moreover, as energy is quantitative, and can be measured in its various manifestations, it must, upon this basis also, be regarded as finite, for no aggregation or multiplication of measured quantities can constitute an infinite. Therefore, even this suggestion, made in the interests of a possibly eternal, and therefore uncreated, universe, in order to eliminate the need of a Deity, is seen to have no foundation in truth or fact.

Moreover, as to a supposed *eternal evolution,* there would be an inherent insurmountable difficulty. If evolution were external, its end would have to be infinite. Then, what would that infinite product be? Again, if the universe were eternal and the evolution were not eternal, where or when would it stop? Moreover, such a possible end of evolution would be in direct conflict with the preconceptions of these men as to the operations of an infinite and eternal universe. Hence, an

explanation must be found to overcome this difficulty. And such an explanation, apparently satisfactory to himself, Spencer attempts to give in the following words: "Is it possible for the universal metamorphosis to proceed in the same general course indefinitely? or does it work towards some ultimate state admitting no further modification of like kind? The last of these alternative conclusions is that to which we are inevitably driven. Whether we watch concrete processes, or whether we consider the question in the abstract, we are alike taught that Evolution has an impassable limit" (*First Principles,* p. 446).

Thus, one theory must be developed to bolster up another. Eternal evolution would mean an infinite product. That, in accordance with Spencer's own philosophy, would be inconceivable. And an evolution not eternal would mean an end of evolution; and, in the light of the present operations of nature's laws, it would mean an end of nature with her laws. This is a dilemma, either horn of which it would be dangerous to his philosophy to grasp. Hence, a limit must be assigned to the evolutionary process beyond which nature's laws must be either eternally passive, or perchance operative along other lines of evolution, or of devolution for another re-evolution, etc. But where is that limit of this supposed evolution? What or who set its bounds? If nature's laws are supposedly uniform in their operations up to a certain point, why should that uniformity of operation thus at that point break down? Who keeps on recharging the batteries of an eternally cycling universe? Where now is the great law of inertia? But why press further questions! It is enough to say that all this was mere theory even with Spencer himself. And it is, of course, only too manifest that even this theory implies an absolute and eternal Cause at every step. And even then it would not prove the existing universe to be eternal with reference to the future—as already shown—any more than it could prove it to be eternal with reference to the past—as we shall presently see.

Thus, upon whatever basis considered, the physical universe will have an end. And this is the conclusion that is *necessarily* reached, both from its only too manifest *testimony* and from its very *nature*. Thus, even John Fiske was moved to

accept the teaching of the Apostle Peter (II. Peter, Chapter 3) on this point, as definitely expressed in the following words: "The day is to come, no doubt, when the heavens shall vanish as a scroll, and the elements be melted with fervent heat. So small is the value which Nature sets upon the perishable forms of matter!" (*The Destiny of Man,* p. 114). Or, in the words of England's greatest poet,

> "And, like the baseless fabric of this vision,
> The cloud-capp'd towers, the gorgeous palaces,
> The solemn temples, the great globe itself,
> Yea, all which it inherit, shall dissolve;
> And, like this insubstantial pageant faded,
> Leave not a rack behind."
> (Shakespeare: *Tempest,* Act IV., Scene I.).

II A BEGINNING IN THE PAST EVIDENT FROM THE PRESENT OPERATIONS OF NATURE'S LAWS

An application of the principles and facts stated above, also unmistakably points to limitation, or a beginning, in the past.

I EVOLUTION MUST NECESSARILY IMPLY A BEGINNING OF ITS OPERATION

Had the universe—which is necessarily finite, as already shown—existed from eternity, then in the eternity past, or long ago, would the outworkings of its laws have been accomplished. And, therefore, its supposed evolution would necessarily have run its course to a completed universe unassignable ages ago. Surely, the various forms of energy in cosmic nature would long ago have been transmuted into heat; the heat would long ago have been dissipated and equalized, or lost; and that universal paralysis and undoubted annihilation would long ago have taken place. Indeed, if such an evolutionary process had been at work from eternity, it would, countless ages before the advent of man, have resulted in such a being, and indeed in an infinitely more wonderful being. Yea, an eternal or infinite evolution would necessarily have produced infinite beings—veritable gods. But, the heat is

not yet equalized; all energy has not yet been transmuted into heat; man is still immeasurably below the perfect and infinite being that such eternal evolution should have produced; and nature's laws are still at work on their evidently *designed* mission. And, according to these men, the universe is even still developing. This supposed past eternity of evolving worlds, it might almost be said, must thus have begun in even practically measurable or assignable time—which, of course, is an absurdity.

This fact of the beginning in time of the universe, is also the most assured conclusion of science. Thus Simon Newcomb expresses this truth with reference to a star, in the following emphatic words: "The general fact that every star has a life history—that this history will ultimately come to an end—that it must have had a beginning in time—is indicated by so great a number of concurring facts that no one who has most profoundly studied the subject can have serious doubts upon it" (*The Stars,* pp. 223-4). Even Herbert Spencer was compelled to remark, that, upon the theory of the dissipation of energy, etc., there would not only have to be an end of the world or universe, but that there also must have been a beginning.

Thus, as this theoretical process of evolution, etc., has supposedly been going on and is still supposed to be going on, it must have had a beginning in time, when all the potentialities of all its operations were imposed upon inert already created matter—or upon matter in its creation—from an external source, or by some external power. This was, as we should say—if matter and energy be regarded as distinct entities—by the omnific will of Him Who previously had also created matter—or while creating matter—as the substance or medium for the operations of the associated energy. Or, if matter be regarded as only energy manifested, or energy as matter merely in process of adjustment, it was when that matter or energy was thus first spoken into being. Nor could any initial distribution of heat or other energy be otherwise accounted for, not even upon the fanciful theory of any supposed preceding universe or universes, as no number of such could constitute an eternal successive or concatenated entity. Thus, even though such a theory of evolution were true, yet nevertheless our explanation of the origin of matter and energy—or of

matter *or* energy—would alone satisfy reason, even as it alone could satisfy the human heart.

If such a theory of evolution were true, even then God would no less remain the Source of all. From Him must have come the material substratum for the operations of energy, or energy as the manifestation of so-called matter. From Him must have come all the potentialities for evolutions into actualities, in the gradual transmutation of potential energy into kinetic energy and back again, and in the transmission or generation of matter and energy from preceding to succeeding universes—as already intimated.

Thus, surely, then, there must have been a beginning of the universe, or else it would long ago have passed away. Then, whence or how its energy, or its matter—again we say—if not from an infinite and absolute Cause?

To avoid this obvious difficulty, it is held that matter, in its etheric form at least, existed from eternity, and that the energy came from the contractions and condensations of the ether into ponderable matter. In answer to this we say that the first part of this statement, that matter is eternal, is, of course, a begging of the question; and that the second part, as to its concentration, would be impossible without an external cause. Even if there had been on hand an eternal etheric matter, of itself it could not contract and concentrate; it could not produce energy; and therefore it could not develop into an energized cosmos. Hence, even upon the absurd assumption that matter in its etheric form was eternal, a Deity must be postulated back of that supposed ether for the evolution of the universe from it. But, surely—as we are endeavoring to demonstrate—there must have been a Deity back even of that primal etheric matter as the cause of its existence, no less than as the cause of its energy in a supposedly evolved or evolving universe.

Arrhenius apparently sees the untenableness of the theory of a continually progressive and eternal past evolution, as witness the following words: "Up to the beginning of this century [twentieth] the gravitation of Newton seemed to rule supreme over the motions and over the development of the material universe. By virtue of this gravitation the celestial bodies should tend to draw together, to unite in ever-growing masses. In the infinite space of past time the evolution should

have proceeded so far that some large suns, bright or extinct, could alone persist. All life would be impossible under such conditions" (*Worlds in the Making,* pp. 207-8). The fact that planets, etc., about our sun—and probably about other suns or stars—still exist unabsorbed by, or unconsolidated with, their central suns, has led Arrhenius to look for a cause of such apparent delay in the universal concentration. This he finds in "the action of the mechanical radiation pressure of light, and in the collisions between celestial bodies."

Such counteracting of the force of gravitation by radiation pressure, etc., would, however, imply a perfect balancing of these forces, or else either concentration or disintegration would nevertheless eventually result. However, the ascertained evidence of nature is against the existence of such an equilibrium of forces. At any rate, even such equilibrium would not make for an *eternal* order. Even such a supposedly perfect arrangement would necessarily have had to be originated and adjusted by a power other than that of nature's *own existing* forces. Hence, when considered in the light also of other evidence, especially that set forth in our next chapter, the universe must stand forth as a temporal entity.

2 THE THEORY OF REPEATING OR SUCCESSIVE UNIVERSES INADEQUATE

As already indicated, some scientists have endeavored to account for an eternal process of evolution in nature, by working out an apparently consistent theory of a possible repeating of evolutions from chaos to completed cosmos, by cycles of redisintegrations and reevolutions. According to this theory, our present stage of supposed evolution, or course of nature, would be only one of these cycles, not yet risen to the height of impending redisintegration for a new reevolution. They thus attempt to imagine a past eternity of such repeating cycles. This theory was already suggested by Democritus (fl. about 400 to 357 B. C.), who made bold guesses that all matter is made up of atoms, and that the cosmic whole is an eternity of repeating cycles—of birth, maturity, death and rejuvenescence.

The present conception of eternally repeating cycles has been well expressed by a number of writers. In his work,

Chemistry and Its Borderland, 1914, Alfred W. Stewart declares that "the generally accepted theory of cosmic evolution postulates a cyclic process in the universe" (p. 198). And this theory of cyclic evolution he develops somewhat at length; and his explanation, as a mere scientific theory, is very ingenious and rather plausibly self-consistent. However, upon examination it is seen, in the interests of consistency, to set forth, as though established, point after point for which nature affords but the faintest evidence, or at least only such very fragmentary evidence as in no way warrants the implied conclusions. Soddy, too, holds to the possibility of an evolution "proceeding in continuous cycles, without beginning and without end, in which the waste energy of one part of the cycle is transformed in another part of the cycle back into available forms" (*The Interpretation of Radium,* p. 240). This statement is, of course, based upon the almost unlimited energy and the vast life periods of radioactive substances. But no exaggeration of such energy and duration of existence, nor of any other known forces or cycles of forces operative in nature, would constitute an eternal process. Geoffrey Martin holds that the rate of formation and the rate of disintegration of matter in the long run balance each other. After speaking of supposed nebula formation and of condensing worlds and reproduced nebulæ from collisions and condensations of worlds, he makes the following statement: "And so on for all the ages circulates the universe, like some vast self-compensating machine, radiation pressure compensating gravitation, and the concentration of potential heat energy in the nebulæ compensating its loss in the suns" (*Triumphs and Wonders of Modern Chemistry,* 1911, p. 54). This view of Martin is in agreement also with the theory held by Arrhenius, as developed in Chapter VII. of his *Worlds in the Making.*

It is true that there are some rhythmic compensating operations apparently continually going on in nature; but these by no means afford adequate evidence for any acceptable theory of supposed *eternal* cyclic universe-processes. Our very limited data as to the processes of the universal whole are altogether insufficient to enable us from them to draw the conclusion that the universe is an *eternal* entity. And, in the light of the evidence of its necessary finiteness, as already seen, as well as that of the temporal nature of matter itself,

to be shown in the following chapter, the only logical conclusion possible is that the universe as a whole is also a temporal entity.

It might be said, however, that, if the *absolute Cause* of the universe were included in the above idea of the *universe,* as from eternity possessing the *potentiality* of the *physical* universe—which would be an absurd inclusion in that word—there would be a sense in which the universe might be said to have always existed. Thus, in that unwarranted sense of the word *universe,* as including the *eternal Cause* of the consequently eternally *potential* universe, one might *figuratively* speak of it as eternal. And we fear that this is the somewhat confused sense in which the universe is by many eternalists regarded. We cannot help but consider this as even Haeckel's position.

It is seen that the scientists quoted above speak of cyclic transitions from nebulæ to stars and back to nebulæ again, and of immeasurable epochs, in connection with this supposed evolution of the universe. And, as radiation pressure is undoubtedly as much a reality as gravitation, their theory would at least have this indefinite suggestion to commend it to the speculative mind. If such were the creative Deity's chosen methods of operation, it would make possible an immeasurably longer duration of the universe than various other isolated phenomena seem to indicate, as we shall see. But, no number of cyclic transitions and immeasurable epochs, however long each cycle or epoch might be, could measure off or fill an eternity. For, however great their number and however long each cycle, their accumulated addition or multiplication would still produce finiteness. And, therefore, however long that time in the grand aggregate, it would still be short of an eternity. Moreover, the very association of these *cycles* or *epochs* with such supposed *evolution* would necessarily be a contradiction, if they constituted *eternity.*

It is certainly a long step from immeasurable epochs to eternity. It is, moreover, a bold step to assume that gravitation and radiation pressure are so balanced as to cause a *continuous repeating* of universes. The very least deviation from equality in such balance, according to this theory, even though caused only by ethereal friction, etc., would in almost ascertainable time result either in total concentration or in total disin-

tegration, as already noted. And, in either case—from some facts already cited and others to be cited—it would point to the death and end of the universe. And hence, as that death or end has not yet been reached, it would incontrovertibly prove that the universe also had a beginning. Indeed, this conclusion is inevitable from a number of considerations, whatever theory as to repeating universes might be offered.

These facts, therefore, afford incontrovertible proof that this cosmic nature with its myriad forces and laws had a beginning in time, and that there was a time when it did not exist. Hence, these considerations alone should be convincing that the universe, and therefore matter, cannot have existed from eternity, and that it must therefore have been created.

3 OUR CONCLUSION NOT CHANGED BY MAKING THE ETHER THE FINAL REALM OF ENERGY

It has been contended by some men that the final realm or end of the so-called dissipation of heat, and therefore of all energy, is the imponderable ether, that this ether must be extended infinitely, and that therefore this would be a sufficient medium or ground for an eternal radiation.

To be sure, there can be no radiation of heat into absolutely empty space, for if heat is a mode of motion—as Tyndall first defined it—it necessarily implies a something moved. The same is, of course, true of all energy, as already seen, upon the basis of such a definition. Heat, or any other form of energy, can therefore, upon this theory of energy, not exist apart from a moving substance. And, therefore, the existence of the ether must be postulated in order to account for this so-called dissipation of energy, as well as for other phenomena of light, etc.—unless we changed our conception of heat, etc. And, if our definition of heat were changed to accommodate it to a supposed non-existence of the ether—or space-vacuity—then that apparent dissipation of energy into an empty interstellar void, upon such a theory, also would necessarily become a real dissipation and loss, and therefore without ultimate conservation of it—a fact to which we have already called attention. Then, this dissipation, in hastening the end of the universe, an end, however, not yet reached,

proves that it necessarily had a beginning.

But, retaining our conception of heat, any substance in connection with which it can exist must be composed of individual moving or mobile particles. Therefore, ether being posited, it also must be a substance composed of individual particles, as we shall more fully show in our next chapter, or else there could be no vibration and therefore no radiation. It must, therefore, for the reason already given, be finite in extent, as we have shown indeed matter or anything analogous to matter to be. This would altogether contradict this objection. Therefore, the radiated, or supposedly dissipated, heat or energy throughout the universally ether-enveloped stellar universe, would always have been approaching its equilibrium. Hence, that equilibrium would also long ago have been reached, if this supposed distribution and equilibration had been going on from eternity.

Therefore, the present order of nature, however viewed, had a beginning, just as we have showed it also to be tending to its inevitable end. Nor would the indefinite multiplication of succeeding orders of nature in the past, as we have seen, remove their primal beginning to the eternity of the past, any more than their indefinite multiplication in the future would move their end to the eternity of the future—if indeed we could speak of a past and a future in relation to a beginningless and endless eternity. And, as the aggregate of any number of universes whatsoever could not make up an infinite in quantity or space, so the combined durations of any number of consecutive universes could not measure off an eternity or infinite in time. A beginning there must have been, whether there have been many successive universes, or only one, as also there will be an end.

And even if that end, in the absolute sense, were not brought about by the operations of its own laws or what might be called its inherent death, its annihilation would undoubtedly none the less take place. The very fact of its certainly approaching death or paralysis, upon having fulfilled its evidently designed mission, would as surely imply its *annihilation* by the destructive fiat of an omnipotent Will, as its evidence of a beginning in time as an *ordered universe* implies its *primal origination* by that same Will. Thus, just as the evidences of

a beginning in time as an ordered universe imply its primal origination by an omnific Will, even apart from any *direct* proofs of that fact, so does the very fact of its certainly approaching death or paralysis, upon having fulfilled its evidently designed mission, imply its annihilation by that same omnipotent Will, either indirectly by the originally imposed inherent forces, or directly by His final destructive fiat after its created purpose shall have been subserved. And, indeed, as already noted, as a finite universe it could no more continue through the eternity of the future than it could have existed from the eternity of the past. To be sure, we are here speaking of a *future* and a *past* eternity—a necessity for human conception and expression—but in reality there is no past nor future in an unmeasured and undivided eternity, in which there naturally is no time relativity.

In what is said above, as well as elsewhere in this volume, about the undeniably temporal nature of the physical universe, we would, however, not imply that there may not have existed universes, also necessarily *created* entities, before the present one and that there may not be created universes after the present one will have ceased to be. Nor would we even imply that the Omnipotent might not have created this or any possible past universe—or might not create a future universe or universes—to continue in unchanging duration forever. What we do assert is, that, according to the *existing* universe's own overwhelming testimony, it is so *constituted* that it is by nature necessarily a temporal entity. And the evidence is as convincing that it had a beginning in a creation *ex nihilo* as it is that it will have an end in annihilation. And thus the evidence is equally convincing that it is not an end in itself, but only a created temporal means for the working out of some transcendent purpose, a point which we shall briefly consider in another chapter.

It is therefore evident from the operations of nature considered as a unitary whole, that the universe must necessarily be a *temporal,* and therefore a *created,* entity. We shall now proceed to show in our next chapter also from the very nature of matter itself, that it will have an end, and that therefore it must have had a beginning, or that it must have been created.

CHAPTER VII

EVIDENCE FROM THE NATURE OF MATTER ITSELF THAT THE PHYSICAL UNIVERSE IS A TEMPORAL ENTITY

As various theories of matter have been developed by philosophers and scientists, it is important to know whether these can affect our conclusions. This is, however, virtually as much a question of metaphysics as it is of physics in the more general sense.

It is more and more being held that we do not know matter directly, but that we know it only by its properties and phenomena. This is, of course, in accord with the Kantian conception, that we know only phenomena but not that of which they are the phenomena. Thus, we may see an object by its color; we may hear it by what we speak of as its sound; we may feel it by what we know as its heat, its resistance or its weight; we may taste it by what we designate its flavor; we may smell it by what we call its odor. But, apart from its color, sound, heat and weight or resistance, flavor, or odor —and these are apparently merely the results of the vibrations of its hypothetical particles—it does not exist as far as our physical senses are concerned. Indeed, if we could conceive of our senses as different from what they are, the object would necessarily appear different to us. Therefore, the same object would appear different by its differently affecting differently constituted sense-organs. And this difference might be conceived of in any possible degree, even to non-existence— which, of course, would be the case for *us* with the entire removal of our sense-organs. Moreover, even as we are constituted, to a certain extent no two persons have exactly the same sense-impressions from the same object. And, therefore, no two persons really ever see or know the same object

alike. That we do not really know matter itself, is thus held by many scientists, as well as philosophers.

Outside of ourselves there is, therefore, apparently no light, heat, color, sound, or odor. From the view-point of perceiving man, matter may, therefore, be regarded as virtually an abstraction. And, by many thinkers it has been regarded as even unthinkable apart from energy, the ultimate physical cause of its so-called phenomena. Moreover, to define matter properly is practically impossible, as by its very nature there is nothing with which to compare it, or in terms of which to form a definition. As it is itself fundamental, there is nothing more simple and fundamental of which it consists, and by reference to which it can be expressed or defined. The question has, therefore, naturally arisen as to what the ultimate or absolute nature of that is which we *call* matter.

The majority of thinkers have, however, come to the conclusion that matter is the *substantia* or essence which constitutes the basis or medium of phenomena. Phenomena would thus be only the manifestations of matter under different modes and conditions and with different attributes or properties. These would, therefore, not themselves be substance, but only the manifestations of substance, which constitutes their basis and makes them possible. This may be spoken of as the materialistic conception of matter. We are here, of course, dealing only with what is generally known as material or physical substance.

There are other thinkers, however, who consider what we call matter as nothing but energy. So-called matter itself, according to this view, has no existence in reality, and apart from energy even its apparent existence would cease. According to some, the ultimate nature of this so-called matter is electrical.

According to the view of some philosophers, matter would be virtually only a necessary postulation of reason. With Plato (427-347 B. C.) it was only the correlate of idea, and so had existence only as such. With Descartes (1596-1650), Locke (1632-1704), Bishop Berkeley (1684-1753), Fichte (1762-1814), and even apparently in a sense with Lotze (1817-1881), it had no real objective existence. Generally

speaking, these views may be called the idealistic conception of matter.

The apparent reasoning of many men starts from the idea of mere resistance and ends in non-existence. Resistance is offered by matter, and so it is by energy. And, as we know what is called matter ultimately only indirectly by energy, so-called matter and energy must be identical. And, moreover, as we know so-called matter or energy only as sense-impression, it can have no real existence apart from the senses, and must therefore be a non-reality. Thus a natural conclusion often reached by such reasoning is *idealism*. We cannot stop to examine the merits of such reasoning, except to say that, while for *us,* apart from sense-perception, in its broader sense, matter would not exist, such lack of sense-perception on our part would in itself not prove its non-existence. It might be an objective reality not only in itself, but also for other possible perceiving beings.

While we cannot here enter into a discussion of these rather general conceptions of the ultimate nature of what we call matter, we may say in anticipation of what is to follow, that, upon the basis of these conceptions, matter is at least not a permanent or enduring entity. If it were only a postulate of reason, or an idea, or merely a so-called sense-perception, then of course apart from the thinking or perceiving mind it would have no objective reality. And, even if it be only the basic *substantia* or medium of phenomena, then without phenomena we could know nothing about it, and for *us* at least it would have no reality. And, as phenomena would seem to be the final cause of the existence of matter, it would appear that it must have come into existence with and for phenomena and that with the passing of phenomena it also would pass away. Thus, even these preliminary considerations as to the nature of matter almost necessarily imply that, however regarded, it had a beginning, and that it will have an end.

We shall now proceed to consider the principal definite theories as to the nature of matter that have been offered; namely, the *atomic theory,* the *centre-of-force theory,* the *vortex-atom theory,* the *electrical theory* and the *ether theory.*

I THE ATOMIC OR PARTICLE THEORY OF MATTER

The quite general verdict of science has hitherto been that matter consists ultimately of infinitesimal individual particles, called molecules, atoms, etc. This view is known as that of the discrete or grained structure of matter, as against that of continuous substance. These particles of matter are supposed to be so infinitesimally small that it would require a vast number of them together to become visible under the most powerful modern microscope.

We rather like to retain the name *atomic* theory, as it has become venerable by age. Long before the days of modern chemistry it was already hoary with antiquity. Beginning with the Greek philosophers Leucippus (fl. 500 B. C.) and Democritus (fl. 375 B. C.), and somewhat more fully developed by the great Roman natural philosopher Lucretius (97-53? B. C.), this theory, under slightly different forms, has had its adherents among philosophers ever since. In its modern form as a chemical theory its founder was Dalton (1766-1844), who found it a necessary deduction from the law of multiple chemical proportions in the union of the elements into compounds.

With the development of modern chemistry this theory has, at least as to some of its elements, passed from the sphere of theory to that of scientific knowledge. And the various other scientific theories of matter are to a large extent only modifications of this old theory. This, therefore, expresses the hitherto rather generally accepted conception of scientists as to the nature of matter. It, of course, is also the basis of modern atheistic materialism.

According to this theory of matter, in its later development, corpuscles combine into atoms, atoms combine into molecules, and these combine into masses. And thus these minute particles in their combinations constitute the material universe. Thus, the common substance called water is a combination of hydrogen and oxygen, in the proportion of two to one, and is therefore expressed H_2O, two atoms of hydrogen uniting with one atom of oxygen to form a molecule of water. And, no matter what the mechanical methods employed, all divisions of water, however minute, must result in water still.

But, by the application of chemical methods, the water molecules can be split into their constituents, two atoms of hydrogen and one of oxygen; and these can thus again also be reunited into their compound, water.

Atoms of the eighty or more different chemical elements have selective tendencies to unite in various proportions or numbers with one another, some having greater ranges of affinities and some smaller. And, of course, all atoms of the same element are apparently alike, while atoms of different elements are different in size, chemical affinity and other properties. Some enter into a much greater number of substances, according to their selective affinities. Moreover, from the revelations of the spectroscope it is definitely determined that the same elements, in varying proportions, enter into combinations to form the earth, the planets, and the sun and stars. Thus, the whole material universe is apparently composed of the same material substances; and it is undoubtedly throughout atomic or grained in its ultimate structure. These infinitesimal particles, bound together by mysterious laws of so-called attraction under different forms, constitute the foundation stones of the universe. Further details of this theory are not necessary here, for our consideration has to do with this and other theories as they affect the problem of creation.

Upon the basis of this theory of matter, no matter how many of these infinitesimal particles and how great their number of combinations, they could not constitute an infinite, as already shown. Nor could they of themselves have *produced* the universe. For each particle required the creative act of a transcendent Will to call it into being; and for every motion there must have been an external cause—the same transcendent Will. Even the law of the so-called conservation of matter implies its *creation,* as nothing can either produce or destroy itself. Moreover, a thing must first *exist* before it can be *conserved.* The law of inertia implies that its motions came from some initial impelling force; as, unless thus impelled by an external force, it would forever have remained at rest. Therefore, the atomic theory of matter and the universe necessitates an absolute personal Will as the creative Cause.

Furthermore, according to this theory of matter, these ultimate particles are unchangeable by any physical processes, both as to their substance and as to their intrinsic properties.

Therefore, this very unchangeableness by any forces of nature should be sufficient proof that they are not the product of any forces of nature. This is really equivalent to saying that they were not self-created, for their existence itself forms the material basis of nature and constitutes the basis of operation for nature's forces and laws. Moreover, the wonderful way in which these particles are fitted together and combined into molecules, etc., shows that they are meant for one another in the building up of this wonderful cosmos, and that they must therefore have been created for that purpose, according to some wonderful plan. But of this we shall speak more fully in our next chapter.

The contention of modern materialistic pantheism that this material cosmos is itself God, can, of course, not stand in the light of the atomic theory; for no number of such particles and their combinations can constitute an *infinite*. The universe is thus necessarily finite, and therefore limited and relative—as also demonstrated in former chapters. And such a limited and relative existence would imply something beyond it by which it is limited or to which it is related as a dependent. And, as only an infinite can be unlimited and absolute, such only can be conceived of as Deity. Moreover, as shown elsewhere, to make of the material universe *God,* would be to multiply the number of deities to as many as there are individual molecules, atoms, corpuscles, etc., throughout its mighty reaches. But, Deity must necessarily mean unity of individuality and of action, as well as unity of essence, every element of which the atomic or particle theory of matter contradicts. Hence, the atomic universe cannot be *God.* Therefore, according to the atomic theory, there must be a Deity beyond, and most assuredly also within, the universe, Who is its Cause as Creator and Sustainer.

