VOLUME VIII: The Doorway Papers

science and faith

WORLD VIEWS PAST AND PRESENT

SECOND EDITION

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PREFACE TO VOLUME VIII

THIS VOLUME contains three published papers and one not published previously. One of the former is longer and more elaborately documented than most of the Papers in this series. All three are concerned basically with a single theme: the position of man in the universe and the importance, for his spiritual well-being, of a clear understanding of what this position really is.

The first Paper—"The Universe: Designed for Man?"—is intended to show that there are excellent reasons for believing that the world we live in did not come to its present form by accident, but by design was structured and furnished in a way peculiarly suited as a setting for such a creature as man is. It owes its unique character to the character of the universe as a whole—as though the universe was made for the world and the world was made for man. In that case, in the final analysis, the universe was made for man!

But can such a tiny speck of life in the immensity of space, living on such an insignificant little planet circling around a third-rate sun, which is only one among countless millions of other stars of far greater magnitude, possibly have any significance? Could this puny creature be the cause of such a tremendous display of creative activity which is then merely a stage for *him*?

The answer, I believe, is in the affirmative. Indeed, it can be argued—and is even now being seriously argued by some who have no stated Christian conviction—that it is man who gives significance to the universe by his very presence within it. If the world was made for man, it begins to appear that even the universe was created on his account . . . . This is a staggering thought, but it may be the simple truth.

The second Paper, "Scientific Determinism and Divine Intervention," explores the increasing evidence that *mechanism* is all-pervasive in the natural order and that one area of supposed freedom after another has had to be surrendered as research has demonstrated a surprising measure of rigid causality even in areas that we normally associate with willed activity. For the Christian, the implacable offensive of science seems about ready to drive God out of His own creation entirely. Where will it all end? Are we simply links in a chain of causality without any escape, without any real freedom of action or even of will, and therefore without any responsibility either? Has man any significance if he has no responsibility? And if man has no significance, does *anything* have significance?

Up to a point, such research did underscore the perfection of the natural order. The universe looked like a perfect watch, to use Newton's analogy. But is there any way in which God can now intervene which does not at the same time involve the disruption of His own handiwork or show, in effect, that His handiwork is not perfect? The watchmaker cannot tinker with his watch without admitting there is something wrong with it. Can we discover any pattern of

intervention which is reconcilable with the concept of a perfect mechanism, such as our faith in the flawlessness of God's handiwork would seem to demand? Can we account for the Watchmaker's need to tinker while still maintaining that He had made a perfect watch?

My thesis is that there has arisen a circumstance—a fatal disturbance for which God is not directly responsible—which now demands constant corrective action on God's part, perhaps throughout the whole universe, to preserve the mechanism from a total breakdown. How this circumstance arose in the first place is a subject of divine revelation, and I believe that Genesis 2:3 (And God blessed the seventh day, and sanctified it: because that in it he had rested from all his work which God created and made.) has an important bearing on the matter in a way not previously recognized.

The third Paper, "Medieval Synthesis and Modern Fragmentation," is a somewhat longer study which attempts to show by an examination of history how very important it is to man to have a clear picture in his own mind of what his relationship is to the universe, why God has placed him in this setting, and what is expected of him while he makes his journey along the way. This may be usefully summed up in the term *world view*. Cultures have world views and so do individuals. And there are world views belonging uniquely to periods of history. In its assessment of man's significance in the universe, the Medieval world view, which was essentially spiritual, contrasts markedly with the modern world view, which is essentially technical. For all its faults, the former had tremendous advantages over the latter, yet it could not be sustained: not because its objective was at fault, but because certain of its foundations were faulty. Today we have corrected the foundations to some extent, but in doing so, we have shattered the superstructure and found nothing to put in its place.

The gradual shift in perspective and goal from those days until the present is traced in some detail, and the sad consequences in terms of man's spiritual health are analysed. Some suggestions toward the recovery of a world view appropriate to man's spiritual needs, yet in harmony with the factual knowledge we now have, are proposed with particular attention being paid to the responsibility of the Christian in this process of recovery. Along the way, constant reference is made to the admissions of scientists regarding the inadequacies of the present world view, with some consideration of the kinds of alternatives such men are proposing—all of which are, to my mind, inadequate. The only satisfying world view for man will, in the end, be one which not only recognizes the spiritual dimension of man's life (which many secular writers do) and not merely his physical and intellectual needs, but will also pay due attention to what God was pleased to reveal in Scripture simply because man's native intelligence was not capable of discovering the whole truth without His help. A new synthesis is needed, and the evidence indicates that Christian faith alone can supply the framework and the cement.