Thus, even the very ultimate particles bear witness that they had a beginning, and like silent index-fingers point back to their Creator Who designed them and gave them their being. And their ceaseless revolutions and marvelous harmony in intricate combinations, add to this silent evidence of the existing particles their eloquent testimony not only that these particles have their existence from a Creator God, but also that their every motion is by His throbbing energy.

II THE CENTRE-OF-FORCE THEORY OF MATTER

A very ingenious theory of matter was the one suggested by Ruggiere G. Boscovich (1711-1787), and more fully elaborated by Michael Faraday (1797-1867), *et al.*, and considered plausible by such men as John Stuart Mill (1806-1873) and Thomas Huxley (1825-1895). According to this theory, what we know as matter is nothing but force. What the atomist calls the ultimate particles of matter, the advocate of this theory considers to be only centres of force. The ultimate particle is considered merely as an unextended point, not a material substance, and therefore nothing but energy. It may be said that this theory was in a sense foreshadowed or anticipated by the idealistic philosophers Descartes, Locke, Berkeley and Fichte, who regarded what we speak of as material substance as merely combinations of qualities or phenomena. With them, the one entity, or the only reality, was the soul.

This theory would, of course, remove such difficulties as some supposed reason why the ultimate particle or the so-called atom could not be divided. If it is material, it must have extension, and therefore some solidity and surface. Why it would not therefore be divisible, no one could tell. Then, too, if the atoms be material substances, and all of them individually and unitedly in motion, there must be vacuity between them. And the supposition that the ether fills this vacuity would only hand on the mystery of vacuity from the inter-atomic spaces to the spaces between some hypothetical ether particles. And this, too, would apparently be equally inexplicable. This much, therefore, this theory has to commend itself.

It is not for us here to enter much into a discussion of such a theory. But the natural inference seems to be that, as motion implies something moved, there could be no energy without a moving substance. There could apparently be no activity without passivity. Therefore, to speak of abstract centres of force, would seem to be to speak of an impossibility. How could there be centres of force without a passive basis in which to operate? There could be no energy, apart from will, without a moving or residing medium. In fact, the human will, as we know it in its present state, always

operates through its physical basis. And, as for energy in the case of a disembodied or unembodied spirit, it would be highly improbable that the term energy, as we know it in physical nature, would fully apply. Indeed, the very existence of friction, not to speak of extension and other properties, should make this hypothesis of centres of force practically untenable; for these properties could hardly be ascribed to pure force or energy.

But, the point for us to make is, that, even if this theory of matter were correct, it would not invalidate our conclusions. On the contrary, it would rather all the more firmly establish them. If the supposed atoms were only centres of force, they might not themselves even be force. Indeed, we can really conceive of will alone as a cause, or a real centre, of force. Therefore, this theory would, upon its very surface, lead us to that Will by which all things must have come to be. And, if the whole universe were only a manifestation, or a series of manifestations, of force or energy, then the cessation of motion in the dissipation of energy, as fully explained in our last chapter, would certainly mean the end of the universe. And, to say that the energy would still remain, only unavailable, in another form, would simply be begging the question. In this case, upon the basis of this theory of matter, cessation of motion would mean cessation of energy. Potential energy could not even be spoken of, as there would be no medium, or positions of matter, for such supposed potential energy, as there would be no matter. Surely, annihilation of motion would then mean annihilation of energy; and thus, according to this theory of matter, annihilation of motion or energy would mean the annihilation of the universe.

And, what is more, such energy could not have been self-originated. Even apart from the law of inertia, if considered applicable, the law of causality would forbid any other conclusion. A Will to energize all could have been the only possible and natural cause of its origin. Therefore, according to this theory of matter, universal annihilation of what we call matter or the physical universe, would be its inevitable end. And the time of this end might almost be foretold from calculations based upon data at hand. Hence, according to this *centre-of-force* theory of matter, the universe would neces-

sarily be temporal. It would have an end; and it must also have had a beginning.

III THE VORTEX-ATOM THEORY OF MATTER

Another theory of matter is one that was hinted at by Hobbes (1588-1679), and somewhat more fully developed by Sir William Thompson, later Lord Kelvin (1824-1907). According to this theory, the so-called atoms are small vortex-rings of rotations of a perfectly continuous fluid filling all space. This is, therefore, in a sense also a modified form of the venerable atomic theory. It differs from it on the subject of the divisibility of the ultimate atom, as also on its supposed exact behavior. According to the old atomic theory, the ultimate atom was supposed to be indivisible because of its being the ultimate unit of matter, that by its very nature would resist division, perhaps because of a certain *hardness*. The word *coherence* would not do, because it implies the presence or union of more than one to form a coherence; and this would be contrary to the old idea of an ultimate unit.

According to the vortex-atom theory, the supposed ultimate atom is not indivisible because of its hardness, but because of its *non-resistance to pressure* or force, by virtue of its vortex-motion in a perfect fluid. Such motion in perfect contiguity to similar motion all around it and continuous throughout the vast stretches of space-filling ether, is thus supposed to cause the resistance or evasion necessary to make its further divisions impossible. It would, therefore, be virtually equivalent to dividing space itself.

This theory is, to say the least, a very ingenious one. If it be contended, as has been done by some of its advocates, that the so-called vortex-atoms or vortex-rings, are nothing but motion, then with the cessation of motion, toward which universal nature is tending, as we have shown in the preceding chapter, all these vortex-rings or vortex-atoms would disappear. This would necessarily be the end of the so-called material universe. And, if these vortex-atoms were in constant motion *within the ether,* ethereal friction, however infinitesimal, would certainly eventually cause all motion to cease. And, that there is friction in the ether, is evident from the pressure, and the time element in the propagation, of light,

heat, etc. Therefore, *temporality* must be written across nature, on the basis of this theory. Indeed, even if the vortex-atoms, and from them the visible universe itself, were a development from the ether, as has also been held, even then friction would have to be postulated to account for such a *development,* as development always implies friction. But, as friction in the ether would nullify the idea of perfect fluidity, the theory here already would fail. Moreover, this very presence of friction would show a time element in such development of the universe. And this, in its turn, would necessarily imply that that development must have had a beginning, or else it would long ago have been completed. Hence, even this points to a beginning of the universe, and therefore to its creation in time out of nothing.

In its ultimate analysis, this theory would, of course, apparently also leave the atom a substance. Its vortex-motion would imply a moving something, even if it be but the ether itself. But its weakness seems to lie in a palpable contradiction; namely, that a continuous substance could consist of an indefinite number of such vortex-atoms or vortex-motions. If the ether were so composed, it could surely not be spoken of as a continuous medium. But, even if this were held, the fact would still remain that, as you could not have an *infinite number* of such supposed vortex-rings or vortex-atoms, it would necessarily remain a finite, limited, non-absolute, temporal, and therefore created entity. And, such great forces as electricity and gravitation could apparently not be explained without assuming some hypothetical independently operating external corpuscles in coincident but smaller vortex-motions. Then, what or whence these hypothetical smaller vortex-atoms or vortex-motions?

Moreover, a perfectly *continuous* medium could not possibly be conceived of as being in motion in its contiguous parts, though as a *finite unitary whole* it might be conceived of as in motion. But, of course, such a universe as a moving unitary whole could not be infinite. An infinite could not be conceived of as in motion; as motion would imply an external something within which, or with reference to which, as an infinite static, or other relatively moving *finite* existence, such motion would take place. This external something would thus be a limitation to such a moving universe, and prove it

to be finite. An infinite would necessarily have to be motionless. And, again, an infinite could not consist of parts any more than it could consist of particles. It would have to be an undivided unity. To an infinite there would be no beginning in extension nor an end. It could not be conceived of as having an *up* or a *down,* a *right* or a *left,* a *before* or a *behind,* an *east* or a *west,* a *north* or a *south.*

As to an infinite there could be no parts, so to it there could be no successions. As to an infinite there could be no successions, nor revolutions, no relations nor changes, so to it there could be no time, since time is the measure of successions. The measure of the duration of its existence, if it could be spoken of as a *measure,* would therefore have to be *eternity.* An infinite would therefore have to be timeless, as well as motionless. Conversely, a timeless existence would have to be infinite. And, furthermore, an infinite could not have been or be created, for creation implies an external existence within which such creation takes place or its product can exist, even apart from the creative Cause. This is also confirmed by the fact—as shown above—that an infinite must necessarily be eternal, as creation implies a time or beginning of creation, before which its infinite creative cause must have existed. Then, too, an infinite must necessarily be absolute, as shown elsewhere; and absoluteness implies self-existence and eternal duration.

Therefore, even upon the basis of the *vortex-atom theory,* the universe would have to be finite, temporal, and therefore created—and of course necessarily created by an external Power or Will, *ex nihilo.* This reasoning would also apply to the other two theories of matter already discussed, as well as to the two yet to be considered.

As thus shown, such a supposed continuous medium for the vortex-atom motions, or the associated universe, would have to be finite and temporal, and therefore a created existence. This fact is also fully attested by a further consideration of these supposed motions; namely, that these could no more have been self-originated than could the basic moving stuff, if it might be called so. Thus, though this theory may seem to shift further back a great First Cause, it no more accounts for existing nature without an omnipotent creative

Will than does any other.

It must, of course, be remembered that all these three theories *assume* an ultimate something merely as a working hypothesis to explain phenomena. In their last analysis all are therefore finally based upon scientific faith no less real, and no less helpless of actual demonstration, than the Christian's faith in the revealed fact of the creation of the world by a transcendent Deity.

IV THE ELECTRICAL THEORY OF MATTER

We have thus far considered three theories of matter—the *atomic theory,* the *centre-of-force theory* and the *vortex-atom theory.* We have seen that, instead of strengthening the contention that the universe is infinite, eternal and therefore uncreated, the whole weight of the evidence according to these theories is against such a contention. In other words, upon the basis of these three theories, the universe must be finite, temporal and created. There are still two other theories of matter that we shall consider. And, because of their very great importance for our subject, thus necessitating a fair understanding, we shall consider them more at length and in detail than the other three. In this subdivision we shall discuss the *electrical theory,* developed in connection with the remarkable recent discoveries as to radioactivity, etc.

I STEPS IN THE DISCOVERY OF RADIUM

The discovery of the X-rays in 1895 was the opening wedge to a number of nature's secrets. Although several earlier chemical discoveries had paved the way for this one, and had even foreshadowed some of its phenomena, the discovery of these waves by Roentgen marked a definite transition point from the older to the newer chemistry. Chemistry has now truly become the astronomy of the infinitesimal.

Although these X-rays somewhat resemble waves of light, it was soon learned that, because they cannot be reflected, refracted nor polarized, they are perhaps not exactly of the nature of light; and it was supposed, therefore, that they are probably not waves of ether. It was, therefore, seen that, in dealing with these subtle waves, science was dealing with a new set of phenomena, and perhaps—as was at first suggested—

even with a new medium for wave transmission. A great field for scientific speculation was thus opened up.

While authorities were for some time divided as to the real nature of these X-rays, the prevailing opinion now is that they do consist of transverse waves within the ether, somewhat similar to light waves of short wave-length. They undoubtedly belong to the unexplored end of the ultra-violet region. These are not, however, like those of light, a regular succession of waves, but rather a series of irregular pulses. The ether-pulse theory of the X-rays does not, however, explain all their phenomena in passing through matter. It is, therefore, held by Bragg, and others, that they consist of minute corpuscles, as better explaining all the phenomena. This theory was proposed by Bragg in various issues of the *Philosophic Magazine,* 1907-1910. According to this authority, these X-ray corpuscles are neutral *doublets,* proceeding with great velocities.

The phosphorescence on the glass walls soon led Becquerel to the discovery of the rays that bear his name. These were found to be due to the natural radioactivity of uranium, and to resemble the X-rays. Deeply interested in this discovery, the Curies tested different uranium ores, and found different ores having different degrees of radioactivity, some of them having even more radioactivity than pure uranium. That this unusual radioactivity was not due to uranium itself, but that it was due to some hitherto unknown element, was therefore certain. To isolate this element was the task set before themselves by the Curies. After elaborate tests with large amounts of pitchblende, they finally succeeded in separating this substance in the form of a salt, 1895—though as a pure element it was apparently not isolated until 1911, when Mme. Curie finally succeeded in doing so. Because of its marvelous amount of radioactivity they very appropriately called it *radium.* It was soon found that this substance has, according to some estimates, one and a half million times as great a radioactivity as uranium. It should, however, be said that for the extracting of only the very minutest amount of radium it requires tons of pitchblende. Indeed, only a comparatively few ounces have as yet been isolated. It is said that radium is as rare in pitchblende as gold is in sea water. Hence, its great cost, which is several million dollars an ounce.

2 THE VARIOUS RAYS OF RADIUM

In this wonderful element we have a complexity of phenomena that are full of meaning. It gives forth three principal kinds of waves or radiations, called *alpha, beta* and *gamma* rays, by Rutherford, to which have been added the *delta* rays.

The alpha rays are composed of escaping minute particles, which have been found to be atoms of helium, whose atomic weight in terms of hydrogen is 4. Their velocity is calculated to be from about 12,000 miles to 20,000 miles a second, or averaging nearly one tenth of the velocity of light (Rutherford has lately placed this at 10,000 miles). Though these alpha particles (helium atoms) are very minute, their kinetic energy is comparatively very great. Their power of penetration, of course, varies with the density of the matter penetrated. Rutherford estimates that a cannon ball moving with the same velocity would have many thousand times as much energy as would be necessary to melt it and dissipate it into vapor. But, on account of the relatively larger mass and smaller velocities of these alpha particles than those of the particles of the other rays to be discussed, their penetrating power is not as great. They apparently pass through atoms of matter in their path, thus ionizing them.

The beta rays are apparently composed of sub-atomic corpuscles, which have been called *electrons.* These probably escape singly from their atoms, and are very much smaller than the alpha particles (helium atoms). The helium atom is a little over 10^{-8} cm. in diâmeter (more correctly probably about 1.25×10^{-8} cm.); or it would require nearly 250,000,000 helium atoms side by side to measure an inch. And yet, from their velocity and deflection, etc., the electrons are calculated to measure only about 10^{-13} cm. in diameter. In actual size the helium atom must therefore have a diameter near 10^{5}, or 100,000, times as great as that of an electron; or it would be nearly 10^{15}, or one quadrillion, times as large as an electron. And, therefore, as a helium atom contains about 6,800 ($4 \times 1{,}700$) electrons, the distance between the revolving electrons—if they were uniformly distributed throughout this atom—would be relatively very great. This distance between the electrons, upon the basis given, we find to be approximately 4,000 times their diameters. What an in-

conceivable number of electrons in a minute particle of radium weighing but a gram!

It is, of course, readily seen that, because of their smallness, as well as because of their great velocity of an average of about 90,000 miles a second (ranging from about 40,000 miles to 170,000 miles), these beta particles (electrons) have a much greater power of penetration than the alpha particles (helium atoms). They can penetrate one fourth of an inch of lead. And, of course, of these beta particles or electrons, every atom of radium contains probably upwards of 350,000 (about 226×1700), each revolving on an average of about 90,000 to 100,000 miles a second.

These beta particles are found to be the same as the Cathode-rays of Crookes' so-called "Radiant Matter," obtained by passing an electric current through a highly evacuated vessel. And, even here the electrons can be made to attain a velocity of 10,000 miles a second—and even much more, according to some authorities.

The gamma rays are apparently irregular pulses in the ether with approximately the same velocity as that of light. They are considered to be the same as the X-rays, but with even greater power of penetration than those artificially produced rays. These gamma rays can penetrate about two feet of iron. They occur only in conjunction with the beta rays, by the impact of which they are undoubtedly caused. Indeed, Rutherford lately has come to the belief that they are from disturbances in the ring of electrons nearest the positive nucleus, to be considered later. The penetrating powers of these three kinds of rays, considered above, are about as 1, 100, 10,000—the alpha rays penetrating about $\frac{1}{5\,0\,0}$ of an inch of aluminum, the beta rays about $\frac{1}{5}$ of an inch, and the gamma rays about 20 inches.

The delta rays are believed to be slow-moving beta particles (electrons) struck off from ordinary matter by the impact of the other rays. Their velocity is about 25,000 miles a second.

The recoil rays constitute a fifth kind of radiation often spoken of. These are due to the recoil of the residuum of atoms sending forth the alpha and beta particles. And, as the alpha particles consist of helium atoms and are, therefore, much larger than the electrons of the beta rays, this recoil radiation caused by the expelling of the alpha particles is much

greater than that caused by the expelling of the beta particles. As the atomic weight of radium is 226 and that of helium is 4, it is readily seen that this recoil radiation has a velocity a little less than one seventh of that of the alpha particles themselves ($\frac{1}{2}MV^2 = \frac{1}{2}mv^2$; or $\frac{1}{2} \times 222V^2 = \frac{1}{2} \times 4v^2$; or $55\frac{1}{2}V^2 = v^2$, or $V = \frac{1}{7}v$). But, as the electrons are so very much smaller than the helium atoms, the recoil radiation from the expulsion of the beta particles is of little practical importance.

In this element radium we have an additional light thrown upon the subject of energy. It is found that the temperature of radium is always higher than that of surrounding objects, and that it gives out several million times as much heat as any chemical reaction known. Mme. Curie and Laborde calculated that the heat from radium in an hour would raise its own weight of water from the freezing point to the boiling point and then keep it boiling more than a thousand years. The heat from the radium emanation is said by some actually to be over 3,500,000 times that of any known chemical reaction. This heat is undoubtedly, in its last analysis, from the intrinsic energy of its electrons, which apparently move faster than electrons of other tested substances. Hence, the greater radioactivity of radium and its greater tendency to disintegrate, a fact of which we shall presently speak. An idea of the energy represented by a revolving electron may be formed from the fact that, according to a calculation lately made by Rutherford, it would require two million volts of electricity to set in motion an electron with a velocity of 98% that of light. This energy is regarded, therefore, as residing in the atom, as either kinetic or potential energy. The atom is, therefore, a vast infinitesimal storehouse of energy, caused by the enormous velocities of its multitude of these sub-atomic particles. An additional element in this intrinsic atomic energy may be due to the passages of the charged particles through intense intra-atomic electric fields.

3 RADIOACTIVITY DUE TO DISINTEGRATION OF ATOMS, SUCCESSIVE DISINTEGRATIONS RESULTING IN DIFFERENT SUBSTANCES

The above paragraph brings us to the more definite point to be made from our consideration of radium, the point for which

the foregoing discussion was to prepare the way. Radioactive substances are continually disintegrating, and to *some extent* apparently also constantly being produced again. That disintegration or decomposition is the correct explanation of radioactivity was probably first suggested in a public way by Geoffrey Martin in *Chemical News,* May 2, 1902 (Vol. LXXXV., p. 205). And in 1903 Rutherford and Soddy also published their conviction that radioactivity is due to disintegration.

Thus it has more recently been calculated that a gram of radium gives off over 6×10^{10} alpha particles (atoms of helium) per second, while it gives off over 7×10^{10} beta particles (electrons) per second. And it should be stated that, though this reckless giving off of its substance goes on constantly, it would require upwards of sixteen centuries for this radiation to spend even half of its resources. It should also be said that the fact that helium and its allied elements are so universally found, has been taken by some authorities to indicate that it is one of the by-products of earth's unmistakable dissolution.

What is true of radium as an element, is true of the whole family of elements to which radium belongs. There is an emanation in very minute quantities from radium salts that is continually given forth from the alpha particles, while radium is apparently continually being restored. And this emanation itself spontaneously disintegrates—giving off relatively great energy—and produces or results in helium, and a residue that, by giving off alpha or alpha and beta or possibly gamma particles, is transformed, according to Ramsey, Soddy, Rutherford, Mme. Curie, *et al.,* successively into radium A, radium B, radium C, radium D, radium E and radium F. And it is believed that this radium F eventually results in lead, which has been called the ashes of the radium, after passing through its successive emanations or transformations of several thousand years. The genealogy of lead, as far as it has been traced, is thus shown to be the following: uranium, uranium X and Y, ionium, radium, emanation (niton), radium A, B, C_1 and C_2, D, E, F (polonium), lead. A very interesting diagram of the generations of the radium family is given in Soddy's valuable work, *The Interpretation of Radium,* page 205. This table illustrates almost even the very processes of disintegration. Rutherford gives a table of the same on

page 24 of his great work, *Radioactive Substances and Their Radiations,* 1913, not to speak of other authorities. A summary of the general results obtained by the researches of various investigators will be of interest.

Uranium 1(238), by giving off alpha rays (6×10^9 yrs.), yields uranium 2; uranium 2(234), by giving off alpha rays (10^6 yrs.), not separable from uranium 1, yields uranium X; uranium X (230), by giving off beta and gamma rays (22 days), yields uranium Y; uranium Y (230), by giving off beta rays (1.5 days), yields ionium; ionium (230), by giving off alpha rays (5×10^4 yrs. ?), yields radium; radium (226), by giving off alpha and slow beta rays (2000 yrs.), yields emanation (niton: Ramsey); emanation (222), by giving off alpha rays (3.8 days), yields radium A; radium A(218), by giving off alpha rays (4 minutes), yields radium B; radium B(214), by giving off beta and gamma rays (26 minutes), yields radium C; radium C_1 (214), by giving off alpha, beta and gamma rays (19 min.), yields radium C_2; radium C_2(210), by giving off beta rays (1.4 minutes), yields radium D (radio-lead); radium D(210), by giving off slow beta rays (16.5 years), yields radium E; radium E(210), by giving off beta and gamma rays (5 days), yields radium F (polonium); radium F(210); by giving off alpha rays (136 days), yields radium G (lead ? 206).

The numbers within parentheses, after the names of the successive elements, indicate the atomic weights in terms of the weight of hydrogen, given in whole numbers for simplicity, while the approximate half-life period, or period of half-decay or half-disintegration, is given in parentheses after the words *rays.* It will be noticed, of course, that where a difference of 4 in atomic weights is found in two successive elements, it is due to the disintegration from the separation of alpha particles or helium atoms, whose atomic weight is 4. The loss in weight by the disintegration from the separation of the beta and gamma rays, because of their smallness, is, however, so small as to be negligible, and can therefore not thus be indicated. The so-called half-life period is given, because the disintegration apparently proceeds in such a way as to leave a residue at each successive step, which acts as a whole like the original amount. Thus, the disintegration might be regarded as reducing it to half the original; and this remaining half

is similarly reduced to half, and this remaining half to half its amount, etc., indefinitely. The tabulation of uranium X and Y, and of radium C_1 and C_2, might be regarded as not strictly illustrating the process.

It might be said that, though different eminent chemists have reached slightly different conclusions as to life periods—and other details—as to all the main facts all are in almost perfect agreement. Thus, the half-life period of radium, as found by Ellen Gleditch in 1915, is 1642 years, while, according to Rutherford's latest determination, it is 1690 years. It is sufficient for our purpose, however, that the main principles have been removed from the realm of theory.

4 DISINTEGRATION OR DEVOLUTION PROBABLY UNIVERSAL IN NATURE

That disintegration is thus continually going on in these elements is, therefore, a demonstrated fact. That the same is true of some other groups of elements, such as that of the *thorium* and *actinium* families, has also been shown. The rate of disintegration varies apparently with the atomic weight of the elements. The heavier atoms have been shown to be, by their very nature, generally more unstable as to their revolving electrons, and, therefore, throw off their electrons more readily. Hence, the disintegration or decomposition of the elements would ordinarily proceed from the heavier to the lighter elements. The fact of the disintegration of all so-called radioactive elements, was well expressed by Sir Ernest Rutherford, in an address at the Royal Institution, London, June 4, 1915, on *Radiations from Exploding Atoms* (Published in *Nature,* July 1, 1915), as follows: "It is now well established that the radio-active substances are undergoing spontaneous transformation, and that their characteristic radiations—the alpha, beta, and gamma rays—accompany the actual disintegration of the atoms. The transformation of each atom results from an atomic explosion of an exceedingly violent character, and in general results in a liberation of energy many million times greater than from an equal mass of matter in the most vigorous chemical reaction" *(Nature,* Vol. XCV., p. 494).

We are here, therefore, face to face with what is undoubt-

edly a process of disintegration and dissolution. And, as far as can be seen, there is an absolute loss of energy. And even the *period* of this process is *measurable*. And what is true of radioactive elements may be true of all other elements. Thus it has been shown by Sir J. J. Thomson, that in a Crookes' tube other elements give off two kinds of hydrogen and helium. In other experiments by Sir William Ramsay, *et al.,* it has been shown that apparently all elements at least partially decompose into hydrogen. Therefore, that disintegration is probably going on in all elements, though less apparently so, is altogether probable. If biologists speak of *evolution,* chemists can with considerably more certainty, and with apparently more truthfulness, speak of *devolution*. And, in the ultimate upshot, devolution rather than evolution is the great moving principle in the present universe. And, of this devolution, so-called evolution might be only the ascending of a local wave that is surely to break against the rocky barrier of the eternal shore to end in quiescence.

Indeed, that *all* elements are thus undergoing a process of transformation and disintegration, is now generally *accepted as a fact* by physical chemists. Upon this point Soddy expresses himself as follows: "The aspect which matter has presented to us in the past is but a consummate disguise, concealing latent energies and hidden activities beneath an hitherto impenetrable mask. The ultra-material potentialities of radium are the common possession of all that world to which in our ignorance we used to refer as mere inanimate matter" (*The Interpretation of Radium,* p. 225).

It is thus seen that probably all substances spontaneously, or by an inherent law, tend to disintegrate from more complex to simpler forms, so that here truly we have the unmistakable evidence that the universe is in a process of ultimate dissolution, accompanied with a corresponding loss or annihilation of energy.

Moreover, the fact that the ultimate cause of atomic disintegration has not yet been found, is no argument against its being itself the cause of radioactivity. Nor is it an argument for the theory of *chance*. Causes before unknown are one after another being found, in explanation of phenomena which before some men tried to ascribe to so-called *chance*. And no one need draw the hasty conclusion, because this or that par-

ticular phenomenon has not yet been traced to any particular cause, that it may not by further research be so traced. But the point for us here is, that *the disintegration is going on,* however men might be inclined to explain it. It is not here so much a question of *why* or cause as of *fact* or effect.

Thus what is called radioactivity is due to the disintegrating of the elements. This disintegration is also undoubtedly going on in substances not manifestly radioactive. This disintegration unmistakably points to a temporal universe. And, even if it be contended that the universe might have thus been an evolution or a devolution from uranium or any other substance, even the ether, this contention can not remove the necessity of a primal creation of matter as represented in that primal substance. As that supposed primal substance could not have been infinite, for reasons already given, even as the material cosmos supposedly developed from it is not infinite—as we have shown—it could not be eternal or absolute, and therefore uncreated. Therefore, even if uranium, or any other substance, were held to have been the primal substance from which the universe was developed, it would itself have had to be created. Hence, we must assume back of the universe, upon whatever theory of development one adopts, an almighty creative Power that called it into being with all its potentialities, for the very purpose of evolving or developing such a universe.

5 THE CORPUSCLE OR ELECTRON AND THE ULTIMATE NATURE OF MATTER

We have already seen that the structure of the atoms of elements is at least largely electronic. And, whether there is a positive particle similar to the negative particle or electron, we shall consider a little later. We shall now proceed to consider the electron with reference to the ultimate nature of matter.

The tendency among scientists at present is to accept Sir J. J. Thomson's theory as to the corpuscle or electron; and thus the phenomena of radium have led to the development of the *electrical theory of matter.* Thomson showed that all electrons, under similar conditions, from atoms of whatever

elements, are alike; that is, that all so-called matter in its ultimate elements may be considered as consisting of electrons of the same kind, not taking into consideration, however, a possible positive element or nucleus. He showed that these electrons have mass and inertia; but he also showed that an electric charge has these. Then he showed that the mass of the electron is apparently wholly electrical, and that, therefore, its inertia is electrical. Thus, step by step, the theory was arrived at that the corpuscle or electron is not material, as that term is understood, but that it is a charge of disembodied negative electricity, or only a negative charge of electricity.

The conclusion has thus been arrived at that the mass of the electron is wholly electrical or electro-magnetic. It is accordingly held that, though for low velocities this mass does practically not vary, its calculated mass must increase as its velocity approaches that of light, and that there is even a definite law of this increase of mass with velocity. Indeed, its mass has theoretically been calculated for various velocities. Thus, at a velocity of half that of light, the mass has been calculated to be 1.12 times that for ordinary or normal velocities. And, according to Kaufmann, the mass for .963 times the velocity of light should be 2.42. In line with this is the fact that inertia has been shown not to be a constant quantity. Sir J. J. Thomson and Oliver Heaviside have calculated that it increases with speed, when it approaches one tenth the velocity of light. And later experiments have confirmed this. And, according to Sir Oliver Lodge, the electrons suffer even a loss in inertia if they get too close to one another, or encroach upon one another's magnetic field. This is also in line with the theory held by some men that the different atomic weights of different substances are due to a difference in their intrinsic energy or electronic revolutions.

The electronic theory of electricity is somewhat in line with Franklin's theory, that electricity is of the nature of an all-pervading fluid. That fluid might thus be considered as made up of immaterial particles called electrons, flowing from the negative to the positive pole. Indeed, electricity is apparently simply the passing of electrons from atoms to atoms, conductivity varying with the ease of the passing of these electrons. A current of electricity might thus be spoken of as a process

of equalization or adjustment somewhat analogous to that between connected waters of different levels. An electron (or electrons) attached to a molecule makes it a negatively charged molecule or ion. A molecule that has lost one or more electrons is spoken of as a positive ion. The separation of an electron from one atom and its attachment to another is probably due to its revolutions around the atom. Thus, it is readily seen that the mass of such an ion is slightly different from that of the atom from which it is formed. The anion, or negatively charged ion, is what might be called a neutral atom plus an added electron or electrons, while the cation, or the positively charged ion, is what might be called a neutral atom minus the separated electron or electrons. Thus atoms may also be spoken of as electro-negative, when they have more electrons than necessary for atomic balance, or electro-positive, when they have less electrons than necessary for such balance.

It might also be said that chemical union is supposed to be due to the bringing together of atoms of different potential, that is, one set having at least one negative particle, for each atom, more than necessary for stable condition and the other having at least one less. These would thus neutralize each other in uniting. Thus, chemical affinity is supposed to be electrical in its nature; and some have thought that gravitation might be due to some such electrical action through the ether.

6 THE POSITIVE ELECTRICAL ELEMENT IN THE ATOM

At this point it is necessary for us to consider the hypothetical positive nucleus, or field of positive electrification. As something neutralizes the motions of the flying electrons, the probability of the existence of a positive electrical nucleus, or perhaps of a number of nuclei or particles, so as to balance the negative particles, is very strong. Indeed, such a field or nucleus of positive electrification, by attraction to hold in balance the electrons, which by their very nature would indefinitely repel one another, is necessary to explain the integrity of the atom. And this positive electricity is also necessary to explain other phenomena of atomic action. Thus, in addition

to the negative electrons, there is supposed to be a positive element, within or around which these electrons revolve with terrific velocities. But whether this positive electricity is also apparently granular, or whether it is one body or mass, has not yet been determined, though various evidences seem to point to a granular structure akin to that of the electronic part of the atom.

If this positive nucleus be not granular in the sense that it is composed of a number of minute particles similar to the electrons, which together constitute the negative element in the atom, it would seem almost certain that it must then consist of one corpuscle for each atom. And it might be that there is one of these corpuscles for a certain number of electrons, perhaps one for the equivalent of an hydrogen atom, so that the oxygen atom would have sixteen of them, etc. But whether there be one positive corpuscle for each atom or one for a certain number of electrons, that positive corpuscle should be much larger than the electron in order to balance so many of them. And yet, as the electrons are so very small as compared with the atom, so also must this positive corpuscle be rather small as compared with the whole atomic size.

There are, indeed, men who hold that the positive element in the atom is not only granular or corpuscular in its nature, but that its corpuscles are even of a lower order of magnitude than the electrons, and that these form the basis of all wave motion. This theory is expressed by Marion Erwin in the following words: "The positive current is accounted for by flows composed of minute force rays in which particles of a lower order of magnitude than the electron constitute the traveling wheels which are at the basis of all wave motion. . . . The electric current is the motion of the train of electrons through space, the mechanical action involved being the forward motion of the electrons constituting the negative current, and the reaction flow of minute force rays constituting the positive current" (*The Universe and the Atom,* p. 235).

If this were the correct theory as to the positive electrical element in the atom, its corpuscles of a lower order of magnitude might be ether particles, and might thus constitute not only the basis of all subtle wave motions, but perhaps also of all matter, the electrons themselves perhaps consisting

of these ether particles so arranged in this case as to make possible or produce the phenomenon known as positive electricity. Thus light, electricity, magnetism, and perhaps gravitation, would be from the subtle action of these ultimate constituents of all so-called matter.

Somewhat similar to the above is Larmor's theory of the electrons, that they are only strain-centres, or merely infinitesimal eddies, in the ether; as also a theory suggested by Sir Oliver Lodge, that they are only knots or twists or vortices in the ether. But, in either case, they would be equally evanescent.

7 THE UNIVERSE NECESSARILY TEMPORAL ACCORDING TO THIS THEORY OF MATTER

According to this theory of matter, all so-called elements of matter are composed of atoms, consisting of positive and negative electricity, the difference of these atoms in weight, etc., being due to different numbers and arrangements and revolutions of the electrons around a positive nucleus or nuclei. And these negative electrical corpuscles (electrons) are, under similar conditions, supposedly alike in all elements, as also apparently should the positive corpuscles be, the mass of at least the negative corpuscles, however, apparently varying with velocities according to a fixed law. Hence, both the mass and the inertia of atoms would necessarily have to be electrical, that is, they would be due in their variations to electrical charges in motion. Thus, as the atoms in combinations constitute masses, or all that we call matter, it must follow that all so-called matter must, both in its elements and in its aggregate, be electrical in nature. Hence, all mass in the aggregate and all inertia, as indeed all energy, would, according to this theory, be electrical. But, as the mass of matter is equivalent to what is known as its quantity, it is readily seen that this quantity varies, according to a definite law, with its velocity. And, therefore, so-called matter is not a constant quantity, as has been supposed. This fact has even been shown experimentally by Heydweiler, *et al.* Thus, also, energy is not a constant quantity. Moreover, as mass varies, according to some fixed law, with energy, the natural conclusion from this theory of matter would be that matter and energy are

one. And this is more and more being held by men of science.

The above conclusion is somewhat in line with the monistic theory of Haeckel, *et al.,* that matter and energy are *one,* as the *substance* of all existence. And in this philosophic conception of monism there is no doubt thus a bold groping after the truth—as, indeed, all philosophy is thus a groping after the ultimate truth of the unity of all existence, and in so far is really monistic in its tendency. And this would seem all the more natural and to be expected, when the subject is viewed from the higher plane of the origin of all things from one ultimate Cause. But, surely, as an explanation of the *existence* or *ultimate origin* of the universe, the Haeckelian, or any other, theory of monism itself proves nothing. And, furthermore, if we may anticipate, while the monism of Haeckel ends with matter and energy, or matter *or* energy, as the one existing substance, the truth as to ultimate unity must lie in the theistic conception of its unity in *God,* the only eternal existence, in Whom all other existence might be regarded as having eternally been a Divine potentiality.

A word should here also be said as to a possibly different view of the nature of electricity and matter. While one can accept the theory that all electrons are only negative charges of electricity, it would for him not necessarily imply their non-materiality. He might rather regard electricity as the action or effect of the motions of the infinitesimally small divisions of the atom, called electrons, regarded as *material* corpuscles, handing on by successive separations, from atom to atom, the energy which is known under the term electricity. Thus, instead of regarding so-called matter as electrical and immaterial, a person might prefer to regard electricity as the flow of energy propagated by material electrons. Or, instead of regarding matter as electrical and immaterial, there is a sense in which one might regard electricity as material. And, if the electrons of negative electricity are matched by similar particles of positive electricity, and if these two in their arrangements and revolutions complete the atom, then one might, in a sense, say that all electricity is material and constitutes all materiality, or that all matter is constituted of electricity.

But even this view of matter and electricity, or of the electrical nature of matter, would not alter our conclusions as to the temporality of matter. As already noted, it has been quite definitely established that the mass and inertia of the electron vary with velocity. Hence, even if the electron, or electricity, be regarded as material, our conclusion would stand. Upon this basis, matter would decrease with motion and with energy; and with the cessation of motion and energy it would cease to be.

However, from the very fact that the mass and the inertia of the electron vary with velocity, as well as for other reasons so well pointed out by Thomson and others, the evidence from this scientific view-point rather points to the immateriality of the electron. Hence, upon whatever basis regarded, according to this theory of matter, it is temporal.

In considering this theory of matter and electricity, or this electrical theory of matter, in its bearing upon the question as to the duration of the so-called physical universe, it should, therefore, need no further argument to prove that it would spell *temporality*. If it were accepted upon its face value, not only disintegration, but even real annihilation of matter with corresponding annihilation of energy in final cessation of all motion or vibration, toward which the universe is certainly tending, as well as of all potentiality, would necessarily result. Thus, with the passing of motion and energy, all matter itself would also pass away. And the reverse might even be true, that the generation anew of energy might result in so-called matter.

William Ostwald, in his famous paper on *Overthrow of Scientific Materialism,* 1895, even at that early period of these investigations of the newer chemistry and physics, declared that all we know about so-called matter is the energy it manifests, or its changes of energy, and that the existence of matter is only a supposition required by our modes of thought, especially in their historic unfoldings. Other investigators have reached similar conclusions.

Thus, the testimony of the latest science, as well as that of philosophy, is unmistakable; namely, that what is called the physical universe will finally end in dissolution and annihilation, even though left to its own inherent forces or laws,

and that, therefore, it must have had a *beginning* in a creation by an external transcendent Power.

V THE ETHER THEORY OF MATTER

One of the as yet unsolved problems of science is the determination of the real nature of the so-called luminiferous ether. Heinrich Hertz, before the *Sixty-Second Congress of German Naturalists and Physicians,* Heidelberg, 1889, expressed himself as of the conviction that a knowledge of the real nature of the ether would mean to understand the ultimate nature of matter. He also expressed the belief that all matter is from the ether, that is, that the ether constitutes the ultimate substance of the material universe. His words, as we find them translated, are in part as follows: "Immediately connected therewith [the question of the nature of electricity] arises the momentous and primary question as to the nature of the ether, of the properties of the medium that fills all space, its structure, its rest or motion, its infinitude or finitude. It becomes every day more manifest that this question rises above all others, that a knowledge of what the ether is would reveal to us not only the nature of the old 'imponderables,' but also of the old 'matter' itself and its most essential properties, weights and inertia. Modern physics is not far from the question whether everything that exists is not created from the ether" (Haeckel: *Monism,* p. 103).

Other scientists have come to similar conclusions. And there is much in recent scientific discoveries that points in this direction. And this may, of course, be acknowledged without accepting some fanciful theories of spontaneous creation, etc., of ponderable matter, in the interests of which this theory of the ether is often defended.

It is not within our province to enter into the various theories of the ether, except in so far as they are related to the subject under discussion. A number of ingenious theories are reviewed in the *History of the Theories of Aether and Electricity,* 1910, by E. J. Whittaker, Royal Astronomer of Ireland, to whose work we would refer the reader for theories not referred to here.

The necessity of postulating some very attenuated medium filling all space not occupied by ponderable matter, is, of

course, felt by any one who reflects on the transmission of light and heat from sun to earth—not to speak of electricity and gravitation. As light radiation through the ether exerts pressure, as was calculated by Clerk Maxwell nearly half a century ago, and as has been definitely demonstrated since, no one can doubt the existence of the ether. And, moreover, even reason would demand some *medium* for light-propagation, etc., as indeed for any other form of energy, for action at a distance, or without some intervening medium, is virtually unthinkable.

Although the idea of the ether is quite an old one, it was not till the year 1804 that it was first somewhat developed by Dr. Thomas Young of England. But it was even then regarded by many as altogether too strange a speculative theory to deserve much consideration. And, hence, it took years till it gained many advocates. It gradually, however, gained more and more adherents, as it was more fully developed. At present it is, of course, a universally accepted theory of science.

I THE MORE GENERALLY ACCEPTED THEORY AS TO THE NATURE OF THE ETHER

The ether is quite generally conceived of now as a very rare gaseous but imponderable substance, that pervades all space, even passing between all the infinitesimal particles of so-called ponderable matter—as all matter must be porous. It is by transverse waves of the ether as a medium that light, heat, and electricity in wireless telegraphy, are definitely known to be transmitted. This is not, however, as if light, heat and electricity are transmitted as though they were things, but rather that these phenomena are due to the ether waves themselves.

It is held by eminent investigators that the ether is granular in its nature, that is, that it is composed of infinitesimal particles. This is the theory of the Russian chemist Mendeleef. And Haeckel is apparently in some passages inclined to accept this particle or granular theory of the ether. And to this, such phenomena as the transmission of light, heat, electricity, etc., through the ether, already noted, unmistakably point. The transmission of these by disturbances analogous to those of air for sound, and of water waves in concentric rings caused

by a pebble, plainly indicates that the constitutions of these three media are somewhat similar. As the air is a much rarer medium than water, but also granular in its nature, so no doubt is the ether a medium much rarer than air, but also granular in its nature. So-called matter, as known to us, may be spoken of as existing in a *solid state,* a *liquid state,* a *gaseous state,* and a *radiant state,* as in the disintegrated atoms in electronic rays. And, because of its association with radioactive substances, this last state might well be called "radiant matter," as Sir William Crookes, in a paper on *Molecular Physics in High Vacua,* read before the Royal Society of England, called the cathode-rays in a highly evacuated vessel. And, the supposition is quite well confirmed by various phenomena, among them the power of penetration, that the *ether* is a still rarer *state* of what one might choose also to call matter. Thus the ether may be conceived of as supposedly passing, or filling the spaces, between even the electrons, as the electrons apparently pass between or through atoms, and as gases may penetrate liquids and liquids may pass between an aggregation of solids like a pile of bullets.

2 THE ETHER AND SO-CALLED PONDERABLE MATTER ACCORDING TO THIS THEORY

It is held by some eminent scientists, as already suggested, that not only do the even smaller particles of the ether pass between the particles of other matter, but that even these other particles themselves are composed of ether particles. Or, in other words, in its interstellar or ultimate state, the ether is thus supposed by some to be matter in its rarest form. It is this that gives us the name of this theory of matter. The ether would thus be the ultimate state or element (*urstoff*) of all so-called material substance. Thus, the great physicist J. G. Vogt considered what we call matter as in a sense condensed ether, the atoms being individualized centres of ether concentrations. In the interests of his evolutionary monistic philosophy, Ernst Haeckel entertained somewhat similar views. But, as to the exact relation of the ether to ponderable matter, Haeckel acknowledges that we are as yet in ignorance.

In his *Riddle of the Universe,* pages 227 and 228, Haeckel considers the ether rather as a highly attenuated elastic jelly-like—and probably, however, continuous—substance, fully occupying all space between ponderable matter, and, of course, to its ultimate particles. Its exact weight he regards as beyond experimental determination, though he seems inclined to accept the weight determined from the energy of light waves, according to which its weight is about one fifteen trillionth $\left(\frac{1}{15 \times 10^{12}}\right)$ that of air. That is, its weight would be about $\frac{1}{1155 \times 10^{13}}$ that of water. Or water would weigh over 10^{16} times as much as the same volume of the ether. And this puts the density of the ether in nearly the same order of magnitude as that determined by Lord Kelvin and Graetz, the former calculating its density to be about 10^{-18} that of water and the latter, about 9×10^{-16} that of water.

The ether is thus held by Haeckel to be one of the five conditions or stages of matter; namely, etheric, gaseous, fluid, viscous (in living protoplasm) and solid—a classification somewhat like the one suggested above. He regards the ether as limitless and in eternal motion, which, in reciprocal action with mass-movement or gravitation, is supposedly the ultimate cause of all phenomena. So, also, J. G. Vogt regarded force as due to condensations and contractions of the primal substance or ether. From this process are supposedly developed what he called pyknatoms, or material particles (like atoms), supposedly having will-movement, floating within the as yet uncondensed portion of the primal substance.

Thus, according to this form of the theory, viewed in a general way, matter would be divisible into molecules, these generally into atoms, these into negative particles (electrons) and positive particles not yet definitely determined, and both these finally into what might be called *etherons.* And these etherons would probably be moving within the electrons and positive particles in infinitesimal orbits with wonderful velocities, in a manner similar to that of the electrons within the atoms. Hence, all so-called matter would ultimately consist of ether, or ether would form or be the ultimate substance of all matter. Thus, what we call matter would be nothing but

condensations of the ether, in constant motion within the part not condensed. Or, matter would be only a manifestation of the ether. And these facts would, of course, be unchanged if the ether were considered to be like rarefied glass, whose condensations in certain sections would supposedly constitute what we call matter—a theory that is merely a modification of the one given above.

3 THE MATERIAL UNIVERSE TEMPORAL UPON THE BASIS OF THIS THEORY OF THE ETHER

Upon the basis of this theory of the ether, the present universe would necessarily be a temporal existence. Being supposedly a development from the ether, it would necessarily, by cessation of motion, or annihilation of energy, pass back at least into this elemental ether. Thus, LeBon is compelled to hold that, upon the basis of the ether theory of matter, the universe must have originated from the ether, and that, after running its course, it must again pass away. His theory in a nut-shell, as given by one of his best commentators, is as follows: "We imagine the world to be formed at first of diffuse atoms of ether which, under the action of unknown forces, have stored energy. This energy, one of the forms of which is matter, dissociates and appears in various forms—electricity, heat, &c., so as to bring matter back to ether. 'Nothing is created' signifies that we cannot create matter. 'Everything is lost' means that matter disappears entirely, as does matter by its return to the ether. The cycle is therefore complete. There are two phases in the history of a world: 1, Condensation of energy under the form of matter; 2, Expenditure of this energy" (LeBon: *The Evolution of Forces,* 1908, pp. 96-97).

LeBon holds that what gives apparent solidity to so-called matter, is really the great velocity of the vortex-rings formed in the ether. Matter would thus be nothing but rapidity of ether motion, and therefore a form of energy. And when that motion ceases, matter as we know it must cease to be. Energy is due to motion; and, in the concentration of the ether, as noted above, it would have been stored up for use in future dissociation or disintegration. And thus gradually, by spontaneous processes, all energy, even to the so-called

intra-atomic energy, is apparently given forth and dissipated. And when this will have been completed, the material universe will have ceased to exist. Certainly, if matter were only a manifestation or form of energy, then with the manifestation of energy so-called matter must have begun to exist, and with the cessation of energy it must cease to be. Thus, upon the basis of this theory of matter, the material universe would pass away, as also it must have begun to be.

This fact is, moreover, also implied in the very granular nature of the ether, as well as in its constant motion or vibration, for a granular and moving entity must necessarily be finite, as already pointed out. And, if it were contended, for the sake of argument, that it is not granular, even then, for the reason that it supposedly produces finite granular matter and for reasons elsewhere given, it must be finite. Indeed, the very force of gravitation, which is probably due to very subtle and as yet unsuspected waves of ether, somewhat like those that produce the phenomena of light, etc., is itself another proof of the finiteness of that medium within which it operates, as well as of the so-called ponderable matter upon which it operates and whose positions and motions it controls. If the universe of matter and ether were infinite, it would have to rest in eternal equipoise. But, as it does not thus rest in balanced quiescence, it must be finite, and therefore by nature temporal, not only as a *cosmic whole* but also in its ultimate *ethereal particles*.

Thus, in this wonderful arrangement for gravitation, even according to this theory of matter, often appealed to in attempting to explain away a creative Divinity, we have one more link in the chain of evidence for the finite and temporal nature of the universe and for its creation by a Supreme Deity.

4 THEORY MAKING THE ETHER THE ONLY, OR AT LEAST THE DENSER, MATERIALITY

There is at least one other ingenious, and rather suggestive, theory as to the ether that should here be considered, to determine whether it might in any way affect our conclusion as to the duration of the universe. This very interesting theory makes the so-called imponderable ether the only material exist-

ence. According to this view, what we know as matter would have no real existence. This theory of the ether may be regarded as based upon a view-point almost diametrically opposite that upon which the more generally accepted theory is based. According to this newer theory, the ether is the only real material, out *upon* which we look from *so-called* materiality. According to the other and accepted view of the ether, matter is the denser medium, or the only real matter, out *from* which we look upon the more rarefied medium, which, compared with it, is practical non-materiality.

This theory was somewhat fully developed by Professor Reynolds in his *Sub-Mechanics of the Universe,* published in 1903 by the Cambridge University Press. He considers the ether as an all-pervading liquid mass of indefinite extent, granular in its structure. And, what we call matter, in its particles, he regards as only empty cracks in silent nothingness, in constant motions within the ethereal fluid, the only real matter. The density of this ether has been estimated to be even about 2,000 times as great as lead. According to Reynolds' calculations, its ultimate spherical particles would be so small that their diameters would measure only 5.534×10^{-18} centimeters. That is, it would require about 5×10^{17}, or 500 quadrillion, of these ether particles side by side to measure an inch; or, in a cubic inch there could thus be 125×10^{51} ether particles. These would then correspond to the ultimate particles for which we above suggested the name *etherons.* Even as compared with the electrons these ether particles would be infinitesimally small, so small that it would require about 15 to 20 thousand ether particles side by side to measure as much as the diameter of an electron, or about 4 to 8 trillions to occupy the cubic space of one electron. How inconceivably larger, then, would an atom or a molecule be! And yet, even these molecules and atoms lie in the unfathomable depths far below the reach of the best modern microscope.

Because of its vast extent, the pressure at any point within the ether, according to this theory, it is calculated, would be inconceivably great—about 10,000 tons per square centimeter, or 62,500 tons per square inch. Parts of matter, according to this theory, being only vacua or partial vacua within this ether, could thus, like mere waves, supposedly move unobstructed. However, as matter is supposedly a non-reality, we

need not speak of its temporality. And the grained structure of the ether would necessarily imply even its finiteness and temporal nature.

This theory is similar to that of Whetham, who regards matter as only "a permanent strain form flitting through a universal sea of ether," and the ether as "a close-packed conglomerate of minute grains in continual oscillation." It is, of course, readily seen that, as a strain implies a tendency to motion and adjustment and therefore to final relaxation and rest, the ultimate removal of this strain would mean the end of so-called matter. Moreover, the very grained nature of the ether, according to this theory also, would mean its own finiteness, dependence, and temporality, and that it must have been created. But the temporal nature of the ether itself we shall presently discuss more fully.

Others regard matter as merely whirlpools in the universal ether, a theory which amounts to practically the same thing for our purpose, as those noted above. Thus, if matter were but whirlpools in the ether, quiescence would inevitably finally result, and at least so-called matter, from atom to star, would cease to be.

5 THE PHYSICAL UNIVERSE TEMPORAL AS TO BOTH ITS MATTER AND ITS ETHER

Thus far we have more especially shown that, upon the basis of these theories of the ether, the physical universe as to so-called *ponderable matter* must necessarily pass away, as also it must have come into being in time. We have also briefly noted that, from its necessary finiteness, the ether itself cannot be an eternal entity. We shall now, from the very nature of what might be called the *essence* of the ether, briefly show that an ether-constituted universe would be temporal not only with reference to its so-called ponderable or material side, but also with reference to its imponderable or ethereal side.

It is seen that the ether, which supposedly is the basic substance of all so-called matter, according to this theory of matter, is itself held to be a so-called imponderable immateriality. Like the electron of the electrical theory of matter, the supposed ultimate something (etheron) of the ether theory of

matter, is supposed to have mass and energy by virtue of its motion. In fact, in this subtle entity, energy and mass, or what might be called elemental matter, are generally held to be identical. The same reasoning that ends in the immateriality of the electron, also ends in the immateriality of the ultimate element of the ether. And thus, in their aggregations in so-called matter, according to this theory, they would still, as such *apparent* materiality, remain immaterial. This fact was already foreshadowed in the electrical theory of matter, in what was said about the possible composite nature of the electron and the positive element of the atom. It should thus readily be apparent that, according to this theory of matter, no less than according to the electrical theory of matter, the physical universe *in toto* would be a temporal entity.

If the electron (as also the positive element of the atom) is non-material, or nothing but energy, and if it itself consists of etherons, or of ether in whatever form—as would be the case according to the ether theory—then the ether constituent or component of the electron must necessarily be immaterial and nothing but energy. Hence, the argument in proof of a temporal universe upon the basis of the electrical theory of matter, would be equally valid upon the basis of this ether theory of matter. According to this theory of matter, therefore, with the annihilation of energy in final cessation of all motion and vibration, toward which the universe is unmistakably tending, a corresponding annihilation of what we know as matter must necessarily result. Thus, the physical universe must necessarily have an end.

Moreover, as its present existence, whether viewed from the angle of so-called energy or from the angle of so-called matter, by the very law of inertia, implies some extrinsic power to account for its motions or vibrations, it must have had a beginning in a transcendent creation. And, if it be contended that what is spoken of as creation means simply the development of the material universe out of the elemental ether —as has often been done—even then the unavoidable question would arise unbidden before the mind, Whence the ether, and what the power back of that supposed evolution to cause it to evolve?

Indeed, the very existence of the ether and its supposed evolution, upon such a theory, constitute the two positive

witnesses by which the outstanding fact of their creation by an external power is definitely established. Hence, a supreme Creator there must have been, and be, back of the physical universe as His creature. And that supreme Creator is He Whom the Christian knows as God, by whatever name any other class of thinkers might choose to call Him.

And, even apart from the inherent temporality of the universe, as to both a beginning and an end, according to this ether theory of matter, there is another consideration from which it is also certain that the universe must be temporal. According to this ether theory, even the universal whole is finite, for the unanswerable reasons elsewhere given. Hence, as we have already shown that a finite entity cannot be self-existent, and as it can, therefore, not be eternal, the physical universe, also from this view-point of the ether theory of matter, is a temporal entity. Therefore, however viewed, it must have had a beginning, as also it must have an end. And, therefore, it must have come into being by the voluntary act of a supreme Deity.