The final Paper, a new one hitherto not published, deals with the question of how fitness of living things is constantly adjusted to a changing environment. Is this due to chance improvements arising from mutations that happen to be beneficial (as current evolutionary doctrine requires); or the inheritance of acquired characters by the conventional route as proposed by Lamarck (which is now entirely out of favour); or an immanent divine intervention, adjusting every

element in the web of nature as required? Or is there, after all, some built-in mechanism of self-adjustment which operates as a kind of Lamarckianism but not via nuclear genes?

The evidence for the last alternative, generally referred to as *dauermodifications*, but still virtually ignored by Christian writers, has been accumulating for some years. It seems to provide for the maintenance of the integrity of the species as such, while providing an effective means whereby long-range variation to suit changing life conditions can also take place. This Paper explores the evidence for this fourth alternative.

All these Papers bear witness to the existence of divine forethought in creation, as well as emphasizing the importance of recognizing this evidence in the search for meaning and purpose in life.

PART I

THE UNIVERSE: DESIGNED FOR MAN?

[Doorway Paper #35, first issued 1970]

In the beginning God created the heavens and the earth.

Genesis 1:1

The heavens declare the glory of God and the firmament showeth His handiwork.

Psalm 19:1

By Him were all things created, that are in heaven, and that are in the earth . . . and by Him all things hold together.

Colossians 1:16,17

Through faith we understand that the worlds were framed by the Word of God, so that things which are seen were not made from things which do appear.

Hebrews 11:3

Thou, Lord, in the beginning hast laid the foundation of the earth; and the heavens are the work of Thine hands: they shall perish; but Thou remainest; and they shall wax old as doth a garment: and as a vesture shalt Thou fold them up, and they shall be changed.

Hebrews 1:10-12

The heavens shall pass away with a great noise, and the elements shall melt with a fervent heat.

2 Peter 3:10

And I saw a new heaven and a new earth: for the first heaven and the first earth had passed away.

Revelation 21:1

Introduction

There are times in history when calamities of such magnitude have overtaken whole societies that they suffer a kind of spiritual trauma from which it may take thousands of years to recover, if they recover at all. Perhaps the event which did most to undermine the Medieval world view was the Black Plague. It was not merely that an appalling number of people died under frightful conditions and in great agony; it was rather that the plague itself seemed totally indifferent to its victims. The righteous died with the wicked. Those who might have been expected to be given some divine protection by reason of their Christian piety or their nobility of character were struck down just as mercilessly as the most evil among men. The older view of the universe as being governed by a righteous and beneficent God who punished sinners and rewarded the righteous received a staggering blow. It left men wondering whether God is in His heaven at all, whether life has any transcendental meaning, and whether man is any more than just a pawn of a capricious fate. But men did recover some measure of peace and assurance in time—for hope springs eternal . . . .

The Second World War (1939-1945) had a somewhat similar effect because so many millions of innocent people were uprooted or destroyed, people who were essentially harmless individuals and, in a tremendous number of cases, God-fearing and devout. Once again men began to ask whether God really is in His heaven and whether life really does have any transcendental meaning. Perhaps, after all, the universe is a giant accident and man totally insignificant, his fate being of no consequence except to himself.

Viktor Frankl, a world-renowned psychiatrist of Vienna, found, after a very great number of interviews with disturbed people since World War II, that whereas children tend to seek in life *pleasure* above all, and adolescents *power*, mature adults seem to feel a greater need to find *meaning* in life than ever before.[1] And there is no question that the search for meaning demands that the individual find in some way a satisfactory answer to the question of his own relationship to the universe, to eternity, to the sum of things—and not just to his own little world of immediate experience.

In Medieval times, whatever miseries may have marked the lot of the common man, it does seem that he enjoyed this at least, namely, that he possessed some sense of the meaning of life in transcendental terms—that is to say, in terms of his relationship to God, his origin, his destiny and the meaning of the created

1. Frankl, Viktor E., "Reductionism and Nihilism" in *Beyond Reductionism*, edited by Arthur Koestler and J. R. Smythies, Hutchinson, London, 1969, in the discussion, p.414.

order of which the earth seemed to be the central focus. Whereas his means, his resources, were pitifully small, his ends or goals—though honoured more in the breach than in the fulfilment and often wrongly motivated—were nevertheless reasonably clear and lifted him to some extent above his miserable circumstances. They provided him with both a stimulus and a comfort. But today, as Sir Eric Ashby has pointed out, while we have tremendously improved our means we have almost completely lost sight of any worthwhile ends.[2] Aldous Huxley observed sadly that modern education in our higher institutes of learning has become dedicated to providing improved means to unimproved ends.[3]We have reached a point where we spend our energies acquiring a first-class ticket on a train, the destination of which seems of little concern to us. It is more fun to travel than to arrive, and the only goal in life seems to be to travel in style.