6 THE ETHER AND ENERGY—MONISM'S CREATIVE DIVINITY

In accordance with his theory of a universal evolution—including even the primary elements as historic products of an evolutionary process—Haeckel inclines to the view that the ether itself is a kind of creative divinity working upon or in ponderable matter as creative material, which is itself evolved by condensation from the ether. The statement of Haeckel upon this point is as follows: "The two fundamental forms of substance, ponderable matter and ether, are not dead and only moved by extrinsic force, but they are endowed with sensation and will (though, naturally of the lowest grade); they experience an inclination for condensation, a dislike of strain; they strive after the one and struggle against the other" (*The Riddle of the Universe,* p. 220). To this he adds that there is no space not filled with ether matter or ether, and that all action is by immediate contact or by the mediation of the ether. With him, atoms and molecules have sensation, inclination and feeling, resulting in combinations, etc., even as the sexes are drawn together.

There seems, however, to be a confusion of ideas or words

in Haeckel's various statements upon this point. He apparently uses ether, energy, and even spirit, for the same thing, This makes his so-called religious position at first somewhat difficult to determine—if it can, indeed, be spoken of as a *religious* position. But it should deceive no one upon careful examination. He seems to labor in search of an adequate cause of the physical universe. Reason drives him toward some unifying eternal, infinite something as fundamental to all existence. And this he finds, to his own satisfaction, in a monistic conception of the universe. Thus, all is of one and all is one—one eternal infinite substance under different manifestations. To the ether, as apparently substance in its ultimate nature, he ascribes sensation and will; and hence he somehow regards it as spirit, and therefore as energy. But his conception of spirit or will as being at the foundation of the universe, is far from that of the Christian. Some of his utterances must therefore be carefully weighed to avoid misinterpretation. The following words will illustrate this point: "We hold with Goethe that matter cannot exist and be operative without spirit, nor spirit without matter. We adhere firmly to the pure, unequivocal monism of Spinoza: Matter, or infinitely extended substance, are the two fundamental attributes, or principal properties, of the all-embracing essence of the world, the universal substance" (*Ibid.,* p. 8). Thus, all physical and chemical operations, in their last analysis, are made to be spiritual or mental, as, conversely, all mental and spiritual operations are held to be physical or chemical. Physical processes, chemical processes, mental processes or thinking, consciousness—what a confusion of ideas!

It might also be said that Herbert Spencer was inclined to a similar exalted conception of the ether, as expressed in the following words: "The only supposition having consistency is that that in which consciousness inheres is the all-pervading ether. This we know can be affected by molecules of matter in motion and conversely can affect the motions of molecules; as witness the action of light on the retina" (*First Principles,* p. 201).

Of course, when a conscious Personality back of nature as its First Cause is denied, another cause must be sought somewhere, for a cause there must be. And thus it is only natural to look for it in the most subtle, as apparently the

ultimate, thing in physical nature, of which man knows. Indeed, the very mysteriousness of the ether is its best recommendation to be exalted into an ultimate cause, or a subtle divinity. To these speculators the ether is, therefore, more like what God is to the Christian than anything else they can conceive of.

Thus, the ether theory becomes to many philosophers and men of science somewhat of an article of faith. This is even acknowledged by Haeckel, as witness the following words: "Religion itself, in its reasonable forms, can take over the ether theory as an article of faith, bringing into contradistinction the mobile cosmic ether as creating divinity, and the inert heavy mass as material of creation" (*Monism,* pp. 24-25). And, of course, the learned philosopher must be understood to incline to the view that this relation between "ether as creating divinity" and "mass as material of creation," is itself one of actual creator and creature, in the sense that the ether "originally engendered the heavy mass" (*Ibid.,* p. 29).

Thus, the ether is his equivalent of the Christian's God, of Whom the universe of ponderable matter is the creature. There is this deviation, however, from the Christian conception of primal creation, that with Haeckel this creation is not a creation by a supreme absolute Will *ex nihilo,* but by a blind evolutionary emanation of this ethereal divinity itself. This emanation supposedly resulted in a universe-material of *one kind,* from which spontaneously evolved all the different so-called chemical elements, from which in further evolution has evolved, and is still evolving, the present cosmic universe. Thus, in accordance with this monistic philosophy, the whole material universe is of one ultimate substance, and that substance is the emanation of its blind *ethereal* divinity, with which it is, therefore, supposedly likewise ultimately of one substance.

This theory, apart from its theistic or religious aspect, is certainly a bold guess at some possibly ultimate truth. And, as to its material side, the more recent discoveries of chemistry have gone a long way to confirm some of its elements. But, as a theological explanation of the ultimate origination of things, it has no value. Its implied blind Chance back of the present orderly universe cannot account even for Haeckel's

theory, or for the *book* in which it was given to the world. I cannot deny the existence of some learned personality back of his book, nor can he deny the existence of an infinitely greater personality back of the ordered universe. Indeed, by the very laws of thought and by his own religious instincts, the monistic philosopher is forced back to some sort of divinity and some sort of creative process. And, as these are infinitely below those set forth through His servants by One Who, from every available evidence, alone knows, it would be far grander, and even more honest, openly to accept as final the declaration of that One, Who Himself spake and it *was done,* rather than to hide from Him behind mere theories of speculative philosophy.

Indeed, in Haeckel's own premises of reasoning the impossibility of accounting for cosmic nature without a supernatural sentient Being, is only too evident. In the passage from page 220 of *The Riddle of the Universe,* cited above, he speaks of "the two fundamental forms of substance, ponderable matter and ether" as *endowed* with what he calls "sensation and will." It is from this endowment as a potentiality that the cosmic universe supposedly evolved. But, this very assumption of an *endowment* of the ether is suicidal to his own theory of the self-sufficiency of "ether as creating divinity," the divinity that supposedly "originally engendered the heavy mass." That very *endowment* of the ether as a supposed potentiality for the evolution of the physical cosmos in its mass and energy, must necessarily imply the previous existence of some power, or rather Personality, that thus endowed it. Hence, even Haeckel's own premises imply a supernatural Creator back of physical nature as a creature.

Moreover, it would not help matters to assume back of that ether some still more primary substance or energy, from which it might have derived as an endowment that supposed potentiality for the evolving of the cosmos. Such an assumption of some still more primary element than the ether, would immediately necessitate the postulation of a something still more fundamental, and so on indefinitely. And yet, such could not continue infinitely, as there could be no *infinite number* of such successive steps. Such reasoning would be as unsatisfying as was the reasoning of those who held that the earth rested by its four corners upon the backs of four huge

elephants, or that it somehow rested upon the shoulders of some mythical Atlas, as those elephants or that god Atlas would necessarily have to rest upon something still more fundamental. Indeed, such reasoning, instead of accounting for ultimate existence, only deepens its mystery. It does not reach the ultimate; it only pushes it back into still greater mysteriousness. The only possible cause, beyond which there would be no need of another, must be an infinite Will, or a spiritual Personality. Such an undivided and indivisible entity alone can be infinite; only an infinite entity can be self-existent; only a self-existent entity can be eternal; only an infinite, eternal, self-existent entity can be a creator in the absolute sense; and only in such an ultimate reality as a pure cause, can reason rest and be satisfied.

And yet, this very failure of mere speculative philosophy, in its attempt to explain existence, is itself a groping after that something that does have existence in reality; namely, the only eternal reality, the omnific Deity. And, indeed, this unsuccessful search for ultimate truth, is itself thus an evidence of its existence. And thus, the final testimony of the speculative philosopher, as well as that of the pure physical scientist, confirms our conclusion; namely, that the universe is a creation *ex nihilo* by a transcendent Personality.

7 THE INEVITABLE CONCLUSION FROM THE ETHER THEORY OF MATTER

Upon the basis of this theory, a temporal universe, created in the beginning *ex nihilo,* and finally again dissolving or passing *in nihilum,* would thus stand out as virtually a demonstrated fact. Thus, back of its origination and energy it must have had Will, an infinite Personality, as its Cause. Hence, all things must have their cause and subsist in Will alone, as the only ultimate eternal entity, as already noted. This thought is thus also expressed by Alfred Weber: "Modern science has reduced matter to *force,* and Leibniz very aptly said: No substance without *effort.* Now, to make effort means to will. If effort constitutes the essence of matter, the will must be the basis, the substance, and the generative cause of matter. On the other hand, effort is also the source of perception, for there can be no perception without attention, and no attention

without effort. Perception proceeds from will, and not *vice versa.* Hence, *the will is, in the last analysis, the higher unity of Force and idea* . . . it is being in its fulness. Everything else is merely a phenomenon" (*History of Philosophy,* tr. Frank Thilly, pp. 600-601). One might not wish to go the full length of the conclusions involved in this statement; but it undoubtedly expresses a profound truth as to the *cause of matter* and therefore of the existing universe.

The evidence for a temporal universe is truly cumulative in its nature. And the ether theory of matter, as above outlined, is a weighty addition to that cumulative evidence. And, whether we adopt or accept one form of the theory or another, the final conclusion must inevitably be the same: the universe will have an end, and it also had a *beginning.* Therefore, it must have been created in time; and that creation must have been *out of nothing,* by a *transcendent Will.*

VI CONCLUSION IN SUMMARY: THE UNIVERSE TEMPORAL ACCORDING TO ALL THESE THEORIES OF MATTER.

From the above consideration of the five principal theories of matter, it is seen that, upon the basis of any and all of them, the physical universe is by nature *temporal.* It had a *beginning,* and it will have an *end.* Matter itself slowly disintegrates and energy ultimately disappears. The law of the conservation of matter is thus no more a demonstrated fact than that of the conservation of energy, of which we have also spoken. Sir Oliver Lodge has truly said, "This law [that of the conservation of matter] has been called the sheet-anchor of chemistry, but it is very far from being self-evident; and its statement involves the finding of a property of matter which experimentally shall remain unchanged, although nearly every other property is modified" (*Life and Matter,* p. 21). And of similar import are the following words by another man of science: "It is a fundamental principle of the theory of evolution, . . . that matter itself is eternal. . . . But we doubt whether any physical philosopher of the present day would be satisfied to accept any demonstration of the eternity

of matter. . . . He would . . . admit that his experience no more sufficed to settle the question than the observation of an animal for a single day would settle the question of the duration of its life, or prove that it had neither beginning nor end" (Newcomb: *Side-Lights of Astronomy,* pp. 58-59).

As has been seen, energy and matter, according to some of the greatest scientists, are so related as to exist together and to disappear together. They cannot really be separated. With the dissolution of molecular structures the unstable atomic elements, with their intra-atomic energy, remain. These, in their ultimate nature, are held to be energy. And, with the dissolution of the atomic structures the intra-atomic energies must disappear. Thus, so-called matter is constantly being transformed into the ultimate energy at the foundation of all, while that energy will itself as certainly cease. Therefore, though by artificial methods or means man cannot annihilate matter, nor destroy energy, but can only change both, by nature's own inherent forces the destruction of both is constantly taking place. Though we cannot destroy or simplify the atom, by the inherent forces of radioactivity this is ceaselessly being done. And, what is true of the atomic structure, is true of nature as a cosmic whole.

Nor can we *create* either matter or energy. And yet, not only does the temporal nature of matter *imply* its beginning or existence and therefore a creation, but by other evidence more direct is this almost incontrovertibly demonstrated. Indeed, very recently some scientists have come to the conclusion that matter may possibly even now be in process of formation or creation, by inherent forces in nature, as also it is even now by similar forces in process of destruction.

But even if this were the case, it would surely not explain away a *creative Deity.* If it were true, it would simply mean that nature was originally so endowed with the necessary forces as to make these supposed processes possible. And, of course, their ultimate Cause would have to be none other than the One to Whom all other theories conduct the honest investigator and searcher after truth. And, indeed, upon the basis of such a theory of present creative and destructive processes, the temporal nature of the universe would become all the more evident and certain. Temporality everywhere, not only as to a beginning but also as to an end, would thus flash

forth from every point of the universal whole. And, of course, such successive creations and destructions could not form an endless cycle; and therefore as a whole the universe must have had a *beginning* and would have to have an *end.* Moreover, even the least balance in favor of the destructive process would *hasten* universal annihilation.

Furthermore, it is almost certain that the present energy of the universe is the result or effect of this destructive or disintegrating process of so-called matter. Thus, while radium is disintegrating there is a manifestation of energy, and when disintegration has been accomplished, its energy has ceased. So, as electricity is only the passing of electrons from atoms to atoms, it, too, is the result of disintegration. And, when that disintegration has gone to the point of equalization or equilibrium, the current stops and energy disappears. And, if the electron is nothing but energy, with its passage in electricity, etc., there must be a dematerialization of matter. What we call matter would thus be only the manifestation of energy, and would therefore disappear when that energy would be spent.

It is, therefore, incontrovertibly true that, according to any form of the kinetic theory of matter, the universe would necessarily be a temporal entity, and that with the equalization or ultimate dissipation of its energy, or of all its motions, it would certainly wholly pass away. So also upon the basis of any theory of matter whatsoever, because *in toto* it must necessarily be a finite entity, the universe must be *temporal* and must, therefore, have been *created* by a transcendent Creator.

CHAPTER VIII

EVIDENCE FROM DESIGN IN NATURE, NECESSARILY IMPLYING ITS CREATION IN TIME BY A DESIGNING CAUSE OR CREATOR.

ALL nature, both in its cosmic unity and in its every detail, appears as an effect or as an event. From electron to star, everything appears and acts as part of a mighty machine, adapted and related to everything else, each fitting into its own suited place in the complete and perfect whole. Thus, in everything, from particle to universe, from dead matter to the human soul, design is clearly manifest, that it was made for a specific place and purpose. Indeed, it would be infinitely more difficult to believe the universe to have thus eternally existed or to have developed by so-called chance, than that it was created by a personal Divinity with design, in time. Thus, the great whole exists upon a sublime *plan,* so that to the very last element it must have had its existence first as an *idea* in the mind of a Designer, a creative Deity.

In this chapter we shall consider this evident design in nature, as further absolutely unmistakable evidence that the universe has not existed from eternity, but that it is the product of a supreme intelligent Will.

As we have said, the universe exists upon a mighty *plan.* All its parts are related to all other parts with mathematical precision. The mighty velocities and revolutions of the heavenly bodies are according to rigid mathematical formulas. The heavenly bodies are weighed and balanced against one another with more accuracy than could be attained in the laboratory with the most delicate scale. Their weights, distances, orbital velocities, etc., are more delicately measured and adjusted than in the most perfect clockwork. Indeed, without this, the calculation of eclipses, etc., would be impossible; all science and mechanics would be impracticable. And, on the

other hand, with a *perfect* knowledge thereof, men would be able to calculate, for any definite past or future time, the place and the velocity of any body in all the countless stellar hosts. It might even be said that, as everything is affected by everything else, if man could know all the forces and circumstances that enter into a coming avalanche, or even into the growth and fall of an apple, the same might be definitely foretold for any future time. So, conversely, under similarly *ideal conditions,* from any such individual object or event the whole complex series of objects or events that preceded or affected it, might be calculated. Or, it might be said that from any one object all other objects might be determined.

Thus, as all affect each and each affects all, both successively and simultaneously, as more fully shown in a previous chapter, all are theoretically in each and each are in all. The whole, even to the ultimate electron of the last star, is, in accordance with an exquisite *unity* of design and purpose, bound together and mutually related and interdependent in one mighty, but no less dependent, universe. This would not, however, preclude the possibility of interference, or of direct operation, on the part of its absolute Cause or Creator.

To say, on the contrary, that the universe is self-evolved, as is often asserted, is as absurd as to say that a stone is self-moved. A self-evolved or self-existent entity must necessarily be infinite, and even to such the word *self-evolved* would not apply. As something must have been first and self-existent, it must have been infinite and absolute, or else it would have been finite and therefore *necessarily* related to something else. And, as that first something was infinite it must have been the only infinite, as there could be but one infinite existence, else they would in a sense mutually exclude each other. This infinite must, therefore, have been the cause of all else, a conclusion also arrived at before.

Again, to an infinite there cannot be any evolution possible, by the very nature of an infinite, already pointed out. An infinite is unlimited, absolute, complete. It cannot, therefore, become more unlimited, more absolute, more complete. Therefore, as evolution means a development toward greater completeness, etc., an infinite cannot evolve or be evolved. Therefore, as the universe is supposedly evolving, it cannot be infinite, a fact already demonstrated; and, as it cannot be

infinite, it cannot be self-existent; and, as it cannot be self-existent, it cannot be *self*-evolved; and, as it cannot be self-evolved, it must have been created, or it must have been or be evolved by a Power beyond itself. And such supposed evolution must necessarily have been preceded by an adequate involution to make it possible. And that Power back of such involution and evolution must have been self-existent and therefore infinite, and therefore the cause of all else, a conclusion also reached by another process of reasoning. By that Power the universe must thus have first been involved with all the potentialities that were, by the supposed evolution through secondary causes, to result in a completed universe—a goal apparently not yet attained, if we accept the testimony of philosophic scientists themselves.

Thus, in answer to the question what caused and what maintains existence, Sir Oliver Lodge makes the following suggestive remark: "Of our own knowledge we are unable to realize the meaning of origination or of maintenance; all that we ourselves can accomplish in the physical world is to move things into desired positions, and leave them to act on one another. Nevertheless our effective movements are all inspired by thought, and so we conceive that there must be some Intelligence immanent in all the processes of nature, for they are not random or purposeless, but organized and beautiful" (*The Substance of Faith,* p. 70).

I THE OBJECTION AGAINST THE IDEA OF DESIGN IN NATURE ANSWERED

It has been stoutly denied by many scientists that there is any design in nature. This view is dogmatically stated by Haeckel in the following words: "The development of the universe is a monistic mechanical process, in which we discover no aim or purpose whatever; what we call design in the organic world is a special result of biological agencies; neither in the evolution of the heavenly bodies, nor in that of the crust of our earth do we find any trace of a controlling purpose—all is the result of chance" (*The Riddle of the Universe,* pp. 273-4).

And not only has the *presence of design* in nature been

denied, but also any *act* of an omnipotent Creator, especially His use of *means,* has been denied. On this point, John Stuart Mill makes the following declaration: "It is not too much to say that every indication of Design in the Kosmos is so much evidence against the Omnipotence of the Designer. For what is meant by Design? Contrivance: the adaptation of means to an end. But the necessity for contrivance—the need of employing means—is a consequence of the limitation of power. Who would have recourse to means if to attain his end his mere word was sufficient? The very idea of means implies that the means have an efficacy which the direct action of the being who employs them has not. Otherwise they are not means, but an incumbrance. . . . Wisdom and contrivance are shown in overcoming difficulties, and there is no room for them in a Being for whom no difficulties exist" (*Three Essays on Religion: Theism,* 1884, pp. 176-7).

This objection of Mill, if analyzed, leads, however, to a counter objection to his objection. If Mill could contend that "Design in the Kosmos is so much evidence against the omnipotence of the Designer," we contend that his contention, by just that much, limits that omnipotence. An omnipotence that is not *able* to work by design or through means is not omnipotent. Indeed, a being (God) that would not be able to operate through means would be as truly limited, though in a different way, as a being (man) that is not able to operate *without* means. If Mill had said that *necessary* means or design would limit omnipotence, he would have spoken correctly. Man is limited by *necessary* means. And, if design or means in creation were *necessary* with the Creator, He, too, would be limited. But that is precisely what we contend is not the case. However, Mill inadvertently speaks of "the necessity for contrivance—the need of employing means"; and thus he really nullifies his own argument against design. It is, therefore, Mill who limits the Creator's omnipotence by design or means, by reading into them *necessity* on the part of the Creator; but the mere *use* of means by the Creator, and the *presence* of design in nature, do not thus limit Him.

On the contrary, the very necessary freedom of an absolute Creator implies freedom of choice in the *method* of creation. And to choose means, after He had first created them, would

only be a glorifying of the means in the further operations of creation. In illustration of this fact, we would point to the method of Jesus of Nazareth in the raising of Lazarus. He first directed men present to remove the stone from the grave, because this could be done by ordinary human agency or means. Then, with an exercise of His own power, he called Lazarus to life, because this could not be done by merely human means. And then he directed the men to remove the bands, etc., because this again could be done by them. And this, surely, was a method of choice and not of necessity. Although this is not exactly parallel to the operation of the Creator as a pure Spirit in using already created means, it is certainly closely analogous to it. Indeed, there are many things that a thoughtful parent requires a child to do that he could better do himself without the child's help, while other things he does because the child could not do them. But this does not *limit* the parent in so far as the cooperation of the child is concerned. Neither does the one voluntary or chosen method of the Creator, any more than any other chosen method, limit His omnipotence.

And, as for *design,* no one should deny design to an infinite mind any more than to a finite mind. To deny design would be equivalent to denying intelligence. To deny intelligence would be equivalent to denying mind. And, to deny mind would be to deny personality. And, an impersonal Creator would not only be an impossibility, as already noted, but it would even be a contradiction in terms, as the very name *Creator* implies personality, and a personality that is conscious.

Moreover, here, too, our very limitation makes the full conception of an infinite and absolute Creator impossible, as that limitation unconsciously impels the thinker to ascribe limitation to the Absolute. But the fallacy in Mill's argument, of course, is in making the Creator's operations, in accordance with design or wisdom and through means, a *necessity* in the sense in which means to us are a necessity. In speaking of design in connection with the Creator's work, we must, of course, not lose sight of the fact that we cannot separate design from act in an infinite and eternal Being. A chronological sequence of these two things, in the sense in which it exists in man, there surely cannot be to an eternal or timeless Personality.

This denial of the existence of design or purpose in nature has, of course, been the case especially with reference to living organisms. Paley's famous argument has not only been rejected as valueless, but it has even been ridiculed. But the arguments against design have been based partly upon misapprehension or a confusion of ideas, and partly upon unproved assumptions. The terms Designer and design as applied to Deity must not be considered as exactly parallel to the same terms as applied to man. The Deity is not a corporeal conditioned Being; and the ideas of design and act cannot be separated in an absolute, eternal, spiritual Personality. But, even if Paley's argument be considered open to the charge that it attempts to prove too much and that it is too materialistic in its nature, it must nevertheless stand as a highly *suggestive* explanation of the ways of God in nature.

And, to say that to speak of *design* is merely begging the question, as by the very idea of that term we already imply a designer, is an argument of straw. One might with equal force object to Darwin's term "natural selection," by arguing that by that term he implied a selector and therefore purpose or design. Indeed, it is exceedingly difficult to get away from terms that express human ideas which seem to be almost universally instinctive. Our earth-developed language is altogether inadequate to express totally transcendental ideas. We cannot, by unenlightened minds, rise above ourselves and the earth, with the naturally associated ideas and language. And even to select a term of passive meaning, like "survival of the fittest," does not altogether rid the subject of difficulty. To speak of a survival of the fittest is merely to assume that they are the fittest that survive.

We are, therefore, content to retain the old word *design* as applied to nature, until a better word will have been furnished to express that definite idea for which we use the term. And, surely, to deny design in nature in the sense of purpose or order, in which it has been used, is to deny the very ideas of purpose and order even in the thoughts and works of man, nature's crown. And to deny them there, on the plea that man is not a mentally and physically free agent, is to make our life an illusion. Then, all the arguments of these objectors to a designing Deity, are also nothing but illusion and confusion. Sir Oliver Lodge well said, "The essence of mind is

design and purpose. There are some who deny that there is any design or purpose in the universe at all: but how can that be maintained when humanity itself possesses these attributes?" (*Life and Matter,* p. 102.) And, as to human design, as against the idea of materialistic automatism, the same author says, "Matter is the vehicle of the mind, but it is dominated and transcended by it" (*Ibid.,* p. 107). And Sir William Thompson, in his address before the British Association, 1871, as published in *Nature,* Volume IV., declared for design in the following emphatic words: "I feel profoundly convinced that the argument of design has been greatly too much lost sight of in recent zoological speculations. [Here is a brief comment on Paley's *Natural Theology.*] . . . Overpoweringly strong proofs of intelligence and benevolent design lie all around us, teaching us that all living beings depend on one ever-acting Creator and Ruler" (p. 270). And no less emphatic are the following words of Samuel Butler, at the conclusion of his work on *Evolution Old and New,* 1911, "It has been the object of the foregoing work to show that those who take this line are wrong, and that evolution not only tolerates design, but cannot get on without it" (p. 408).

II DESIGN MANIFEST IN EVERY LIVING ORGANISM

It is too evident to require argument that living organisms are constructed and adapted for specific ends. Every organ or limb is a tool to perform a definite function. Paley long ago called attention to the eye of the eagle as compared with that of the owl, and to the wonderful poise of the human head for universal motion, and to the wonderful binding down, by a ligament, of the tendons running from the leg to the foot, etc. To say that these are only cases of spontaneous adaptations or appetency does not explain them. The fact is that the binding down of the tendons is in direct opposition to any such supposed spontaneous action. By spontaneous action, instead of being bound down they would tend to be more and more released. Many other equally striking cases might be cited, but these are enough to illustrate our point.

Moreover, the provisions of pleasure and pain are too manifest to need more than a passing notice. The very fact that

an act is pleasurable or painful has the purposive effect to cause a desire to repeat or to avoid it. The sensations of pleasure and pain are inseparably connected, as secondary causes, with the preservation of the individual, as well as of the race. They are teleological means to a greater end. And the provisions of sex, as complex means existing even in different or separate individuals for the propagation and perpetuation of the species, afford an unanswerable evidence for a designing Mind, as ultimately superintending the multiform operations of nature.

In a late work by Alfred Russel Wallace (*The World of Life*), design is elaborately and conclusively demonstrated from various organisms. His argument from birds and insects for "an organizing and directive life-principle," an organizing mind (pp. 309, sq.), is unanswerable. And so his chapter on *Mystery of the Cell* (pp. 361, sq.) should bring conviction not only to every modern doubting Thomas, but even to the avowed atheist. Indeed, the very idea conveyed by the word *organism* or *organ* so evidently implies that of an *organizer,* that the most pronounced skeptic cannot get along without it. Thus, Kerner tried to explain the living organism in terms of what he called *vital force;* Thomas Huxley, in terms of what he called *the organizing power;* and Ernst Haeckel in terms of *unconscious cell-souls.* In Haeckel and many others, in ascribing a sort of life, self-activity and consciousness to matter, we have a return to a form of ancient Greek hylozoism. In trying to eliminate a designing Creator, these men have thus inadvertently created a supposed unconscious or impersonal creator or cause of their own. A cause they feel compelled to recognize back of organisms; and, hence, their respective special theories.

Those who would follow this particular line of thought on design in organisms further, will find in the above work by Wallace, and in Janet's *Final Causes,* as well as in some excellent works on *Theism,* a fuller development of this subject.

As already noted, there have been men, who, on finding themselves unable to explain the processes of life without design, have looked for an explanation in the life of the organism itself, thus making it a self-evolved entity. The great pioneers

of the doctrine of evolution, especially Buffon (1707-1788), Erasmus Darwin (1732-1802) and Lamarck (1744-1829), inclined to this view. But, this would in effect be equivalent to deifying the life of the organism itself. Thus, the creative and directive force or agency in organisms, with these men, would be the vital force of the organism itself.