The question arises whether we can find *ends* without defining man's destiny: and we cannot define destinies without settling the prior question of origins. If man has been cast up accidentally as a by-product of purely materialistic forces in a universe which has no meaning or purpose except to burn itself out so that everything that charms or challenges will perish with it and all aspiration will be as though it had never been, then "nature" has played a tremendous and tragic joke upon us all and our strivings are ultimately meaningless. So the crucial question, really, is whether the universe does have meaning: and, in the final analysis, this meaning must be "meaning for man". Is it possible, then, to make sense out of such a gigantic display in terms of the time taken, the distances involved, and the inconceivable masses of material which compose it, to find in all this vastness that such a puny creature as man is the ultimate explanation?

How did it all begin, and why? Where is it all tending, and to what end? Is man of consequence in this tremendous drama? Does the evidence provide us with adequate cues in cosmic terms sufficient to justify the conclusion that the universe is *not* a meaningless accident destined to burn itself out to no end, but a demonstration of the power and the wisdom of God and so designed as to convey this message to a creature such as man is?

2. Ashby, Sir Eric, "Technological Humanism" in *Nature*, 10 March, 1956, p.443.
3. Huxley, Aldous: quoted by John Walsh in a note on Aldous Huxley, *Science*, vol.142, 1963, p.1446.

Chapter 1

The Power of God as Creator

There are two kinds of *models* of the universe which satisfy different kinds of people. There is the mathematical model for those who do not find it necessary to be able to reduce their understanding to the terms of sticks and strings and physical realities; and there is the mechanical or physical model for those who find that they are not satisfied until they can visualize a structure for which analogies in mechanical terms are available. I am one of those who fall in this latter group and therefore find it necessary to create this kind of model, hoping thereby on the one hand not to contradict the requirements of the mathematical formulae of those who dwell in "ivory towers," but on the other hand—and more importantly—to satisfy the demand for a physical reality. So, in the following pages some liberties have been taken in interpreting the concepts of the mathematicians, the chief justification of which is that the picture that emerges is at least imaginable in the terms of ordinary experience without, I believe, doing injustice to the less mechanical concepts of the mathematicians.

Probably everyone who has travelled anywhere by train over a level crossing in the New World or through a tunnel in the Old World will have observed that as the train approaches a ringing bell the note appears to rise slightly to a higher pitch and then, once it has gone past it, to fall of immediately to very nearly the original pitch. This is known as the Doppler effect, and it results from the fact that during the time of approach the sound waves are increasingly crowded into the ear and thereby shortened, giving rise to an apparently higher note as the approach is made. It is a sensation only, since the note has not really changed. As the source of sound is passed and left behind, the reverse sensation of a falling note is observed. This phenomenon is also true when we approach a light. It should appear to become slightly whiter as we draw near to it and slightly redder as we pull away from it. However, the change in colour is so slight, for reasons which are not important in the present context, that our eyes are not capable of detecting the change. If we could travel fast enough toward and away from the source of light, we should probably be able to observe the same kind of change which applies to the ringing bell at the level crossing, but we cannot attain sufficient speed on earth.

On the other hand, the earth's movement relative to some of the distant galaxies out in the immense reaches of space does involve speeds of a magnitude which enable us to detect this colour shift. In this case, however, the change can still be registered only by instruments. This colour shift seems to point unmistakably to the fact that the distance between the earth and these remote

galaxies is increasing. This could be interpreted in several ways. We may be running *away from* these objects and successfully making our escape; or *we* may be running *after* them and they are escaping from us. Or alternatively, we may be simply standing still while they are in flight, or they could be standing still while *we* are in flight. There is one further alternative, and that is that we are both moving away from a common centre at about the same speed in different directions, thereby increasing the distances between us. To decide which is the correct interpretation, it is necessary to look very briefly at the nature of the evidence.

When a substance is burned, it emits light waves. The light waves from different substances are found also to differ when analysed with a suitable device. By using an instrument called a spectroscope, it has been found that the light given off by any burning substance can be quite precisely analysed and catalogued. In their attempt to analyse what distant galaxies or nebulae were made of, early astronomers used this principle because it was reasonably certain that the bodies which composed these nebulae were actually on fire. By analysing their light by means of a spectroscope, it was believed that we could discover whether the rest of the universe was made out of essentially the same materials as composed our own immediate world. It was during this period of experimentation that—unexpectedly —the phenomenon of colour change, now referred to as Red Shift, was first observed. It was found that the further away from us any particular nebula happened to be, the greater was the tendency for the band of light which emerged from the spectroscope to emphasize the longer wavelengths toward the red end of the spectrum. It was this observation which introduced us to the concept of an expanding universe in which the distances between the galaxies were becoming increasingly greater.