Nevertheless, whatever form of the theory of evolution one may choose to adopt, he can no more get away from a designing Creator than if he regarded all things created full-fledged and perfect by an immediate act of Deity. This is acknowledged even by many of the greatest authorities on the doctrine of evolution. Thus Wallace expressed himself on this point as follows: "I argue that they [structures of organisms referred to] necessarily imply first, a Creative Power, which so constituted matter as to render these marvels possible; next, a directive Mind, which is demanded at every step of the process we term growth and often look upon as so simple and natural a process as to require no explanation; and, lastly, an ultimate Purpose, in the very existence of the whole vast life-world in all its long course of evolution throughout the eons of geological time. This Purpose, which alone throws light on many of the mysteries of its mode of evolution, I hold to be the development of Man, the one crowning product of the whole cosmic process of life-development; the only being which can to some extent comprehend nature" (*The World of Life,* 1911, Preface, vii.).

And, that the so-called natural selection of the doctrine of evolution could in no way be mere chance or accident, is openly acknowledged by some of the most eminent naturalists, among them such authorities as Mivart, Prof. Owen and John Fiske. The last named says on this point, "The Darwinian theory, properly understood, replaces as much teleology as it destroys. From the first dawning of life we see all things working together toward one mighty goal, the evolution of the most exalted spiritual qualities which characterize Humanity" (*The Destiny of Man,* p. 113). This fact he further developed in the second volume of his *Cosmic Philosophy.*

We believe, therefore, that further argument on our part, in proof of the fact that even the theory of the so-called evolution of species does not eliminate design from nature, and therefore a designing Creator, is made unnecessary by the em-

phatic testimony of even its greatest defenders. Indeed, design in living organisms has generally been regarded as so evident, and indeed convincing, that it has hitherto been made the chief argument from nature for the existence of a Supreme Being operating through nature. Writers on *Theism,* a generation ago, used this argument with great force to convince doubters and unbelievers of the various types, of the tenableness of the Christian position, as well as to strengthen believers in their faith. And some of the men who viewed this manifest design in organisms more especially from the scientific angle, went to the extreme of well-nigh declaring for a religion of nature, almost to the ignoring of the need of a supplementary Revelation. It should be needless to say, however, that such an extreme position is equally dangerous to truth and religion. And the reaction against the very idea of design, noted above, might be expected to be a natural consequence. While design in organic nature is thus so evident that it should require hardly any argument in proof of it, it alone is nevertheless altogether insufficient to form an adequate basis for a religion of nature.

But, not only in organic nature, but also no less in inorganic nature, is design everywhere manifest. And, as this opens up even a larger field of investigation, a field hitherto not adequately explored for evidences of design, it deserves here a much fuller consideration than that of organic nature. To such a consideration we shall, therefore, now proceed.

III DESIGN MANIFEST IN EVERY PART AND EVERY LAW OF INORGANIC NATURE

Let us now contemplate inorganic nature and set forth such evidences of design as are there unmistakably manifest. This rather neglected field for the study of teleology affords us an additional proof for the temporal nature of the universe and its necessary creation out of nothing by a designing Deity.

I THE CONSTITUTIVE PARTICLES OF COSMIC NATURE LIKE MANUFACTURED ARTICLES

About eighty so-called primary elements are known. And all these chemical elements are composed of atoms, not to speak

at this point of further subdivisions. These atoms are so small that a drop of water would contain approximately 500 quintillion atoms of hydrogen and 250 quintillion atoms of oxygen. That is, it would require a sphere of many millions of these atoms to be seen under a powerful microscope. And yet, these atoms are weighed and balanced against other atoms, in nature's mysterious laboratory, with absolute precision. And though there are so many of these atoms throughout the vast stretches of the material universe as to be beyond all human comprehension, there are probably but a few more than fourscore different *kinds*. And those of the same kind, or of the same elementary substance, under similar conditions, are apparently absolutely alike in weights, etc., while those of different substances are always different. The atoms are thus more perfect than if they had been made by the most perfect artificial means.

Taking the hydrogen atom as the standard of weight and calling it 1, the oxygen atom weighs approximately 16, that of silver 107, that of radium 226, etc. Nor do these relative weights, under similar conditions, vary the minutest fraction. Thus different atoms are apparently fitted to one another by exact weights, etc., necessary for the constitutions of the various different molecules and complex substances, just as the various prepared materials that enter into the make-up of different complex buildings are unmistakably made for one another.

The atoms, in their chemical unions with one another, form molecules. And these are of two kinds, molecules of elements composed of atoms of the same kind or substance, and molecules of compounds, composed of atoms of different kinds or substances. So, many elementary molecules consist of two or more atoms of the same kind. Thus the hydrogen, oxygen and nitrogen molecules have been found to have two atoms apiece (diatomic). And, when we come to the various chemical compounds, we find the molecules generally much more complex and the atoms more numerous. Thus in nitric acid (HNO_3) there are one atom of hydrogen, one of nitrogen and three of oxygen. In the Caffeine ($C_8H_{10}N_4O_2$), found in coffee, there are eight atoms of carbon, ten of hydrogen, four of nitrogen and two of oxygen. And the molecules of many other compounds are still more complex. What wonderful

structures! What skill or intelligence must be necessary to build up such complex infinitesimal structures in their countless duplicates, all exactly alike for the same substance! Yet, so wonderful are the workings of nature's mysterious laboratory that no two of the same kind among the countless number also of these molecules, wherever found throughout nature, differ in the least detail. Surely, a law here that requires an infinitely intelligent law-Giver! Thus Clerk-Maxwell declared in a lecture before the *British Association* at Bedford, "None of the processes of Nature since the time when Nature began, have produced the slightest difference in the properties of any molecule. On the other hand, the exact equality of each molecule to all others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent. Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost of our thinking faculties when we have admitted that because matter cannot be eternal and self-existent, it must have been created" (*Scientific Papers,* published by Cambridge University Press, 1890, Vol. II., p. 376).

As already stated, the atom and the molecule are far below the reach of the most powerful microscope. Some additional facts as to the sizes of these minute particles will add further evidence that they were *created,* while they will also enhance our conception of their wonderful Creator, Whose designed work is thus perfect in its almost seeming artificiality, even to every detail of the infinitesimal.

According to one calculation, by Perrin, the oxygen molecule measures 2.6×10^{-8} centimeter in diameter. Or it would take about 100,000,000 of them side by side to measure an inch. Or it would require about 10^{24}, or one septillion, of them for a cubic inch. Other calculations have brought slightly different results, but not to change the order of magnitude. Thus, according to Meyer's *Kinetic Theory of Gases,* Tr. Baynes, 1899, page 331, the mean diameter of a molecule would be about 2×10^{-8} cm., or it should require 125,000,000 molecules to measure a linear inch. That is, one molecule would measure 0.2 *micro-micron.*

It might be said that, with the best modern microscope, it

is possible to distinguish a particle only $\frac{1}{175,000}$ of an inch in diameter. And yet it would require about 600 oxygen molecules side by side to measure as much as the diameter of this smallest visible microscopic particle. Thus it would take nearly 300,000 oxygen molecules arranged within a circle, or about 100,000,000 in spherical mass, to become barely visible under the most powerful microscope.

Indeed, the individual molecule is far below the reach even of what is known as the ultramicroscope, devised by Zsigmondy. With this instrument, a particle in a colloidal solution of gold, with a diameter of only about $\frac{7}{100,000,000}$ of an inch, it is claimed by some authorities, can be distinguished. Or, with this arrangement, a particle only about $\frac{1}{80}$ of the diameter of the smallest ordinary microscopic particle can be distinguished. That is, it would require about 80 ultramicroscopic particles side by side, or over 260,000 in spherical mass, to be distinguished in the most powerful ordinary microscope. But, as it would require approximately 600 oxygen molecules side by side, or 100,000,000 in spherical mass, to be seen with the ordinary microscope, it would require about 7 or 8 molecules side by side, or approximately 300 to 400 in spherical mass, to be discerned even with the ultramicroscope. This would also follow directly from the fact that a particle of $\frac{7}{100,000,000}$ of an inch can be distinguished with the ultramicroscope.

Thus the atom becomes all the more wonderful by its inconceivable littleness. And its perfection and marvelous adaptation for union with other atoms thus stand forth all the more strikingly as evidences of design in their origination.

And, wonder of wonders! by spectrum analysis it has definitely been determined that the same atom-composed elements that constitute the substances of the earth, are also the constituent elements of the sun and stars. And what is true of the unity of the universe with reference to its separate chemical elements, is more and more found also to be true even with reference to the constitutive parts of it as a cosmic whole. Surely, design in all this, and a designing Creator must be back of it! Thus, not only in ultimate minuteness, but also

in cosmic unity, design becomes an unanswerable evidence that all things are from the same intelligent creative Will.

We have thus, in the constitution of the very elements as building materials, a remarkable provision for the combinations of these elements in the structures of all substances in the earth and in the sun and stars. This adaptation is so perfect and so marvelous in its every detail as to leave no possible room for doubt that it is an *intentional* arrangement for the very purposes which it subserves. Surely, blind must he be who sees not the finger of God in this thing. And all really thoughtful men, whether they have any religious convictions or not, if they lay all preconceptions based upon pet theories aside, are compelled to acknowledge the presence of some wonderful guiding hand in these marvelous adaptations. Thus, even John Stuart Mill, in spite of his pronounced negative attitude toward all arguments from the doctrine of cause, from consciousness, and from nature in general, for the existence of a creative Deity, was nevertheless compelled to make the following confession: "I think it must be allowed that, in the present state of our knowledge, the adaptations in Nature afford a large balance of probability in favour of creation by intelligence" (*Three Essays on Religion: Theism,* p. 174).

2 EVIDENCE OF DESIGN IN CHEMICAL UNION AND THE "PERIODIC LAW"

The union of atoms of one kind with atoms of other kinds is in a wonderful way according to definite laws, in definite multiple proportions. It is always as 1 to 1, 1 to 2, 2 to 3, etc., as for example in hydrochloric acid (HCl), carbon dioxide (CO_2), and arsenious oxide (As_2O_3). Moreover, every kind of atom has what are called different affinities for different other kinds of atoms, but in different proportions. One atom of oxygen may be said to unite with itself two of hydrogen to form water (H_2O), one of carbon to form carbon monoxide (CO), while it may be said to require two atoms of oxygen to unite with themselves one of carbon in forming carbon dioxide (CO_2). Thus an absolute law governs all the

multiform combinations in the complex compositions of matter. This is another wonderful arrangement, resulting in the many different kinds of compound substances for use and beauty, of almost infinite variety.

Moreover, atoms of different elements unite with each other so closely or intimately in forming molecules that in their union they lose every trace of their individualities or characteristic properties, thus forming really what is known as an entirely different material substance. And even the very attractions that hold these atoms together are just what they should be for the variety of combinations of various different atoms. Much more might be said upon these and other unmistakable evidences of design in the laws of chemical union, so-called valency, etc., but these facts are sufficient for our purpose.

Another remarkable evidence of design, closely related to that of chemical union, is found in the fact that the eighty or more primary elements are divided into groups or families according to what is known as the "Periodic Law," or the law of octaves in atomic weights. This law was in substance discovered by several investigators. It was first suggested by John Newlands in a letter to *Chemical News* in 1863, that, in an arrangement of the elements from hydrogen to uranium, the various elements, like octaves in music, would be similar to the eighth above or below them in the series. In a series of papers in 1864 and 1865, containing tables of atomic weights in illustration, he gave more definite form to the principle suggested, in the latter year naming this law the "law of octaves." It might, however, be said that this law had already been foreshadowed by Prout (1815) in his investigations as to atomic weights, in which he was led to believe all elements, as apparently whole numbers with hydrogen as 1, to be only condensations of hydrogen. In Döbereiner's "triads," suggested several years later, some of the elements of this law were also suggested.

Other men soon applied themselves to further investigations, among them Lothar Meyer, who as early as 1864 gave a very suggestive table, which he very much improved in 1868. He more definitely pointed out that the properties of elements are periodic functions of their atomic weights. But it was the Russian chemist Dmitri Ivanovich Mendeleeff who

most fully developed this law, in its various applications, already in connection with his first published table calling it the "Periodic Law," the name by which it is now generally known.

According to this wonderful law, the eighth element from any other is found to repeat properties of the first. And it is readily seen that, if the weight of an element is known, its properties can largely be determined, as the weight is found to fix its properties. Hence, where there occurs a gap in the elements, it suggests a still undiscovered element. Thus, as the planets are separated from one another and from the sun according to Bode's law of proportionate distances, so the members of a group of chemical elements may be regarded as separated from one another and from corresponding members in other groups in accordance with this atomic law of octaves. And so, as the asteroids between Mars and Jupiter were discovered from Bode's law, new chemical elements have been discovered by this periodic law of chemistry, as they were previously predicted to exist with almost definite properties. Thus, in 1871, Mendeleeff forecast the existence of three new elements, which were later actually found, with properties very closely corresponding to the prediction; namely, *Gallium, Scandium* and *Germanium*. And as yet undiscovered elements have also been predicted and theoretically described according to this law; and these may in time also be discovered. Thus, in Mendeleeff's table of chemical elements according to the "Periodic Law," 1903, he placed two as yet undiscovered elements which he called x and y. The element y is now believed to be an element found in the envelope of the sun, with an atomic weight of .4, and called *coronium*. And for the supposed element x the name *Newtonium* has been suggested. To this element Mendeleeff gave the atomic weight of .000001, or about 600 times lighter even than the electron, the subatomic corpuscle, spoken of in the preceding chapter. It is needless to say that the natural inference would be that this element might be the subtle ether, as the ultimate basis of all matter. If this element were discovered and could be proved to be identical with the ether, it would be the key to the solution of one of the hitherto greatest mysteries of nature. So, likewise, Johnstone Stoney also came to the conclusion that there are three elements lighter than hydrogen.

It might also be said that with this law of chemical elements correspond the numbers and arrangements of electrons in the atoms of the various kinds. Or, in other words, if we may anticipate, the numbers and arrangements of these subatomic electrons, in conjunction with their positive nuclei, cause or determine what is known as the "Periodic Law." It is also to these ultimate particles and their arrangements that chemical valency is due. Thus, in the discovery of this great law of chemical elements we are tracing another foot-print of the Creator after Him in His creation. Indeed, in the "Periodic Law" chemistry has found the key to the solution of many mysteries of nature, such as the possible further subdivisions of matter, and perhaps some of the methods and purposes of the Creator.

As above noted, according to the "Periodic Law" there are recurring points marking certain properties for every eighth element in the ascending series. And in every octave the stability of the atoms apparently decreases with the relative increase in atomic weights. Moreover, the atomic groups themselves, considered as units, appear to be more and more unstable as to their forms, as we ascend the scale of atomic weights. The highest and most unstable in the scale of a chemical family, is followed by the lowest and most stable of the family above it. And thus, as the scale is ascended, we reach the last chemical family, beyond which there is no other known family. The highest atomic instability is here reached, beyond which instability would apparently have to be so great that no other higher kind of atom could exist separately. This has led some men to conclude that the order of creation, or of supposed evolution, of the material elements from some original "protyle," or cosmic ether, began with the elements of lowest atomic weight and proceeded up the atomic scale. The disintegration, as indeed radioactivity evidently suggests, would then normally proceed from those of highest to those of lowest atomic weights.

All these facts, instead of making against design, leave no room for any other explanation than that they are the unmistakable work of an intelligent designing Personality. Blind must be he who does not see design and purpose in such marvelous arrangements for order in nature!

3 EVERYTHING APPARENTLY IN CEASELESS MOTION ACCORDING TO FIXED LAWS.

Let us now consider another wonderful arrangement of these molecules and atoms. All are in ceaseless motions. Indeed, not only atoms and molecules, but everything above, as well as everything below them, is in motion. And cessation of motion would mean stagnation and death, and, as we have seen, in all probability, utter annihilation.

That everything is in motion is the general verdict of science, and was well expressed in the following words by W. R. Grove: "Of absolute rest nature gives us no evidence; all matter, as far as we can ascertain, is ever in movement, not merely in masses as with the planetary spheres, but also molecularly, or throughout its most intimate structure; thus every alternation of temperature produces a molecular change throughout the whole substance heated or cooled; slow chemical or electrical actions, actions of light or invisible radiant forces are always at play, so that as a fact we cannot predicate of any portion of matter it is absolutely at rest" (*The Correlation and Conservation of Forces,* 1868, pp. 26-27). Thus, "with larger, other eyes than ours," we could see all things in ceaseless motion or vibration.

All atoms are thus apparently in ceaseless motions or revolutions, one around the other. The elementary hydrogen molecule with its two atoms is like a double star of the infinitesimal world, one revolving around the other. And what wonderful systems of revolving atoms are the more complex molecules of chemical compounds, all probably revolving around their common centre of gravity! Try to conceive of the wonderfully intricate and complex atomic rotations and revolutions within a molecule of the compound quinine with its 20 atoms of carbon, 24 of hydrogen, 2 of nitrogen, 2 of oxygen! And these molecules, composed of rotating and revolving atoms, are themselves likewise in ceaseless motions, at enormous velocities and developing great quantities of energy.

It should be almost needless to say that in these marvelous provisions for the orderly operations of nature, not chance, but *purpose* is everywhere manifest. The hand of the infinite Operator is so clearly in all these details that we can almost see Him at His mysteriously wonderful work.

Another remarkable thing about the molecules is that though molecules of different elements are very different in size and weight, yet equal volumes or quantities of all gases, at the same temperature and pressure, have equal numbers of them. This law, first enunciated by Avogadro (1776-1856), has been demonstrated by mathematico-scientific methods and is no longer theory. Moreover, since the pressure in such equal volumes of gases is the same, and as the numbers of molecules are equal, it must follow that the average kinetic energy of the molecules in the different gases must also be equal. And, as the kinetic energy of any moving body is equal to $\frac{1}{2}mv^2$, we can readily determine the relative velocities of moving molecules of different gases. Thus, for the moving molecules (or atoms) of oxygen and hydrogen, the formula would be as follows: $\frac{1}{2}MV^2(O)=\frac{1}{2}mv^2(H)$. But $M=16m$. Therefore, substituting $16m$ for M and dividing by $\frac{1}{2}m$, $16V^2=v^2$; or, $v=4V$. That is, the velocity of the hydrogen molecule would be four times that of the oxygen molecule. It has been determined that the average velocity of the molecule of oxygen, under standard conditions, is about 1500 feet per second, and that of the molecule of hydrogen is therefore about 6000 feet a second. What energy is thus locked up in even a cubic inch of oxygen gas, with its inconceivable number of molecules, averaging over a mile a second! But we must not anticipate.

This law furnished the basis for the determination of the atomic weights of different elements, and thus led to the discovery of the "Periodic Law," spoken of above.

It has thus been found that a cubic inch of any gas, at 760 mm. barometric pressure and 0° C., would contain approximately 10^{21} molecules. Some, however, by slightly different methods, make this somewhat less. It has also been demonstrated that the velocity, and therefore the kinetic energy, and for the same volume the pressure, or for the same pressure the volume, increases with the rise in temperature, as also that they decrease with the lowering of temperature. Thus, at approximately 273° C., the molecular velocity, kinetic energy and pressure of the gas (for same volume as at 0° C.) would be doubled; at 546° C. they would be trebled, etc. And, at —273° C. there would be no pressure. And the molecules of the gas would therefore

be motionless and have no kinetic energy. And, as heat is due to the motions or vibrations of the molecules, or, as some hold, to their arrested motions, this state of —273° C. must be regarded as that of absolute stagnation and cold, or of absolute zero of temperature. Indeed, theoretically at least, at —273° C. the very volume of the gas would entirely disappear. This is also in line with our contention, elsewhere stated, especially in the preceding chapter, that cessation of motion would undoubtedly mean annihilation. And this would necessarily have to be the case if the ultimate so-called particles of matter were nothing but energy. And, conversely, toward the ultimate identity of matter and energy this theory of the absolute zero of temperature, with no vibration and no volume, singularly points.

Surely, design in these and many other similar laws of inorganic nature!

4 ATOMS THEMSELVES LIKE PURPOSEFUL MINIATURE STELLAR SYSTEMS OF THE INFINITESIMAL UNIVERSE

Let us now consider further the wonderful constitution of the atom itself. It is not, as until within recent years believed, the ultimate particle that cannot be cut, as the word means. But it is really a miniature universe in itself. The atom contains thousands of electrons or negative particles in ceaseless revolutions within a positive field of electrification, which is also believed to be made up of granular particles like the electrons, or to consist of one larger particle. According to Rutherford's latest views, the positive nucleus surrounded by negative electrons is probably very small as compared with the atom itself. This would seem to point to a single nucleus, or to a small number close together. Accordingly to a theory of G. N. Wilson (*Philosophic Magazine,* Feb., 1916), the atom "consists of a ring of electrons (repelling one another according to the ordinary inverse square law) rotating, in the normal configuration of the atom, in a symmetrical manner round a small positive charge."

A curious modification of the theory of the electronic structure of the atom is given by A. L. Parson, in *Smithsonian Miscellaneous Collections,* Nov. 29, 1915. According to this view, the atom consists of a positive part and ring-shaped

negative charges called magnetons, revolving around the nucleus with peripheral velocity of the order of light at radii less than that of the atom. According to this view these magnetons are supposed to be ring-shaped instead of spherical or concentrated at a point, as they are generally regarded under the name electrons.

The electron is thus generally regarded as one of the ceaselessly revolving particles which in or around, and together with, a field of uniform positive electrification, or a positive nucleus, or nuclei, constitute an atom. It has, therefore, by some been regarded as the definitely determined basic element of all matter, exclusive of the ether. It would appear, however, that, as we generally use the term matter, the so-called uniform field of positive electrification has materiality no less than the negative particle or electron which apparently revolves around it, if this be considered to be material—a fact by many, however, denied. The weight of all the electrons of the atom is apparently, according to some investigations, not the same as, and indeed less than that of, the atom itself. Therefore, this so-called field of positive electrification must cause this difference of weight. And, though this positive particle has not yet been determined to be granular in its nature, it is undoubtedly so, the two sets of particles thus constituting the intrinsic atomic energy by their contrasted or opposing revolutions.

There is some difference of opinion as to the size and number of the electrons. According to Sir Oliver Lodge's calculations, there are about 30,000 of them in an atom of oxygen (about 1875 in an atom of hydrogen); and these are of course widely separated. According to Arrhenius (*Theories of Chemistry,* p. 92), an electron has a diameter of 0.961×10^{-13} cm. Or, it would take over 10 trillion of them side by side to measure a cm., and over 25 trillion to measure an inch. It would, according to this calculation, require about 200,000 electrons side by side for the diameter of an ordinary oxygen atom (taking atom to be $\frac{1}{125,000,000}$ inch), or over 4,000,000,000,000,000 to *fill up* an atom, showing that the 27,000 or 30,000 electrons in the oxygen atom, or the 1,700 or more in the hydrogen atom, are indeed relatively widely separated.

Now, try to conceive of the number of electrons necessary to become visible under the most powerful microscope. It would approximately require 120,000,000 side by side, or 900 sextillion of them in spherical mass. And it would require even about 1,500,000 side by side, or approximately 2×10^{18} in spherical mass, to become visible under the ultramicroscope. What inconceivable numbers of these electrons, not to speak of even possibly smaller ether particles already referred to, would be in a drop of water or a grain of sand! What vastly greater number in this little earth, the sun, and lastly the aggregate universe! And yet, every one of them is apparently as perfect as if it were the only one in existence. Surely every ultimate particle, no less than the aggregate whole, must have had an omnipotent Creator! And every particle must have received the same attention, if we might so speak, as the cosmic whole, or as if it were the only creature. And just so surely must that omniscient Creator know and sustain and guide the motions of every last one of them. As no hair can fall from man's head without His knowledge, so no electron exists and moves without His power and knowledge.

Thus, according to the slightly different views, the atom consists of many hundreds of electrons or negative particles, together with the still undiscovered particles of the positive nucleus. The atom of hydrogen has about 1800 or less comparatively widely separated electrons, themselves in ceaseless revolutions with a normal velocity of about 18,000 miles a second. And it is calculated that even the very mass or size of the atom itself depends upon these internal electronic velocities, and that for even the same atom it varies with these velocities and with temperatures, etc. What wonderful provision for the constitution of matter in this arrangement of even its ultimate elements! Surely, wonder is added to wonder! The design for the very purposes thus subserved is so manifest that no one should have the slightest doubts that an almighty hand produced every ultimate particle and gave it its properties and revolutions, for the wonderful complexities of the unspeakably marvelous universe. To deny this is madness.

Moreover, these electrons or negative particles in motion, handing on energy in a wire, etc., from one atom to another, constitute what we call electricity. This has given rise to what

is called the electrical theory of matter, discussed in our last chapter; namely, that what is called matter is in its last analysis nothing but energy, whose accumulated manifestations, or resisting properties, we *call* matter. And, of course, supposing the electron to be the ultimate unit, then one of two things is apparently certain: either that electricity is in reality only material electrons in motion and is therefore a manifestation of matter, or that matter is ultimately composed of electricity, made up of electrical charges, electrons or energy, within a possible field of positive electrification, or revolving around a positive integral or granular nucleus. But, because of resistance, reflection and polarization of these electrons, as also because of weight, some still prefer to regard them as probably material in nature. Indeed, their energy, known as the intrinsic energy of the atom, can even be calculated, according to the ordinary formula, $\frac{1}{2}mv^2$. But, then, even their mass has been calculated to vary with velocity.

Another remarkable thing about the electrons is the fact that, while atoms of the same element are alike in size, shape, weight and other properties, but different for different elements, the electrons, at least under similar circumstances, are apparently the same as to their properties, or identical for all the elements. This, surely, should suggest the ultimate identity of all the elements in the constitution of all matter, whether the electron be regarded as material or purely electrical. Different elements of matter would, therefore, differ only in having different numbers of electrons with different velocities around or within their fields of positive electrification, or around their positive nuclei. And if the positive field of electrification consists of granular particles, as seems necessary for the integrity and stability of the atom, then these particles, like the electrons, must also no doubt be the same for all the so-called chemical elements. Therefore, all matter, in its ultimate analysis, would be composed of the same electrons and positive particles, differing only in their numbers, arrangements and revolutions. And it is not at all improbable that these negative and positive particles might then be composed of only different numbers and arrangements or revolutions of still smaller constitutents (etherons?), whose very difference in arrangements or revolutions, in a way not known to us, may cause their so-called respective positive and negative electri-

fication.

If men have dreamed philosophic dreams about a possible monatomic nature of matter, their dreams are now probably matched by facts in what might be called the monelectronic or even perhaps monetheronic constitution of matter. And if it were possible artificially to break up substances into their electrons and positive particles, and to unite these again at will, according to their laws of composition for any other substance, then the long dreamed of transmutation of metals or other elements would become possible. Surely, the solution of the problem of such dissolution and reunion of electrons and positive particles would constitute the real philosopher's stone. But this problem is probably beyond solution, from the very nature of the law of atomic structure and atomic combinations. As the so-called transmutation of elements in the natural process of radioactivity is apparently from heavier to lighter elements, this would indicate the probable impossibility of transmutation of silver into gold, etc., or of a lighter into a heavier, even though the apparently impossible process of some artificial transmutation should at some time be discovered.

As already noted, the electrons are in ceaseless motions. Nor are these motions simply at random vibrations. On the contrary, they are held to be of the nature of planetary revolutions, according to certain fixed laws. Thus, every atom is really a miniature universe of ceaselessly revolving electrons at relatively great distances apart. If it were magnified so that the atom's size would expand to the size of a vast star-cluster, it would present a truly wonderful sight.

Let us now imagine an atom of oxygen to be magnified 4×10^{22} times its actual size in diameter. This atom would then be over 6,000,000,000 miles in diameter. And its constituent electrons would be over 30,000 miles in diameter, or about four times that of our earth. And within this magnified atomic sphere there would be approximately 27,000 of these electronic stars (or planets) of over 30,000 miles each in diameter, all revolving in mighty revolutions within vast orbits, and probably around their common centre of gravity. Moreover, if these electronic bodies were uniformly distributed, they would be approximately 150,000,000 miles apart, or about one and two-thirds our distance from the sun. This

enables us to get some idea of the truly wonderful structure of even an infinitesimal atom, according to latest science.

The above would, however, be only one oxygen molecule. If now we should conceive of a spherical volume of oxygen gas an inch in diameter to be equally magnified, it would assume a size in diameter of approximately ten times that of the known universe, or somewhat over 50,000 light years in radius. Its atoms would constitute an inconceivable number of widely separated electronic star- or planet-systems, all in wondrous rotations, as well as revolutions around one another. And each of these atomic systems would be made up of 27,000 individually revolving and rotating electronic stars or planets. Thus a bit of simple oxygen gas only a tenth of an inch in diameter might be called a whole universe in miniature!

Or, if the known universe were reduced in its diameter (approximately 10,000 light years) so as to be only $\frac{1}{4 \times 10^{22}}$ of its actual size, it would be only one tenth of an inch in diameter. Upon this basis our sun would be so small that its diameter would be only about 25 to 30 times that of an electron. Or it would take nearly 10,000 such suns side by side to measure as much as the diameter of an oxygen atom. That is, it would require 1,000,000,000,000 such reduced suns to measure a linear inch, or approximately 5,000,000 side by side to be seen with the largest compound microscope, if it were possible to see such a line.

The above had reference only, however, to a simple atom or to oxygen gas. But the molecule would be still more complex and wonderful. The little electronic system of each atom would revolve around a similar system or systems. And, complex as even an elementary molecule would be, how vastly more complex and wonderful would be a molecule of the more complex compounds, such as, for example, that of strichnia ($C_{21}H_{22}N_2O_2$), with its union of 47 atoms! Under sufficient magnification, it would appear like a complex universe composed of many electronic stellar systems. If every carbon atom (atomic weight approximately 12) consists of about 20,000 electrons, every hydrogen atom (atomic weight 1) of

about 1700 electrons, every nitrogen atom (atomic weight approximately 14) of about 23,000 electrons, and every oxygen atom (atomic weight approximately 16) of about 27,000 electrons, a single strichnia molecule would contain about 557,400 electrons, not to speak of the positive part of the atoms.

Thus in the carbon part of every molecule of strichnia there would be 21 lesser electronic systems of 20,000 electronic stars each, every one of them in wondrous revolution around some centre or centres, and all these 21 electronic systems in systemic revolutions around one another—a total system of 420,000 electronic stars. In the hydrogen part of every molecule of strichnia there would be 22 such lesser electronic systems of 1700 revolving electronic stars each, and all of these 22 systems in constant systemic revolutions around one another—a total system of 37,400 electronic stars. In the nitrogen part of each molecule of strichnia there would be 2 such lesser electronic systems of about 23,000 revolving electronic stars each, both of them in constant systemic revolution around each other—a total of 46,000 electronic stars. And in the oxygen part of every molecule of strichnia there would be 2 such lesser electronic systems of 27,000 revolving electronic stars each, both of them in constant systemic revolution around each other—a total of 54,000 electronic stars. And these four inconceivably complex atomic systems of systems of electronic stars would be revolving around one another, and presumably around a common centre, as a molecular universe of 557,400 electronic stars.

But even this molecular universe of atomic systems of electronic stars, would be only one of the vast number of such in a speck so small as to be barely visible to the human eye, or even with the most powerful ordinary compound microscope. And yet, every one of these 557,400 electrons constituting a single strichnia molecule may itself constitute a still minuter system of revolving particles of ether, the elemental substance of the material universe, thus making the complexity of revolutions within revolutions, etc.—of revolving systems within or beyond revolving systems—still further almost infinitely more complex. Moreover, it is the electronic revolutions that set the ether in motion for the production of light, heat, electricity, etc., of which we shall speak later.

From the above it is readily seen that the latest scientific theories, instead of making against the necessity of an infinite Intelligence and Power back of the universe as its ultimate Cause, would rather, if that were possible, make such necessity all the more imperatively necessary. According to these scientific theories, nature becomes all the more indescribably wonderful, and a supreme creative Will in the structure and operation of its every ultimate detail all the more astonishingly manifest. The intelligence, will and power of what must be an infinite spiritual Personality, are too evident even to permit of honest argument to the contrary, in what we can not better describe than as design throughout the ultimate depths of what constitutes the infinitesimal universe. Thus, from the ultimately infinitesimal to the ultimate whole, design and purpose throughout nature, to him who would hold communion with her, speak in silent eloquence of nature's infinite, eternal and almighty Creator and Sustainer, God.

5 THE VAST ENERGY IN THE UNIVERSE AN UNMISTAKABLE EVIDENCE OF PURPOSE

We should hardly need to point out that the immeasurable energy of all the infinitesimal particles in the cosmic universe and of all the stars of the universal whole, is for the very purpose which it so wonderfully subserves, and that it is therefore an undeniable evidence of design.

Conceive of hydrogen molecules moving upwards of a mile per second, and then consider the millions within a space barely visible in the most powerful microscope. To get the combined energy multiply one half the mass by the square of the velocity, and then multiply by the number of molecules. What energy is thus locked up in even a cubic inch of hydrogen gas, with its inconceivable number of molecules averaging in velocity over a mile a second!

Moreover, the energy in the chemical union of different elements is almost inconceivably great. Thus, when hydrogen and oxygen (1800 cubic inches), in the ratio of 2 to 1, are chemically united in the production of a pound of water, the energy from the clashing together, at a final velocity of about four miles per second, of the hydrogen and oxygen atoms

and from the consequent revolutions around one another, would, it is claimed, raise 32,462 pounds of water from 0° C. to 1° C. The number of revolutions of the atoms of hydrogen and oxygen about one another is calculated to be about three trillions per second. And, as the heat required to raise a given quantity of water 1° C. is equivalent to the raising of that quantity of water 1390 feet against gravity, the chemical production of a pound of water would develop energy equivalent, if properly harnessed, to the raising of 32,462 pounds of water 1390 feet, or one pound over 45,000,000 feet, against gravity. Or, it would raise a projectile of a ton nearly 25,000 feet or almost five miles. Similar figures were arrived at by Tyndall. See also LeBon on *The Problems of Heat,* in his *Evolution of Forces.*

So the quantity of electricity required to separate these two elements in even a very minute quantity of water, is estimated to be equivalent to that of a flash of lightning. And this power is spoken of as latent or as potential energy. What enormous amount of energy is thus latent in even a drop of dew! What inconceivable energy in all the rivers and oceans of the earth!

And what is true of the kinetic energy both in the production and decomposition of water, and of its latent energy, is also true, in varying proportions, of other substances. It has thus been well said that the explosion of a grain of gunpowder is the destruction of a miniature universe and the building of another.

Thus far we have spoken of molecular and atomic energy. Think, then, of the energy of the electrons of all the atoms themselves, or of what is spoken of as the intra-atomic, or intrinsic, energy.

The clashing together of the atoms in chemical union causes their revolving electrons to be accelerated in their velocities, adding greatly to the electronic or intrinsic energy of the atoms themselves. The number of electronic revolutions around the centre of the atom, is estimated to be upwards of a quadrillion per second. The electronic intrinsic energy of the atom is inconceivably greater than anything conceived of before its discovery associated with the exploration of the field

of radioactivity. According to a calculation of Sir J. J. Thomson, this energy of the atoms of a gram of hydrogen would lift 10,000 tons over five miles. And, generally speaking, the energy of other elements varies with the numbers of the electrons, or with the atomic weights. Speaking of the enormous electrical potential, LeBon makes the following at least seemingly exaggerated statement: "A small part of the 96,000 coulombs drawn from the decomposition of 9 grammes of water would charge with electricity to a potential of 7000 volts a globe as large as the earth" (*The Evolution of Forces,* p. 166).

So, the energy of radium is enormous, about several million times greater than that of any known chemical reaction. Conceive of the energy produced by the alpha particles (helium atoms), moving at a velocity of from 10,000 to 20,000 miles a second! Think of the beta particles moving about 90,000 miles a second, and even approaching the velocity of light, not to speak of the energy of the subtle gamma rays! As LeBon says, the energy produced by a sphere as large as a pin's head revolving on its axis with the speed of the projection of a cathode particle would be equivalent to the kinetic energy of 1500 steam engines of 500 horse power each for a whole hour (*Ibid.,* p. 167). What enormous unused energy there is! Of what unlimited service it would be if it could be harnessed! According to Soddy, even a gram of negative hydrogen ions, if free, could charge the world to a potential of a million volts.

The wonderful provision of all these atomic and sub-atomic revolutions is awe-inspiring. It is these very revolutions that hold so-called ponderable matter in existence. The destroying of the mere equilibrium of these complex revolving infinitesimal atomic and sub-atomic structures would cause them to disintegrate, and perchance to pass into the elemental ether, or when their energy would be spent, into non-existence. We are really floating through space upon a potential explosive. It is held from exploding only by a proper equilibrium of forces, or, as it might in a sense be expressed, by its very flight. And at any moment it will take but little to reduce it to dust and nothingness.

Who will put his little preconceptions against design and purpose in all this wonderful arrangement of energy for the conduct of the universe, from electron to flashing sun! What unenlightened human reason is sufficient to fathom the unfathomable wonder of adaptation and purposeful provision of creation, and *think* its Creator out of existence! Where design so overwhelming flashes forth in every consideration of revolving electron, atom, molecule, world and star, who will weigh his little self against an infinite designing creative Deity! Vain man to think thyself so great, in thy great littleness, before the wondrous universe and its infinitely more wondrous Creator, God!

If the revolutions within the atom, spoken of, represented electronic years and if an electron were imagined to be inhabited by sentient beings, whose average lease of life were one hundred of these electronic years, then ten trillion generations of these beings would succeed one another or pass away within a second of our time. And, to them, therefore, a second of our time would practically be an eternity. And so, for all we know, our years, or the lease of human life of three score years and ten, might be but like the infinitesimal fraction of a second of the possible higher universe, in which the earth might be but like an electron, the solar system like an atom, a group of mutually connected star-systems but like a molecule, and the whole *known* physical universe but like a speck of the dust that floats in the sunshine and helps to make up the merest infinitesimal fraction of a minute local spot upon this insignificant world within the universe we know.

At any rate, who can stand in judgment and decide against design and a designing Creator, in the light of the combined evidence of the greater whole! It amounts to a presumption for which language affords no expression, for human intellect proudly to stand before all these evidences of design in the inconceivable energy of all infinitesimal particles and all worlds and stars, etc., in motion according to wonderful laws, and say, "There is no designing Creator; there is no God!" The evidence for a designing Creator with this additional evidence thus becomes more and more cumulative, and indeed altogether unanswerable.

6 DESIGN IN EVERY VIBRATION FROM AN OBJECT PERCEIVED TO THE PERCEIVING BEING

Let us now consider the wonderful purposes of the vibrations or motions, with which the universe is seething everywhere. All these motions, from the infinitesimal gyrations of an electron to the on-rushing, in probably immeasurable orbital revolutions, of flaming stars or suns, are in accordance with rigid laws. These motions lie back of all physical phenomena, from the rainbow of promise to the eclipse of darkness, from the leaf that trembles in the breeze to the *stella nova* of colliding worlds, from pulsating blood to flaming suns. It is this that produces all light, heat, electricity, magnetism, color, etc., etc.

Thus, the particles on the surface of the sun—undoubtedly the electrons—are in ceaseless motions. These set into wave-motion the contiguous ether, and by ether particles, striking forward against ether particles, this wave motion is transmitted through the ether of space until the waves are obstructed or intercepted by a body like our earth. And then the waves, in turn, communicate their motions to the retina of the eye, etc.; and, through the proper nerves, the phenomena or sensations of light and heat are produced—or we might almost say *reproduced*—for the perceiving being. Thus, nothing except transmitted *motion* passes from sun to earth.

For the passing of these various waves from sun to earth, it requires over eight minutes. Or, all ether waves travel 186,000 miles a second. These waves are of different lengths, ranging from long waves of several miles, harnessed in wireless telegraphy, to the infinitesimally short ultra-violet waves. The range in length of waves for the light spectrum is from $\frac{1}{60,000}$ of an inch for violet light to $\frac{1}{34,000}$ of an inch for red light. Thus, for the light spectrum there are from 34,000 waves (for red) to 60,000 waves (for violet) per inch.

But the light spectrum covers only a small part of the whole range of these ether waves. The ultra-violet waves are shorter than the shortest waves of the light spectrum, and the ultra-red, or heat rays, etc., are longer than the longest waves of the visible spectrum. Among the ultra-violet waves, rang-

ing from $\frac{1}{60,000}$ inch to $\frac{1}{250,000}$ inch, are the rapid vibrations that affect the photographic plate, as also do slower waves immediately beyond the red end of the spectrum. Beyond the red are slower infra-red vibrations that mark the bolometer spectrum. Then comes a gap where waves have not yet been detected, although waves are no doubt there. And, lastly, after a considerable gap of undetected waves, we come to the Hertz waves of the electrical spectrum. And, even beyond both ends of the entire known spectrum there is also undoubtedly a considerable range of waves that have not yet been discovered.

Now, as the various wave-motions are transmitted at the rate of 186,000 miles per second, for the violet waves to cover that distance in a second, it requires about 700 trillions of them. Therefore, there are about 700 trillions of violet waves per second, the number of the other waves being more or less as we descend or ascend along what might be called the many-octaved key-board of the whole range of waves.

And, of course, all these ether waves are set into motion by rapidly moving particles—undoubtedly the revolving electrons—in the surface of the sun. Moreover, for a perfect correspondence between the wave-motion of the ether and the moving electrons that cause them, the velocity of the latter should apparently be the same as that of the former. Or, the numbers of the vibrations or waves of the ether as effects would apparently have to be matched by the numbers of the vibrations of the electrons as their causes. Thus, the numbers of the vibrations of these electrons must apparently range to correspond with the numbers of the vibrations or waves along the whole key-board of ether vibrations given above.

We are here in the presence of a wonder of nature, and of a wonderful provision of contacts between the moving electrons and the perceiving eye, or of transmissions from the sun until they become sensations of light and heat, etc., in the mind of man, that no anti-theistic bias could even honestly dream of attributing to anything else than matchless intelligence on the part of an unmistakable Designer or Creator.

Moreover, upon these same revolving electrons depend all the colors that make objects visible and beautify the world.

What wonderful arrangement for the beautifying of nature! What marvelous contrivance for bringing external nature to the apprehension or perception of intelligent beings within it!

Who can think of light and heat as coming to us by inconceivably small waves of the ether at almost inconceivable velocities from distant sun or star, without being overwhelmed with awe and thrilled with rapture over this wonderful *provision* of what must be an all-wise and all-powerful *Provider!* Who can think of the sunbeam as it comes dancing down to us over waves of the ether, without almost falling down in devout and grateful adoration before their wonderful Author!

Every wave is, moreover, apparently perfect, as if it were the only wave transmitted; and yet, there is a complexity of waves of various lengths and numbers causing the phenomena of various colors, heat, and chemical action, moving simultaneously in the same wave-shaft of the same ether medium, from sun to earth, without interference. This certainly is indescribably wonderful. What wonderful provision in the laws of refraction, reflection and absorption of light according to various electronic vibrations, for the wonderful uses of light, etc., and for the exquisite variety and beauty of color! All color is thus due to what we call the power of objects to absorb some waves and to reflect others.

Indeed, if the vibrations of the ether and of the electrons of objects did not match exactly as they do, all the world would look different. And if the electrons of the sun and the particles of the contiguous ether, in their respective motions, did not match exactly as they do, all would be different, leaving perchance total darkness amid chemical action, heat, or what not. The matching of the imponderable ether and ponderable matter is such as to leave absolutely no room for doubt that they were *matched* or arranged together exactly for the purpose which they so wonderfully subserve, by an intelligent creative Will, and that therefore they were *created.*

Who can see colors beautiful and indefinitely varied, blended and matched together, either in the rainbow of the sky or in the blossoms at his feet, without thinking of their Creator in the beauty of holiness! Who can think of these things as the results of infinitesimal vibrations of one kind or another, and therefore as, in a sense, various manifestations of energy,

without thinking of the unspeakably wonderful Being Who made all these things and arranged their operations so marvelously!

IV GENERAL ADAPTATIONS AND PROVISIONS IN NATURE AS EVIDENCES OF DESIGN

Throughout the whole realm of nature we are in the presence of most wonderful provisions and arrangements for use and beauty. Surely, in a sense, *everything* is made for *everything else.* The atoms are clearly made for one another. Their weights, etc., are exactly adjusted for certain definite combinations with other atoms for the building up of the various substances. The laws of molecular, atomic and electronic combinations are exactly what they have to be to make those combinations possible. The electrons of which the atoms on the surface of the sun are composed, revolve with exactly the velocities necessary for producing ether waves in just such a way as to transmit light, heat, etc., for observing beings. The ether is exactly constituted to be a medium for these phenomena. Ponderable matter and ether are so related that they fit each other exactly for definite reciprocal action. Motions of ponderable matter are communicated to the contiguous ether and through it to distant matter for reproduction there, or for the setting up of vibrations of other kinds or orders for definite results. Thus, matter affects the ether and the ether in turn affects matter. And so intimate is their bond of union and cooperation that they could apparently not exist apart or alone. They must have been made for each other, for the production of the wonderful physical operations that we are first beginning partially to understand. Matter and ether are in purpose and unifying design *one,* as in substance they are by many believed to be ultimately one, the ether the foundation of matter and matter the product of the ether. And the scientific world-process is more and more believed by philosophic scientists to be from the ether to matter and back again to the ether. And ultimately it must be from nothingness to nothingness.

The eye with its wonderful mechanism is likewise exactly fitted to receive its proper impression from the ether waves. To it is adapted the exact nerve system to communicate its

impressions to the brain. And the brain is just the organ necessary as an instrument for the invisible mind or personality within, to receive revelations, or to understand. And, throughout the whole chain of sequences, all are different from one another in the succession, and yet all are in perfect adjustment for exactly that work for which they were unmistakably designed and created.

And, to this would have to be added the still more wonderful provision or design seen in organic nature, from the smallest unicellular being to the most complex animal. For each class or species its own kind of cells; for even each organ of an individual its differently designed cells! For each class its own nutrition-selection and provision for the proper collocation of nutrition! And for each its own characteristic kind of blood corpuscles, etc! And who can contemplate the marvelous provision in sex, for the reproduction of species, by which they are endowed with the power of procreation, or we might almost say *creation,* without recognizing the unmistakable design and work of a designing Creator!

Some men speak of protoplasm as the basis of organic life, as if its chief element, carbon, were a creator. But, carbon cannot produce life. And, although protoplasm's principal elements, carbon, oxygen, hydrogen and nitrogen, were united in the laboratory with ever so great exactness, the chemist could not discover nature's secret of producing protoplasm. And yet, even the very perfect proportions unmistakably indicate a proportioning, designing Creator. Surely, design everywhere! a different design for every different species of both plants and animals! Design on every individual of every kind! Design in every organ of the individual, in every blood corpuscle, cell, molecule, atom and electron!

Thus, in the universe of stars, in the universe of the infinitesimal, and in the realm that may be said to lie between, there is design and creative intelligence everywhere. But, if the design and arrangement of material substance in nature are so wonderful, how much more so should be the *existence* of the substances themselves! If the *arrangement* requires intelligence and power, much more so does the *absolute creation* of the material, with which that arrangement was made possible! Surely, a creative Divinity back of each and all upon which His impress is so gloriously manifest! Nor is there anything

in all worlds that would not have occasion to raise heavenward its grateful *Pater Noster.*

The beauties of nature are such as unspeakably to delight the eye; the harmonies of nature are such as inexpressibly to delight the understanding. Blind indeed must be he who does not see nature's beauties; and deaf must be he who does not perceive its harmonies. But, blinder still, or more irrational, must be he who does not recognize back of all this beauty and harmony, the infinite Beautifier, Harmonizer, Originator and Designer—nature's omnipotent, omnific and omniscient Lord. The ancient sages were not so far from the truth after all when they spoke of a supposed music of the spheres. There are harmonies everywhere, from every ultimate sub-atomic particle to the well-nigh infinite universe. Nor is there any discord apparent anywhere throughout the whole, except that of irreverent and rebellious man. These facts of design are so evident that the observing student of nature, whether he has any religious convictions or not, should unmistakably recognize them. And this design in the beauties and harmonies of nature must necessarily be attributed to a higher Intelligence, as Benjamin Moore is moved to say, "The ordered beauty of the world of Nature suggests an infinite intelligence with powers of action such as no man or other creature possesses" *(The Origin and Nature of Life,* 1912, p. 23).

Indeed, design in all things is so manifest as to need no further proof. Law and order are so universal as to convince even the casual observer that a supreme Law-Giver is somewhere upon His imperial throne. And the fact that this earth would not be even a visible speck within the field of the mightiest telescope from even our nearest neighbor among those countless stars of night, makes that great and wonderful Beautifier, Law-Giver, Creator and Designer all the greater and more wonderful. This fact, too, seeing that man is the object of His love in the incarnation of His Son, instead of minimizing man, gives him the exalted place of His Fatherly concern and providence. And, if some men think of man, because of his wonderful being, as the riddle of existence, what should not be thought of man's, and the whole universe's, infinitely more wonderful creative Deity! If the wonder of the human intellect increases with every new *discovery* of the

wonders of the Creator's handiwork, how much more should the wonder of Him increase Who *created* them! If the *footprints* of the Creator, as we trace them after Him in his creation, are wonderful, how much more wonderful must *He* be Who left them there for man's contemplation and delight!

V NOT CHANCE, BUT LAW REIGNS—THE *MODUS OPERANDI* OF AN INTELLIGENT PERSONALITY

Men speak of *chance* as though they meant something; but, even with their own meaning of the term, chance could not, during all the æons of time, produce a single organism, or even a single electron, and much less so the immeasurably complex universe. By so-called chance or accident even the arrangement of a hundred numbers or particles twice in exactly the same way would be practically an impossibility. What, then, shall we say of the impossibility of a repeating in the same arrangement of the indefinite number of particles in two of even the minutest similar microcosms? Then, how about the vast number of the same kind, or the countless numbers of kinds, of the incomprehensibly complex universe? No, the universe exists; and its existence could not even be conceived to be different from what it is while pervaded with and permeated by the present purposeful universal laws.

Indeed, what we call *chance* is no less the result of a cause or causes operating according to definite, though by us not understood or unsuspected, law, than any event with whose cause or causes we may be familiar. And of this fact we should expect a denial least of all from men of science. And, among those most positively convinced of this fact are some of the greatest leaders of scientific thought. Thus, Henri Poincaré makes the following emphatic statement about the universality of cause, as against supposed chance: "Every phenomenon, however minute, has a cause; and a mind infinitely powerful, infinitely well-informed about the laws of nature, could have foreseen it from the beginning of the centuries. If such a mind existed, we could not play with it at any game of chance; we should always lose. In fact for it the word chance would not have any meaning, or rather there would be no chance. It is because of our weakness and our

ignorance that the word has a meaning for us. And, even without going beyond our feeble humanity, what is chance for the ignorant is not chance for the scientist. Chance is only the measure of our ignorance. Fortuitous phenomena are, by definition, those whose laws we do not know" *(The Foundations of Science,* 1913, p. 395).

But, why turn aside even to refer to *chance,* to which we have also referred before, in deference to some speculators who would rid the universe of its God, if that were possible? The very acknowledged presence of *law* in nature should forever settle and rule out of court what these men call *chance.* It would surely be absurd to say that a giant printing press came to be by chance, by the fortuitous concourse of atoms or molecules, resulting in wheels, etc., and in the accidental arrangement and adjustment of these into one mighty mechanism, and in the spontaneous rotations of the wheels in their complex gearings, performing amazing operations. But it would be indescribably more absurd to say that even the minutest organism thus came to be, and even yet more absurd to say that the higher animals with their wonderful provisions of sex—even in different individuals—for propagation, thus came to be. And, to express the degree of absurdity of saying that the whole unspeakably complex and wonderful universe thus came to be, we search in vain for a word.

A further explanation of what we generally call *law* is necessary here in the interest of clearness. A proper understanding of law will take another prop away from under those who would bolster themselves up in their contention for the eternity and self-subsistence of the universe, and therefore against the existence of a supreme Will beyond and within it—the existence of its Creator and Sustainer, God. It will also add to the cumulative force of our argument in further demonstration, even apart from Scripture, that it was God-created and continues to be God-sustained.

What we call *law* is not that by which a thing exists or even by which it operates; but it is the expression of its methods of existence or of its operation. Law is, therefore, not a cause, but a *modus operandi* or a *condition* of existence. The laws of nature are, therefore, conditions of its existence as to time and space, and its modes of operations. To say, there-

fore, that the supposed evolution in nature, or any of nature's isolated events, is brought about by law, is as absurd as to say that the *arrangement* of the proper wheels, etc., and their relations to one another, of a great printing press, are the cause of its existence and its wonderful operations. The printing press exists, because it was made, its wheels, etc., being so made and adapted or adjusted, as to make it capable of exactly the operations for which it was intended. Then the power or energy is applied or superadded from an external source, and its operations are exactly in accordance with the design of the living machinist, who designed and made it and arranged for the application of the necessary energy.

Even upon the supposition that the universe was created at first in its elemental form and endowed with the necessary potentialities for its development to the last link in its immeasurably long chain, it would be no less throughout totally a God-designed and God-created universe.

Thus, the universe exists because it was created, not because it came by a fortuitous concourse of atoms. Its parts are so made and adjusted and related to one another by, or according to, superadded laws, and the great whole is so impregnated with energy, that all events in nature are brought about exactly in accordance with the design of the mighty living Designer, Creator and Upholder of the great complex machinery which we call nature. And, we emphasize again, this is equally true whether the universe be regarded as having come from His creative hand at once complete and perfect, like Minerva full-fledged and perfect when Vulcan struck Jupiter on the forehead, or whether it issued forth an apparently incoherent chaos with superadded potentialities to develop it into the mighty cosmos. Wherever the Creator has used secondary causes, these have been only His voluntarily created and chosen tools. And, in their use, design is just as evident as in any *immediate* act. Nor is the record of Genesis against the use of such secondary agencies in the creation of the cosmic universe. Nay, rather, such a method of operation seems to be implied in such expressions as "Let the earth bring forth grass" (Chap. 1:11-12); "Let the waters bring forth abundantly the moving creature" (1:20-22): "Let the earth bring forth the living creature" (1:24); as also

in Genesis 1:28, etc. And that immediate and mediate creation both figured in that creative week seems to be implied in the expression that God rested from all His work which He had *"created* and *made,"* literally *created—to make.* And, taken very literally, the *continued making* might be considered as implied.

As already said, all things are bound together and move together, there being no isolation of existence, no independence of motion. The Cause of all alone must remain unmoved, or else there would be relativity. And, as the first and only true Cause, that Cause operates and is present in all secondary causes, as already pointed out, though He must also be external to all secondary causes and therefore above nature. That Cause that thus transcends, and is also immanent in, nature, is what by Revelation man has learned to adore as *God.* There is, therefore, even a physical sense in which there is an all-pervading divine omnipresence.

All the operations of nature are, therefore, in accordance with divinely imposed purposeful laws. And, we have seen that what is true of the starry universe is equally true in the realm of the infinitesimal. Even down to the ultimate indivisible particle of matter, all combine in exact proportions by definite laws, in the formations of different substances. Motions, weights, sizes, numbers, all are in perfect balance and adjustment. Thus, from electron or atom to a world, from stars to the great starry universe, everything exists upon an exact mathematical plan. It is one mighty building that must first have existed as a plan or design in the mind of its Designer, God.

Nor does the carrying out of such design through secondary causes in the least detract from the power and glory of the Designer, as such would only be the methods of His operations. His direct and, therefore, absolute power stands back of the initial creation of matter and energy, or, matter *or* energy, and His operation through secondary causes is no less from and by His power. And the so-called laws are only the directed methods of His workings through these secondary causes. He is, therefore, not Himself bound by these laws, but is above them as their Author. Moreover, whenever He so chooses, He can set aside the operation of such laws, or operate by other and higher laws, or directly, if we choose so

to regard it. Even man thus acts in apparent contravention of the law of gravitation, when, in accordance with another law, by will-directed muscular energy, he lifts a stone or performs any other act. This conclusion is not, as some men would have people believe, simply the supposedly biased view of theologians and the Church. It is also the conviction of many of the greatest students of nature, such as Mivart, Wallace, Fiske, Lodge and G. Frederick Wright.

Thus, the physical universe must not necessarily be regarded as rigidly a mechanism, without even an *extraordinary* presence within it of its Author, although it is, ordinarily considered, such a mechanism, mathematically and superbly constituted. As matter cannot think, and therefore design or execute, the inevitable logical conclusion is, that such a manifestly designed universe must have been *designed,* and that design in existing nature executed by Mind—which alone can be a designing cause. We arrive, therefore, at the same conclusion at which we have arrived in a previous consideration.

Thus, the physical universe, as it exists, necessarily implies an architectonic Intelligence and Will as having designed it and called it into being and as still upholding it. And, if that Will were withdrawn, as already noted—and as the overwhelming evidence of both nature and Scripture proves it will be at some time—it would pass away and cease to be. And that Will must be free and sovereign. Moreover, the action of such Intelligence and Will must necessarily be in accordance with consistent reason.

Furthermore, the very necessity of *intelligence* to contemplate and in some slight measure comprehend nature, is itself an *a priori* evidence, an implied conclusive proof, that the nature thus contemplated must necessarily be the designed and executed *product* of *Intelligence.* The *tracing out* of law and order in nature implies the previous *imposing* upon or *placing into* nature, of that law and order. Just as the reading and thinking of the thoughts expressed on a printed page presuppose an intelligent personality as its author, who first thought and expressed them, so does our reading and thinking of thought or law expressed or implied in universal nature presuppose an intelligent Personality as its Author. And as the mind or personality that contemplates nature must be an en-

tity superior to the merely physical nature which it contemplates, so must the Mind or Personality That has constituted nature, the creative Cause of both the contemplated nature and the contemplating mind, be infinitely superior to the merely contemplating mind. And that transcendent creative Personality, Who is thus the Author of both mind and physical nature, or of universal nature inclusive of man, corresponds to, and must necessarily be identical with, the Creator revealed in the Christian Scriptures, Whom the Christian worships as *Jehovah, Lord* and *God.*

VI THE APPARENT PURPOSE OF CREATION

As the whole of universal nature teems with evidences that it is a *designed creature* and yet that it is not an end in itself, the question spontaneously arises, What was the Divine purpose in its creation? Here, if anywhere, from the view-point of limited human understanding, we are in the region of mystery. Surely, the reach of human vision falls far short of the ability to penetrate the ultimate mystery of the well-nigh infinite created existence. We may perhaps see but the fringe of the immeasurably greater whole of God's creation. Beyond our vision may lie existences of which in our trammeled human existence here we could have no conception. Beings or existences beyond the range of the physical eye may lie all around, above and beyond our insulated existence, of which not even imagination could form a picture. Confined within our comparatively little island universe—perhaps a mere speck somewhere within the immeasurable all-inclusive higher universe—unenlightened reason must needs be humble in its pretensions to assign a reason for the greater whole.

Among those who have been compelled to acknowledge this limitation of the human mind was even Thomas Huxley, as witness the following words: "The ultimate forms of existence which we distinguish in our little speck of the universe are, possibly, only two [matter and energy or mind] out of infinite varieties of existence, not only analogous to matter and analogous to mind, but of kinds which we are not competent so much as to conceive—in the midst of which, indeed, we might be set down, with no more notion of what was about us, than the worm in a flower-pot, on a London Balcony, has

of the life of the great city" *(Hume, With Helps to the Study of Berkeley,* 1896, Appendix, Note A, p. 286).

And yet, we are not left entirely without some evidence as to God's purpose in His creation. That man is himself, at least in part, the key to the riddle of the universe, is by no means an antiquated belief. This view of nature on the part of the Church, in her reliance upon the teachings of her time-honored written credentials, is accepted or shared by many of the greatest thinkers of our day and generation. Indeed, toward this view philosophic speculation, especially in the light of more recent researches into man's mysteriously wonderful psychic personality, has a tendency more and more to gravitate. And even many matter-of-fact physical scientists, from the writings of some of whom we have already quoted in this work, are beginning to react more and more against the materialistic conception of man and nature, and to regard man as at least locally nature's glorious crown, and perhaps in a measure its final cause.

We believe, and are convinced, that the evidence from nature, as well as the evidence from the human heart, is wholly in accord with the evidence from the Christian Scriptures, that the physical universe is the colossal, yet finite and temporal, scaffolding spoken into being by the Almighty for the working out of a higher *spiritual* purpose. And that purpose is undoubtedly the development of the even more glorious spiritual kingdom, or spiritual universe, in which glorified men and seraphic intelligences may dwell and enjoy the revelations of His love and the unutterable glory of His unfathomable infinite Being forever.

Man's powers are developing with almost a prophetic consciousness toward some great final goal; and we may devoutly believe that they are perhaps even fitting him better to understand and to appreciate the glories and complexities of the world beyond, where in God's higher spiritual universe they may continue to develop throughout eternity, yet forever incommensurable with the capacities of his God. Even here, the more the intellect thinks the thoughts of God after Him in His creation, the more the heart must feel and appreciate the pulsations of an almighty Creator and anxious Father in every part thereof.

And thus in that spiritual realm some coronation of man

seems assured, in that still higher glory which is in store for him—a fact also set forth in the Christian Scriptures. The Redeemed are said to be destined to stand "before the throne, and before the Lamb"; and there they will reveal unto the rest of created intelligences the love of their common Father in the sacrifice of His Son, as those "who came out of great tribulation and have washed their robes and made them white in the blood of the Lamb." In that capacity, it is written, they shall reign with Christ forever. And we may reverently believe that they may be the only competent beings to declare the story of eternal love in Calvary, to the sinless creatures which may people other realms, and perhaps countless millions of worlds that dot the map of God's magnificent empire.

CHAPTER IX

TESTIMONY OF THE SCRIPTURES AS TO CREATION IN ACCORD WITH THE EVIDENCE FROM NATURE

We have now shown at considerable length that the physical universe everywhere, from the ultimate infinitesimal particle to the cosmic whole, solemnly testifies that it is a temporal entity and that it was created *out of nothing* in time, or at time's beginning, by the omnific power of a transcendent Deity. We have shown, moreover, that this testimony is matched by the very nature of the human mind, perceived material nature's perceiving complement. We shall now briefly give attention to another, and no less, but rather more, credible witness as to this great subject. We say, *rather more credible witness,* because we may be pardoned for considering the testimony of the truthful doer of an act more reliable and more complete and intelligible than even the evidence deducible from the act itself. That witness is, of course, the Creator Himself, as He sets forth His testimony in His Word. But, we were almost about to forget that many either in whole or in part reject that Word as divinely inspired, and therefore regard it, from their point of view, as not acceptable evidence.

And yet, even many of those men who deny not only that Word but even the very existence of a personal Divinity in and above nature, often make remarkable concessions. They are compelled by the force of an inexorable logic to concede enough at least to make them and their honest followers open to conviction. They are thus forced to acknowledge a divinity of their own conception, if they have not yet come to accept the God to Whom nature everywhere eloquently testifies and Whom the Christian Scriptures so clearly reveal. Thus, in a late work by Ernst Haeckel he makes the follow-

ing striking statement: "Our Monistic god, the all-embracing essence of the world, the Nature-god of Spinoza and Goethe, is identical with the eternal, all-inspiring energy, and is one, in eternal and infinite substance, with space-filling matter. It 'lives and moves in all things,' as the Gospel says. And as we see that the law of substance is universal, that the conservation of matter and of energy is inseparably connected, and that the ceaseless development of this substance follows the same 'eternal iron laws,' we find God in natural law itself. The will of God is at work in every falling drop of rain and every growing crystal, in the scent of the rose and the spirit of man" *(Last Words on Evolution,* Tr. McCabe, 1906, p. 112).

Then, why should not such a concession lead at least an honest searcher after truth to the true Light that alone can lighten the darkness—to Him Who alone is the key to the solution of this transcendent question? But here, too, pride of intellect forbids, for such belief in the God of Scripture, and especially as incarnated in the humble Nazarene, is apparently beneath the dignity of a philosopher, as witness the following words: "How could so vigorous a thinker [Goethe], in whose mind the evolution of organic life ran through millions of years, have shared the narrow belief of a Jewish prophet and enthusiast who sought to give up his life for humanity 1900 years ago?" *(Ibid.,* p. 112). If the learned philosopher had learned that humility which characterized that Jewish Prophet, and learned His teaching, that it is the meek that are blessed, he, too, might long ago have bowed his head and knee before the Son of man and incarnate Son of God.

Therefore, as our foregoing chapters have set forth the evidence which these men, even upon the basis of their own premises, are compelled to accept, we shall in this chapter not attempt directly to convince them with the testimony of the Scriptures. We shall rather show that what nature and the constitution of the human mind testify to be incontrovertibly true as to their origin, is positively asserted in the Scriptures. In other words, instead of first endeavoring to prove the creation *ex nihilo* from the Scriptures and then confirming such proof by the evidence from nature, we have first presented our proof from the evidence of nature, that it is such a cre-

ation, and shall now show that this exactly corresponds with the testimony of the Christian Scriptures. This method should be the more likely one to bring conviction for a creation *ex nihilo* by a Deity to those who deny it, as also it should more likely convince the rejecter of the Scriptures that their correspondence with nature proves them to be of a piece with nature, and therefore from the same source. It should thus almost compel conviction also that the Scriptures are no less God-inspired than is the universe God-created—the two being related to their common Author and Creator as His Word and His Work, whose respective testimonies are equally valuable as evidence that they both are creatures of the one only eternal God.

I DIRECT TESTIMONY OF THE SCRIPTURES THAT THE UNIVERSE IS GOD-CREATED

What nature testifies at every turn, from the imponderable ether to flashing suns, from revolving electron to pulsating life and perceiving soul, is emphatically asserted in the revealed Word of God. How definitely does the writer of the *Epistle to the Hebrews* state this in verse three of the eleventh chapter! "By faith we understand that the worlds have been framed by the word of God, so that what is seen hath not been made out of things which appear." This clearly has reference to Genesis 1:1 and reasserts what is there so unequivocally declared, "In the beginning God created the heavens and the earth." Here is no argumentation, no speculation. How refreshing to come upon such a *positive* statement! As already intimated, posit a living, personal, infinite and almighty God, and every difficulty will vanish away like the mist before the sunlight. Put the God-factor into your equation of cosmic potentiality, and the universe exists intelligibly and your problem is solved. The *Ex nihilo nihil fit* does indeed still fit, but only from the conditioned view-point of man, or of any rational creature. But, from the view-point of the Creator-God, Who spake and it was done, it is inapplicable. This is not saying that God does not use the materials and laws, previously created by Him, as already noted, as dependent causes, as He no doubt mainly does since His first or initial creation, to work out His infinite plans. But it means that He is not *limited* to

such existing materials and laws, or that His use of them is not a *necessary* use. And, of course, when these materials and laws did not exist, as at the moment before primordial creation, He first gave them their being, so that all existing things are the product of His creative fiat.

The *nihil fit* in that philosophic axiom, as viewed from the side of man, becomes *fecit omnia* when viewed in the light of the divine fiat. *Ex nihilo nihil fit,* without the divine power, is indeed still true in human consciousness and experience, if the *fit* be regarded as abstract or purely impersonal, and translated *nothing happens,* as is the implied case with the materialist. For, even according to the theistic conception of creation nothing happens from *nothing;* but where nothing existed before, an existence was called into being or caused by *God.* But, as applied by the Christian to the problem of primal creation, and translated *nothing is made* (so as to imply *by God),* it is not true. It must then be changed to, or supplanted by, *Ex nihilo Deus omnia fecit.* Thus, where nothing existed before, there, after God's creative Word, stood forth the elemental materials out of which He fashioned all worlds in the course of six time periods. And, in a real sense, then only did time begin. For, as time is measured duration, duration by cycles, centuries, years, etc., there was really no measured time before the creation of the measuring physical cosmos.

It has, however, been stoutly contended by some writers who, in a sense, accept the Scriptures, that the passages of Scripture already quoted, as also all others that bear upon this subject, can have reference only to a *development*—whether by a personal supramundane Deity or by an impersonal something inherent in, and perhaps cohering with, matter—from the material chaos eternally existing. This latter view might be designated as a subtle form of pantheism. Instead of explaining again, however, the scientific absurdity involved in such a statement, already shown, let us now briefly examine the contrary testimony of the divine Word itself.

II TWO FUNDAMENTAL POSTULATES OR AXIOMATIC TRUTHS OF THE SCRIPTURES

In a general way it might be said that the Scriptures nowhere attempt to *prove* the existence of a living personal and

eternal God; nor do they attempt to *prove* the creation in time, *ex nihilo,* of the existing universe by Him. They take these two fundamental truths, which might be regarded as both scientifically and theologically axiomatic, practically for granted. They are the fundamental postulates for divine Revelation, without which all would be inexplicable. Nor should their demonstration in the least be necessary, any more than that of any axiom that may underlie reasoning anywhere else. But, the intellectual vanity and pride of man in attempting to go beyond what is divinely revealed and necessary, often demand it. No, the universe is; and therefore surely God, the universe-Creator, must be. Therefore, the Scriptures assume these two primal facts as their great twofold premise. In a royal decree, or any other human document, its author does not regard it necessary first to prove his existence and by elaborate argument to convince the reader that he is the author, or that the document had a beginning. The existence of the document itself presupposes the existence of its author and that it was produced. Therefore, these facts are so self-evident as to be taken for granted, without demonstration, by the intelligent reader. The same it is only reasonable to expect to be true of God's Word, that document which the avowed skeptic must acknowledge to be immeasurably above any merely human literature, as to truth and wisdom and self-consistency.

If man can say, *Cogito, ergo sum,* without further demonstration, should God not be able to say, *Cogito, ergo sum: et natura est, ergo creata est?* Then, why should not man be able to accept this implied dictum of God in His Word and re-echo, *Deus cogitat, ergo est; et natura est, ergo a Deo creata est?* Indeed, by the very same reasoning by which man is able to say *Cogito, ergo sum,* he is also able to add with equal confidence of truthfulness, *Sum, ergo Deus Creator est,* or in the words of Derzhavin, "I am, O God, and surely Thou must be!"

The chief purpose of the Scriptures is to unfold to man the divine plan of salvation, and incidentally to reveal only so much of his own and nature's origin as is necessary to make intelligible that plan and his destiny in accordance with it. Thus, the Scriptures refer to only as much of these, and use only as much of human history, as is necessary to constitute

the great scaffolding upon which to construct and unfold or consummate the divine plan for the salvation of the human race.

And what is true of the fundamental postulates of the Scriptures, has a parallel also in what might be called a fundamental postulate in nature. Nowhere does God in the ordinary course of nature avowedly present a direct tangible proof of His existence. Here, too, that existence is assumed to be self-evident from His created work. And yet, indirectly, from the cumulative evidence of nature, which we have already shown to be altogether convincing to the rational mind that will accept certain axioms of reason on faith, He is proved to exist, thus making altogether unnecessary any further direct tangible proof. Thus, as reason must be joined with faith in the study of Scripture, so must faith be joined with reason in the study of nature. But, as faith and reason, united in the study of God's work, lead to knowledge; so will reason and faith, united in the study of God's Word, lead to knowledge; and that knowledge becomes one in the enhanced knowledge of God. We might as well, therefore, not look for demonstrative direct proof of His workings in and through nature. In the words of St. George Mivart, "Thus we might expect that it would be a vain task to seek anywhere in Nature for evidence of Divine action, such that no one could sanely deny it. God will not allow Himself to be caught at the bottom of any man's crucible, or yield Himself to the experiments of gross-minded and irreverent inquirers. The natural, like the supernatural, revelation appeals to *the whole* of man's mental nature and not to the *reason alone" (Genesis of Species,* p. 287).

We should, therefore, not look for a definite *proof,* in the Christian Scriptures, of God and of the creation of the world *ex nihilo* by Him, as these two great facts constitute the manifest background of the Scriptures from Genesis to Revelation. They are everywhere implied as the two fundamental facts that are so evident as to need no demonstration, because all else is built upon them. And yet, the Scriptures are sufficiently explicit even as to these facts to leave no room for honest difference of opinion as to their meaning.

III THE THREE ABSOLUTE CREATIONS OF THE SCRIPTURES

We have said that there are men who, in a sense, accept the Scriptures, but who hold that creation according to the Scriptures consisted only in a *development* from eternally existing chaos. It should be needless to say, however, that they have far from succeeded in establishing their point. It is indeed true, as has been contended, that the word *bara* in Genesis 1:1, translated *created,* has in its root the idea of *cutting, shaping* or *fashioning*—also crystallized in the German *schaffen.* But, that is not necessarily sufficient to *limit* it to the production of something from material at hand. Indeed, no other words in any language could absolutely express the idea of an absolute creation, or of a creation *ex nihilo.* Human speech is necessarily phenomenal and figurative, and is always the product of consciousness and experience, to express ideas that come within their range, as already pointed out in an earlier chapter. But here is an idea that does not, and could not, come within the range of human consciousness and experience; for these can have to do with things only that *are,* or that *appear,* and not with the *origination* of things—as already shown.

And yet, it cannot but be very plain that the word *bara* is used in a discriminative sense in the creation story, to distinguish it from *asa,* the usual word for *shaping, transforming,* or *fashioning*—as is correctly held by many exegetes, and as was also well pointed out by Arnold Guyot. Thus, the word *bara* is used in verse 1, of what must be considered the primal creation of matter. It is used again in verse 21, of the bringing into being of life. And to this the natural scientist is necessarily driven by his utter inability to account, by natural processes, for life in even its most elementary forms, as we have seen in a former chapter. And, once more, the word *bara* is used in verse 27, of the bringing forth of man. And, in other places, where only unfolding or fashioning from already existing, previously created, materials, is spoken of, the word *asa* is used. It should be plain, therefore, that the sacred writer was moved by the Spirit of God thus to use these two terms, the best available, with some purpose of discrimination. And that purpose cannot be mistaken, to have been to distin-

guish between a bringing forth *ex nihilo* of something altogether new and the bringing forth in new form of what had already had previous existence in its elemental material or substance. Even where *bara* is elsewhere used in the Scriptures, where the *ex nihilo* is not necessarily implied by contrast with an *asa,* it is nevertheless of God's work, while of man's work the *asa* or some similar word is employed.

Thus, the bringings forth of elemental matter, of primal life, and of the immortal soul, are set apart as different from other bringings forth or mere unfoldings. These three cannot be explained in any other way than as creations *ex nihilo.* They are the true primal creations, and include the elements of all existing things, from which He brought forth everything else. And, even if this latter bringing forth is to be regarded as simply an unfolding and developing by secondary laws or forces, it must have been, as already explained, no less so by the same supreme divine Will.

This latter position has been unreservedly and reverently accepted by some of the world's greatest naturalists. Thus, the great botanist Asa Gray was a firm believer in the Divine origin of nature and the continued Divine immanence in nature. He was a thorough believer in God's operations through secondary causes in the constituted present order of the universe. He considered it not in the least against the Creator's action through secondary causes, that He called nature into being by omnipotent fiat; nor did he regard the present order of nature in its myriad secondary causes as any evidence against that primal creation. Many striking passages might be cited from his works, especially his *Darwiniana,* 1884, in proof of his attitude on this point. And Sir Oliver Lodge, realizing that the denial of the Divine immanence is chiefly based upon the so-called law of the supposedly absolute conservation of energy, points out, in the following words, that such a conclusion from this law of physics is totally without warrant: "The *serious* mistake which people are apt to make concerning this law [Conservation of Energy] is to imagine that it denies the possibility of guidance, control, or directing agency, whereas really it has nothing to say on these topics: it relates to *amount* alone. Philosophers have been far too apt to jump to the conclusion that because energy is constant, therefore no guidance is possible, so that all

psychological or other interference is precluded. Physicists, however, know better" *(Life and Matter,* pp. 20-21). For an examination of the supposed invariability of the law of conservation see Chapter VI.

Some men's conception of evidence for God in nature, is that alone of a direct miraculous interference with its ordinary laws, or of a superseding of those laws in special acts by higher or supernatural laws. Such miraculous operations should indeed constitute altogether convincing evidence of supernatural power, or of a transcendent and yet immanent Deity. But there are other evidences in nature, as we have shown, for the operations of Divine intelligence and power. Indeed, the general *absence* of the miraculous in nature is itself a striking, and indeed convincing, proof that it is the work of an all-wise, all-powerful, unchanging Creator. Its very perfection as a creature makes miracles unnecessary for its ordinary operations. And hence, their very *absence* in nature testifies of its *creation* by a *perfect Being.* Hence, the ordinary operations of nature, no less surely, though less apparently or manifestly, than extraordinary operations in miracles, testify to the fact that they are from and by a Deity, Who also must first have instituted universal nature with all its myriad manifold laws for these so-called ordinary operations. Thus, the evidence for a God in nature is overwhelming that nature is from God, and that all its operations are by His unerring concurrence, and indeed ultimately also by His imposed power.

IV THE EVIDENT CONCLUSION

We have thus shown that the evidence of the Christian Scriptures is in full accord with that of nature and that of the human mind; namely, that the universe had a beginning and that it was created *ex nihilo* by the omnific fiat of a supreme Being. We have also shown that this is the conclusion to which many unprejudiced men of science are unalterably driven. Nor can any other theory of the origin of the universe command respect from thinking men.

Any theory of self-existence would not only not explain the universe; but such theory would be a contradiction in terms, or an impossible absurdity. Even Herbert Spencer, though

he would not openly accept the theistic theory of the universe, especially in terms of Scriptural revelation, was forced to acknowledge that the atheistic theory is untenable, and that the mystery of the universe and its origin is unfathomable.

Although Spencer elsewhere urges an objection against the theistic theory of the universe, because of its inconceivableness, that does not invalidate his position against the atheistic theory. If it were a mere matter of *conceivableness* then there might be some weight in the objection. But it is a matter of *fitness,* whether the atheistic or the theistic theory best explains the universe and its origin. And, as to this, there is but one choice; namely, the theistic theory, as we have demonstrated. Nor is this only a matter of fitness; but it is even more a matter of *fact,* whether we can comprehend it or not. Moreover, even if self-existence were admitted, it would not *account* for the universe, and must therefore be ruled out of court.

Nature and Revelation are thus seen to agree that the universe was created *ex nihilo* by some supreme Being. And, if ever by the mouth of two witnesses a truth can be established, it is in this case. And, moreover, their very agreement on this point should be a convincing proof of their truthfulness. Thus, viewed from the hither or manward side, both nature and Revelation, like two inerrant index-fingers, point to the same creative Personality beyond, and yet truly within, them both. And that Personality is He Whom Revelation calls *Elohim, Jehovah, Lord,* and sets forth as a triune God, Creator, Redeemer, and Sanctifier—Father, Son and Holy Spirit. And, conversely, viewed from the yonder or Godward side, both nature and Revelation are alike His creatures as His revealed and revealing Work and Word. Then, as nature constitutes the external basis of scientific investigation, even as Revelation constitutes the outward basis of religion, can there be any real conflict between true science as founded upon nature and true religion as founded upon Revelation? Nature and Revelation, true science and true religion, should not be contradictory, but rather complementary, to each other.

To a consideration of the above question, which is of great importance to this utilitarian—we might almost say, materialistic and anti-theistic—age, we shall now proceed in what constitutes our closing chapter.

CHAPTER X

CONCLUSION: NO REAL CONFLICT BETWEEN TRUE SCIENCE AND REVELATION

FROM what we have seen thus far the inference can readily be drawn that there is in reality no conflict between Revelation and true science, as is often asserted. To a brief development of this point we shall devote this concluding chapter.

I THEIR SPHERES TOTALLY DIFFERENT

Revelation has primarily to do with man's spiritual nature, and with his origin and destiny. Physical science has primarily to do with man's physical nature and with his physical environment in the existing universe. Thus, physical science has little or nothing to do with the human soul, or the spiritual nature of man, as indeed not with any spiritual entity. And, hence, the existence of such an entity as the soul and the existence of a supreme transcendent and immanent creative and sustaining Personality, lie wholly beyond the normal realm of scientific search. Therefore, as far as mere physical science is concerned, they might be said to be non-existent, or they might or might not exist. In the words of an able scientific apologist, "The mere study of physical nature does not carry us beyond matter and its processes. Its most elaborate methods can give us no apprehension of God, or soul, or moral sense. So far as mere physical science can discern, 'if God had slept a million years, all things would be the same.' No telescope or microscope can enable us to detect freewill or any other attribute of mind. Physical science can only tell us of physical objects, physical properties, and physical laws" (Robert Flint: *Anti-Theistic Theories,* p. 106).

However, physical science, as the body of systematized results or conclusions from an attentive study or contemplation

of nature, is itself a conclusive evidence that the contemplating mind or personality is an entity different from the merely physical nature which is thus contemplated. Attention *to* something implies attention *by* some one; and the two in such an act are necessarily separate and different. If the human soul were in essence merely a part of physical nature, then we should have the implied contradiction that in so far as the soul would be a part of physical nature, physical nature would, in scientific research, be contemplating itself. Or, a mysteriously conscious fragment of physical nature would be giving attention to the unconscious residue. Then, whence or how did that mysteriously conscious fragment of physical nature attain consciousness? And, while it is true that the soul of man can attentively contemplate itself, it must not be forgotten that it does so as a *conscious personality,* as also it attentively contemplates the environing physical universe.

But, as this point, that the human soul is a spiritual entity totally different from its physical environment and even its physical embodiment, is fully established in our second and third chapters, we shall not further here develop the same. And, of course, in the light of all the arguments of the preceding chapters on that point, it is equally unnecessary here to set forth any further proofs of the existence of a spiritual Personality above nature, by Whom alone nature exists, that supreme Being Whom the Christian adores as *God.*

Thus physical science, as such, is not concerned with God and the human soul, as entities whose existence is, however, as certain (and even more so) as that of the physical universe, whose Creator and Lord the former is and the latter apparently its created crown. And, as long as physical science does not pretend to arrogate to itself the whole realm of reality and possible knowledge, it remains within its legitimate sphere. And, therefore, even as the existence of a Deity apart from, and even within, the material universe, and the co-existence of the human soul and physical nature, are not in the least in conflict with the legitimate results of physical science, who can limit the possible existence, within and beyond the physical universe, even of *other* beings altogether inconceivable by us?

Such transcendent entities, as also God and the human soul,

because not governed by physical laws, could in no way affect our physical sensorium. Not being limited by time and space relations, they might co-exist with, and around, us and throughout, as well as beyond, the ultimate physical universe—and this without in the least affecting human experience and consciousness. And, of course, they could not be or become objects of scientific knowledge. As experience, through its proper avenues of approach, and consciousness, have their necessary limitations, as sources of knowledge, in their limited points of contact with self and nature, so their bodyings forth in the pronouncements of physical science do not exhaust reality. Hence, the great whole of reality can never come within their compass. And this is even true of *physical* reality. But, as to the transcendent hyperphysical or spiritual realities, consciousness and experience, unaided—and therefore physical science—would forever have to remain without a point of contact, and therefore in total ignorance. No one should, therefore, attempt either to set a limit to existence by his limited experience or to make his finite reason the measure of the immeasurably complex universe of the infinite and eternal God.

A person born without the sense of sight cannot see light and color. He cannot even form any real *conception* of them. To him all is darkness. And, as far as he could by his own powers discover, both light and color would have no existence or would belong to the same category as darkness. The man born without the sense of hearing can neither hear sound nor can he even form any correct *conception* of sound and music. And thus, to a blind and deaf individual, even this very tangible physical world is an entity altogether different from the reality. Many of its marvelous phenomena of beauty are to him totally non-existent. And if, perchance, some explanation or revelation to him of these things were attempted by a seeing and hearing personality, these phenomena would yet in a sense be utterly inconceivable by him. He can only by *touching,* etc., acquire some indefinite idea of *grosser* forms and movements. But he could not perceive even any *effect* of those subtle marvelous vibrations that produce light and color and music.

Such an individual lives in a world of marvelous beauty, but he beholds it not, nor can he even form any proper conception of it. But, surely, it would be almost unpardonable

presumption on his part to deny the existence of the glorious rainbow in the heavens and to argue with an entranced auditor against the existence of the majestic symphonies of a Beethoven. For these things that lie beyond his limited physical senses, he must needs accept the testimony of those who have the necessary *senses of perception* to know their reality.

Like that blind and deaf individual, we stand amid the wonders of nature. Though we can perceive, in light and color and music, a minute fraction of the *effect* produced by waves of ether and waves of air, yet these physical *waves themselves* lie totally beyond even *our* natural sense-organs. Like that blind and deaf individual, who through his sense of touch, etc., can form some idea of his physical environment, so we with our limited sense-organs can acquire some knowledge of the surrounding universe. But, as in his case, our limited senses permit of but a very *partial* knowledge, and beyond their range there are realities even in *physical nature* concerning which we can only speculate and which we may never know. We are like children watching a game, from a point some steps away, through a small crack or knothole of a boarded-enclosure. All appears fragmentary and partial. Immeasurably the greater part of the universe, from the infinitesimally small to the universal whole, in ten thousand marvels, lies beyond the range of the whole outfit of our physical senses, or is a physically intangible reality. Thus, the visible light or color spectrum constitutes the record of but a minute fraction of the whole range of the mysteriously wonderful perpetual dance of the imponderable ether. As we showed in a former chapter, it constitutes but one of the octaves of the many-octaved key-board of vibrations. And yet, the other octaves no less truly *exist,* as with our own invented tools of investigation we are more and more discovering from their *effects;* but these *octaves themselves* we cannot perceive. If our eyes could be so adjusted as to enable us to behold the whole range of this fundamental reality, vistas of visions hitherto inconceivable would lie before our astonished gaze. And what is true of the fragmentary nature of our knowledge, through the avenue of the very limited visible spectrum, of these otherwise intangible realities of the physical universe, is true of man's possible knowledge of the vast realm of nature everywhere.

If, then, our knowledge of physical realities is so fragmentary and indefinite, who can assign limits to possible entities transcending physical nature and all our physical conceptions of them, even as the gorgeous rainbow and the entrancing symphony transcend the senses and even the very conception of the individual born blind and deaf? As our additional senses of apprehension enable us to perceive vastly more than is possible on the part of the man born *blind and deaf,* so with added sense-organs might an individual perceive even vastly more than is possible on *our* part. Thus, with sense-organs so adjusted or attuned as to enable one to perceive a billionfold more, both in minutiæ and in range, than is normally possible, and with other equally sensitive superadded sense-organs, many of the to us theoretical subtleties of the infinitesimal world, as well as of the cosmic whole, might become tangible realities. And so might we conceive of superadded transcendent *spiritual faculties,* if not confined within our physical organism. And thus the transcendent glories of spiritual realities, of angelic beings, and even of God, might entrance the astonished perceiving personality. But, needless to say, both such added physical and such spiritual organs of perception are not in accord with the provisions and needs of our present state. Hence, such realities would necessarily not come within the range of our direct knowledge. Such realities would, therefore, not be objects of normal scientific search and therefore not of normal scientific knowledge.

Hence, as the spheres of physical science and Revelation are totally different, there can be no real conflict between them. And, therefore, also, it is as becoming to the mere physical scientist not arbitrarily to deny the existence of the transcendent spiritual realities, as it is to the scientifically untrained Christian not arbitrarily to deny the existence of such well-established scientific realities as the luminiferous ether and the force of gravitation. As the reverent Christian must not stand in judgment upon the more definitely established results of science, so must the enthusiastic scientist not stand in judgment upon religion and its transcendental, but altogether reasonable and divinely consistent, tenets. Indeed, the scientist should rejoice in the knowledge and acceptance of these profound spiritual truths, in confirming and supplementing his visions of

God in nature, and should become reverently religious. So, the Christian should become even all the more profoundly religious, as with sanctified understanding he is permitted, with the scientist as his guide, to read God's thoughts after Him also in universal nature and to trace His plans by following His footprints almost to His throne of wisdom and power. Nor should there be anything to hinder the scientist from being a devout Christian, and the Christian from being an enthusiastic scientist.

II PHYSICAL SCIENCE NOT DIRECTLY CONCERNED WITH THE ORIGIN OF NATURE

Revelation deals chiefly with spiritual essence and ultimate Cause. Physical science deals with physical essence and secondary causes. And, as far as pertains to our general subject, the one is concerned with the origin of nature and of man as nature's crown, the other with nature's methods of operation as man's physical background.

It is, therefore, not the province of science to deal with ultimate origins. Its province is limited to already existing things. It can at the most trace things only to their *existing* elements; but it is limited to the hither side of its own assumed primeval chaos. It deals with the universe only as an *effect* and in its operations of *secondary causes,* but with its *First Cause* science, as such, is not concerned. And, indeed, every discovery of science is only a discovery of other effects or secondary causes. But Revelation steps back of that chaos and speaks to us also of its *origination.* And this, from the Godward side, is definitely done only by inspiration; but on the manward side, its meaning can really be grasped by faith alone. Thus the believer need never fear the definite results of true science.

That the question of the origin of the universe lies beyond the possibility of physical science to answer, is held by many scientists. Thus James Wier, in speaking of ultimate origins, expresses himself as follows: "In recent years much attention has been devoted to certain speculative theories with respect to the origin and ultimate nature of matter and energy. . . . But it is surely unnecessary to point out that all questions relating to origins are essentially outside the pale of true science.

Any hypotheses which may be thus formulated have not the support of experimental facts in their conclusions; they belong rather to the realm of speculative philosophy than to that of science" (*The Energy System of Matter,* 1912, p. 3). So, in line with these statements are also the following words of Alexander Humboldt: "The mystery and unsolved problem of how things came to be does not belong to the empirical province of objective research, the description of what *is.*" And no less emphatic are the words of Carl Snyder—though his reference to supposed *Hebraic tradition* might be misinterpreted—as follows: "Probably it is among the naïvetés of our intellectual childhood to suppose that the pursuit of the scientific method will ever bring us any nearer to the ultimate mystery of creation than were the favored children of Hebraic tradition. Doubtless, no more complete illusion ever possessed the human mind than that through its operations we may penetrate the origin of things" (*The World Machine,* p. 398).

There is a sense in which philosophy begins where science ends, for it attempts to unify the ascertained facts of the sciences and to interpret their meanings for the explanation of the universe and of reality. And, for that matter, whenever inferences or conclusions of philosophy become definitely established, then they cease to be speculations of philosophy and become accepted facts or laws of science. But, while philosophy sometimes boldly steps forth and sagely pretends to speak its *ipse dixit* on these truly transcendental matters, it must nevertheless with trembling tread step back from this final borderland between the conditioned and the unconditioned, between existence and its origination, between humanly attainable and humanly unattainable knowledge, and with muffled voice exclaim, "I can go no farther." Thus unenlightened reason must here truly say in the words of Du Bois-Reymond, "Ignoramus," and "Ignorabimus."

This inability of unenlightened human reason to account for ultimate origins and to attain reality, is well illustrated in the following statement by Bergson, which amounts to a *philosopher's* confession before the exalted altar of unattainable truth: "I have no sooner commenced to philosophize than I ask myself why I exist; and when I take account of the intimate connection in which I stand to the rest of the universe, the

difficulty is only pushed back, for I want to know why the universe exists; and if I refer the universe to a Principle immanent or transcendent that supports it or creates it, my thought rests on this principle only a few moments, for the same problem recurs, this time in its full breadth and generality: Whence comes it, and how can it be understood, that anything exists? Even here, in the present work, when matter has been defined as a kind of descent, this descent as the interruption of a rise, this rise itself as a growth, when finally a Principle of creation has been put at the base of things, the same question springs up: How—why does this principle exist rather than nothing" (*Bergson's Creative Evolution,* Mitchell, 1911, p. 275).

Surely, in the light of these facts it behooves both scientists and philosophers to be humble. In the presence of the mysteries of nature that rise Sphinx-like before the astonished vision in unapproachable glory, they must needs be respectful. And, before the infinitely more wonderful Being Who must be in and through and over all, they should stand in reverential awe. Here is no place for sage scientific utterances concerning those transcendental truths about nature and nature's God, of which only by a declaration from the very Throne man has been vouchsafed fragmentary glimpses. Indeed, science and philosophy may be regarded as the two branches of the hyperbola of possibly merely human knowledge, which never *reach,* though they may ever *approach,* the asymptotes, or straight lines, of absolute reality and truth, whose point of meeting or centre is God.

III THE APPARENT CONFLICT DUE TO UNPROVED PREMISES AND UNWARRANTED CONCLUSIONS

Whatever apparent conflict between Revelation and science there is, has arisen from the drawing of unwarranted philosophic conclusions from certain unproved scientific theories as premises, or from philosophic misinterpretations of some scientific facts. Thus, in adopting as a working hypothesis the theory of evolution, many apparently fair-minded men have been lost in a contemplation of the wheels and spindles of

its supposed mighty machinery. Instead of regarding such supposed evolution as the Creator's possible *modus operandi,* they have come to treat it as though it were itself a causal divinity. Thus, in dealing exclusively with physical nature, it has become to them the great All and the only reality, behind and beyond which the God of the Scriptures is totally eclipsed. In contemplating the creature they have come to worship and serve it more than, and even to the exclusion of, its Creator.

With Sadducean definiteness these men have come to deny the existence of angels and spirits, yea and even of their own souls as spiritual entities, as well as of God. Energy, as manifested in the various forces of nature, is to them an eternal or self-existing entity, together with matter as its basis or carrier, instead of the expression or impression upon it of the eternal God, perhaps chiefly in the form of relative positions of the subdivisions of matter for consequent adjustments. To them, the universe is not only the beginning of all things, but also the ultimate end and aim. Man they regard as its own highest product, instead of its superadded lord, for whose development for a higher sphere physical nature, at least in part, was very apparently ordained. Their conclusion that the universe is uncreated, from the supposed evidence of the uniformity of nature and the apparent persistence of energy and matter, is about as conclusive as that of a certain college professor, who contended that the fact that no one had ever seen a monkey turn or develop into a man is a conclusive proof against Darwinism.

If an infinitesimal being, endowed with reason, had its abode somewhere within a giant printing press, its reasoning might be similar to that of some atheistic scientists. To such a being, a second might be as long as to us a century, and an inch like millions of miles. To it, the printing press would be a universe, with absolute uniformity of operation and with apparent conservation of matter and energy. A thousand generations of its beings, stretching over many thousands of its years (equivalent to but an hour with us) had seen no change in its laws, and therefore no miracle. A beginning and an end would be to them inconceivable. It must be eternal, and therefore uncreated and also indestructible. And, as for a machinist or a printer above or beyond it, no one had ever seen him, and what is more there would apparently be no need of

him. No machinist; no personal operator; no maker! The machine is supposedly self-operating, and apparently develops a complexity of phenomena. Therefore, it is perhaps itself some blind divinity. And perhaps the whole is the product of chance. And, what wonderful discoveries, on the part of its rational infinitesimal inhabitants, as to the *running* of that universe printing-press, and what sage philosophy as to *reality!*

Like that infinitesimal being, man is an infinitesimal creature in a comparatively immeasurably vaster universe. He reasons and loses himself in contemplating its vast machinery. Centuries of uniformity and conservation he takes to be conclusive evidence that such uniformity and conservation have always been and will always be. By natural inference he concludes that it must be all, and the only reality. No Machinist; no Operator; no God!

But what are man's littleness and duration in God's mighty universe! They are totally inadequate to establish sufficient data for conclusions as to infinity and eternity. And, as compared with the expanse and duration of the whole immeasurably complex creation of the infinite, eternal and omnipotent God, the universe known to us might be but a very minute part, our solar system but an atom of planetary electrons, and a thousand centuries but a moment.

In line with the above view are the following suggestive words of Sir Oliver Lodge: "If the Deity has a sense of humour, as undoubtedly He has, He must be amused at the remarkable philosophising faculty recently developed by the creature, which on this planet has become most vigorously self-conscious and is in the early stages of progress towards higher things—a philosophising faculty so acute as to lead him to mistrust and throw away information conveyed to him by the very instruments which have enabled him to become what he is. . . . He must be pleased, also, with the enterprise of those eager philosophers who . . . on the strength of a few years' superficial experience on a planet, by the aid of the sense organs which they themselves perceive to be illusory whenever the actual reality of things is in contemplation, proceed to develop the theory that the whole has come into being without direct intelligence, . . . that no Deity exists, and that it is absurd to postulate the existence of a comprehensive and all-inclusive guiding Mind" *(Life and Matter,* pp. 65-67).

Surely, science loses all just claims to be called *knowledge* when it would sagely declare that the universe is eternal and self-existent and that there is no God. And, as for proud philosophy, it can with truth be said that some of its conclusions are manufactured *ex nihilo,* or from the purely nonexistent. It often pretends to stand in judgment over both science and Revelation, and is often as much in conflict with the one as with the other. In the search for truth and reality, systems of philosophy have, moreover, been pitted against systems. Meanwhile, ultimate reality and truth have eluded every merely human search, as the rainbow eludes the untutored child approaching it over the hill-tops in search of its traditional imbedded pot of gold.

IV TRUE SCIENCE AND PHILOSOPHY AS WITNESSES FOR REVELATION

Both science and philosophy, however, furnish the Christian believer, as we have shown, with unassailable evidence that the testimony of nature, as far as it goes, and the spontaneous faith of his heart, agree with the Revelation of Holy Scripture. Their united testimony, moreover, points him to that Revelation for the only reasonable definite solution of this and other otherwise perplexing and indeed insoluble problems. And the answer of the Scriptures is that the existing universe was *created out of nothing* by the Christian's ever adorable Almighty God. And thus, true science must always necessarily corroborate the divine Word, for nature and Scripture are both from the same Author, the one constituting the great volume of His Work and the other that of His Word.

Indeed, as true faith in God must have its real objective counterpart in the God it grasps, so must a true science of nature have its true objective counterpart in the nature it describes. And, as God and nature are related as Creator and creature, as we have shown, the object of faith can be no less a reality than that of science, but rather more. And yet, both faith and science must be in accord with reason. Therefore, the enlightened reason of man must be matched by the facts of both faith and science. Thus, as the reason of God is reflected both in nature and in the reason of man, the universe must correspond with faith, as well as with enlightened human reason.

V A PLACE FOR FAITH IN SCIENCE, AS WELL AS IN RELIGION

As already intimated, faith in some form is necessary in science, as well as in religion. In all his reasoning the man of science must exercise faith. He must believe the evidence of his senses, whether that evidence be direct, or indirect through his instruments of investigation. He must believe in the uniform operations of the accepted laws of nature, and by faith he must accept those laws. He must believe that like causes are always followed by like effects, or that like effects must have been preceded by like causes. He must believe in the continuity of his own personal identity, the evidence of consciousness, and the reliability of the laws of thought. He must continually set up, and work according to, theories that he may never be able to prove; and he must accept as parts of working hypotheses many supposed elements of knowledge that forever elude demonstration. In all these things he must believe in order that he may know. Faith is for him thus in many respects the highway to knowledge. But his faith, or fundamental and often apparently instinctive beliefs, like those of the man of God, must be matched by objective reality to become a safe guide to scientific certainty. In the words of Bertrand Russell, "All knowledge, we find, must be built upon our instinctive beliefs, and if these are rejected, nothing is left. But among our instinctive beliefs some are much stronger than others, while many have, by habit and association, become entangled with other beliefs, not really instinctive, but falsely supposed to be part of what is believed instinctively" (*The Problems of Philosophy,* p. 39).

In this respect, there is a real sense in which science and religion must approach truth from the same point of view; and both must approach it with humility. The man of God says, upon the evidence of God's revealed Word, *I believe that I may know.* The man of science must no less say, upon the evidence of God's revealed Work in nature and in himself, *I believe that I may know* (though there is a sense in which he may say, I know that I may believe). And upon their respective data, the elements or foundations of which rest upon faith alone, both grow from more to more. And their ultimate goal, if both are honest in their search, will, re-

spectively through His Word and through His Work—His Revelation and His cosmic nature—be the God and Author of both nature and Revelation. They thus start together, or upon a common principle, and after apparently following very different routes or avenues of approach, they must needs meet together where they end. And there is no reason why the man of science and the man of God should not be one. Indeed, the man of science, above all others, should be a reverent man of God.

The man of God, in following whithersoever faith in God's Word leads him, need not fear the legitimate end whither faith in God's Work also leads him, as both will lead to God. Nor need the man of science, in tracing the footprints of his Creator after Him in His creation, fear with all humility to follow the leadings of faith through Revelation's trailing clouds of glory to His throne. The man of God can be an enthusiastic scientist, as already noted, and the man of science can be a devout and devoted man of God. Indeed, both should be upon their knees before the same and only living God.

We do not mean, however, that religion can take the place of science, or that science can take the place of religion. Science can not satisfy the yearnings and aspirations of the human soul. It knows no sin, no atonement, no redemption, and no Redeemer. It can only guess at many other truths of Revelation, such as even God's love, man's exalted nature here and the high destiny of the redeemed in a higher life hereafter. But, surely, this is not against science: it is altogether true to its real nature and proper sphere. Therefore, the man of science must supplement his science with religion. He must accept the atoning sacrifice of the same blessed Saviour, Whom the Christian adores, if he would be saved. The man of God has no such relative need of science as the man of science has of religion. Salvation is not dependent upon faith in, or knowledge of, God's handiwork. It is dependent upon faith in the revealed Saviour of the Christian Scriptures.

This fact of the relative value of science and religion for the higher interests and needs of man, is well illustrated by an old story of a philosopher and a boatman. The two were in a boat on the lake; and, while the boatman was busy

rowing, the philosopher was as busy talking philosophy to him. The philosopher's conversation taking the form of questions, he asked the boatman, "Have you read Socrates?" Upon receiving a negative answer, the philosopher, in his philosophic enthusiasm, said to the boatman, "Then one quarter of your life is lost." Soon the philosopher followed his first question by another, "Have you read Plato?" Again receiving a reply in the negative, the philosopher said to the boatman, "Then another quarter of your life is lost." And after some further philosophic expatiation, the philosopher asked the boatman, "Have you read Aristotle?" The boatman, to whom these names were, of course, only so many meaningless words, again returned a negative answer, upon which the philosopher said to him, "Then three quarters of your life are lost." By this time a gust of wind came up; and the boat, now filling with water, gradually began to sink. The boatman, rising from his seat at the oars, pointed out to the philosopher the imminent danger. And, beginning to take off his coat in order to be prepared for the worst, the boatman asked the philosopher, "Can you swim?" And, upon receiving a negative answer, he said to the philosopher, "Then the whole of your life is lost."

The splendid reasoning of Socrates, Plato and Aristotle, were indeed a source of great intellectual pleasure to the philosopher. But, when the boat began to sink, his knowledge of the speculations of these ancient Greek sages could not save him from drowning. And, while the boatman truly missed much of the delights of intellectual stimulation, by not being able to think the thoughts of those ancient reasoners after them, his safety depended alone upon his ability to swim.

So, while science and philosophy have their truly great value for man in his present physical environment, no scientific attainments, nor any amount of philosophic speculations, can save his undying soul. Faith in the appointed Saviour of the Soul, or that appointed Saviour Whom we grasp by faith, alone can do that. Thus, here, too, the spheres of science and religion are totally different. The former has to do with man's physical life and his physical environment here; the latter has to do with man's spiritual life here and his spiritual destiny and environment hereafter. And yet, these two can truly, and should, co-exist, as man is both physical and spiritual.

Both are necessary, the one in the physical sphere, the other in the spiritual sphere. But this necessity is not one of equal degree. And, therefore, if a choice between the two were necessary, upon the supposition that the two could not co-exist, or that the one excluded the other, one's immeasurably more enduring interests would lie in the choice of religion. However, as already pointed out, the two *can* co-exist. And, as both ultimately rest upon faith, the scientist and the Christian should here, as well as in their goal, find a common unifying principle. And, surely, the scientist can not deny that true religion ultimately leads to knowledge, any more than the Christian can deny that true science leads to knowledge. Hence, the one should be a *Christian* scientist, while the other can be a *scientific* Christian.

The mistake that is often made, is to assume that science, and science alone, is knowledge, and knowledge alone, and that religion is faith alone without knowledge. Therefore, some men of science have professedly rejected religion, while some men of God have professedly rejected science. The former have avowedly refused to believe, and the latter have inadvertently refused to know. But, in the light of what we have just said, and of other things contained in this volume, it is seen that there is a legitimate place for faith in both religion and science, as also there is for knowledge.

VI NATURE AND REVELATION UNITED IN TESTIFYING TO THEIR COMMON ORIGIN

The supposed conflict between Christianity and legitimate or true science has, therefore, no existence in reality. This, then, should also afford additional evidence that the Scriptures, which constitute the credentials of Christianity, must have come from the same source as that from which the universe, upon which science is founded, has come. Nature and Revelation agree in their testimony as to the origin of the universe. The evidence of both is in accord with consistent reason. Therefore, if nature came from God, as we have proved it did, then the natural inference should be that the Scriptures also came from God. The reason of man and the spontaneous faith of his yearning heart are matched alike—though not with

equal clearness and completeness—by the revelations of Scripture and the revelations of nature. The reason of God in its impress upon the human soul and its counterpart in universal nature and in the Christian Scriptures, should indicate their common origin in that supreme reason of the everlasting God. To deny the divine origin of the Scriptures, would thus almost necessarily involve a denial of the divine origin of the universe and of the human soul. And to deny the divine origin of the universe and of the human soul, is to end in a bewildering maze of contradictions, impossibilities and absurdities, as demonstrated in the preceding chapters, while such denial only deepens the profound mystery of existence. But, to affirm or accept the divine origin of the universe and of the human soul, should almost necessarily compel the affirmation or acceptance of the divine origin of the Scriptures. Therefore, as we believe we have conclusively proved the divine origin of the universe and of the human soul, we believe we have made the rejection of the divine origin of the Scriptures impossible.

We hold, therefore, that, even though science of itself cannot resolve the great mystery of origin and existence, and even though it repeatedly errs in its supposed conclusions, it must nevertheless also redound to the glory of God. In its legitimate conclusions from a study of nature, it must necessarily lead the open-minded man to a deeper appreciation of the greatness and glory of the great Author and Lord of both nature and man. Therefore, the man of science, who also understands and accepts God's revelation of His greatness and love and His plan of salvation in the Scriptures, should—because of his profounder understanding of God's works—all the more reverently bend his knee before that infinite and eternal Being, for Whom nature and Scripture are mutually confirmatory and reenforcing, and in a sense supplementary, revelations.

The reverent prayer of every true scientific investigator should be for both wisdom and grace. It should also be a prayer of genuine thanksgiving, as was that of the great Kepler, who in his dedication to God of his *Harmony of the World,* gave expression to the following fervent prayer: "O Thou, Who through the light of Nature, dost arouse in us the longing after the light of grace in order to exalt us into the

light of glory, I thank Thee, O my God and Creator, that Thou dost permit me to rejoice in Thy works."

Enough has thus, we believe, been said to show not only the reasonableness of the Christian conception of creation and of the Biblical cosmogony, properly interpreted, but also the utter inadequacy of any other theory whatsoever to account for the universe. The physical universe has been proved by different methods and by an overwhelming accumulation of evidence to be manifestly a *finite* entity, and to be *dependent* from the ultimate particle to the all-comprehensive whole. It is thus seen necessarily to be a *creature* of a higher Being, Whom we have shown to be a transcendent *spiritual Personality*. It is also seen that this finite and dependent universe was, by that supreme spiritual Personality, called into being, or created *ex nihilo,* or without the use of any previously existing entity or entities. We have shown that what is thus so conclusively deducible from the existing universe itself corresponds to the unmistakable testimony of what we know as the *Christian Scriptures.* We have shown also that that transcendent spiritual Personality Whom nature thus ultimately reveals, is the same as the *God of Revelation,* to Whom nature and Revelation are thus related as His *Work* and His *Word.* We may, therefore, consider our purpose in this volume to be accomplished.

May this humble contribution in support of the Scriptural doctrine of creation be the means of leading many to the feet of the God of both nature and Revelation. May it lead Godward many an honest doubter and many an ardent searcher after truth. May it restore to an unfaltering faith many who have wandered away from it. And, may it strengthen in their faith those who have not drifted from it, as well as put into their hands the weapons with which to meet those who assail this article of their faith. And may it, moreover, in thus setting forth some of the wonders of the Creator in the creation which is His marvelous handiwork, also in this humble way redound to the glory of God. This is the devout wish and prayer of one who would ascribe all honor to Him Whom he delights in this humble way to serve.

INDEX


ARTI et VERITATI