It all began almost fifty years ago when an astronomer, V. M. Slipher at the Lowell Observatory in Arizona,[4] started photographing nebulae in the hopes of identifying their constituent chemical elements. It was thus that the Red Shift phenomenon was discovered. The discovery was an exciting one because of its implications. In 1929, some years after Slipher had ended his studies, Edwin Hubble of the Mount Palomar Observatory had noted that the estimated velocities of the galaxies as determined by their Red Shift were faster as the distance of each nebula from the earth was greater. In short, the nebulae appeared to be receding with greater velocity as the distances between increased. The following table (Table 1) indicates, representatively, the kind of picture that was beginning to emerge this respect.[5]

At the time Hubble discovered this correlation, only forty-six nebulae had been spectrophotographed. In order to investigate the matter further, Milton L. Humason of Mount Wilson Observatory,[6] began a program of determining the velocities of fainter and more distant nebulae, using the 100-inch telescope. By 1948 the number of known nebular velocities had increased to over five hundred. Even at distances of 200 million light-years or so, the limit of the l00-inch telescope for spectra, Hubble's Law of the Red Shifts still held.

4. Slipher, V. M.: see George W. Gray, "The Universe from Palomar" in *Scientific American*, February 1952, p.45.
5. Figures by George W. Gray, *ibid*, p.45.
6. Humason: see George W. Gray, *ibid*, p.45.

Table 1: Galaxy velocity as determined by its Red Shift.

Position of Nebulae	Distance in light years	Velocity in miles per sec
Virgo	6,000,000	700
Pegasus	23,000,000	3,400
Coma Berenices	45,000,000	4,200
Ursa Major	85,000,000	9,600
Leo	105,000,000	12,000
Gemini	135,000,000	15,000
Bootes	228,000,000	24,400
Hydra	360,000,000	38,000

In 1951, with the even larger 200-inch telescope, Humason photographed two nebulae estimated to be 360 million light-years away, a distance of 360 million times 6,000 billion miles! The redward shift recorded by these plates was the largest ever measured and indicated a velocity of 38,000 miles per second! This is the last figure shown in the table above.

At the risk of some repetition, it may be worthwhile quoting Hubble's own words at the time of his original observation:

> The spectrum is composed of light separated according to its wavelength, running from the longer wavelengths of red at one end to the shorter wavelengths of violet at the other. Each element produces light of certain definite wavelengths, which appear in the spectrum unless the source of light is, relatively, moving toward or away from the observer. If the source is approaching, the pattern of lines for any element will appear farther toward the violet. If the source is receding, the lines will appear farther toward the red than they would if the source were stationary with respect to the observer. This shifting of the spectral lines is used extensively to determine the velocities of planets and stars with respect to the earth. Practically all spectra of island universes have their lines shifted toward the red. These shifts are very great for the more distant universes and less for the closer ones. This shift has become commonly known as the "red shift."
>
> It may be stated with confidence that red shifts either are velocity shifts or they must be referred to some hitherto unrecognized principle in nature [...]. The present distribution of red shifts could be adequately described on the assumption that all the nebulae were once jammed together in a small volume of

> space. Then, at a certain instant [...] an explosion occurred, the nebulae rushing outward in all directions and with all velocities.[7]

In a BBC broadcast, C. A. Coulson pointed out that "if the matter in the Universe was really so greatly concentrated at that time, it is hard to avoid calling it the moment of creation."[8] The European astronomer, C. F. von Weizsacker, picking up the concept of this opening phrase, speaks of it as being analogous to an explosion. It is as though God began everything with a tremendous concentration of energy. Thus von Weizsacker wrote:

> The famous red-shift of the spectral lines of galaxies is most naturally explained by the assumption that they are all receding from each *other – not unlike the pieces of an exploding bomb shell* [...].
>
> Physics, as we know it today, does not offer any *other* natural explanation of this red shift than the assumed expanding motion [...].
>
> There is one additional argument for considering the expanding motion as real, and in my view this argument is very strong. If there is a *real motion* it defines a time-scale. Assume the comparison with an exploding bombshell as correct: then, if you can measure the distances and the velocities of the fragments in a given moment, you can calculate at which moment of time the explosion took place. Now the distances of galaxies are roughly known, and the red shift, if interpreted as indicating a velocity, gives you the numeric value of the velocity: hence we can calculate the time of the first explosion. It turns out to be roughly 15,000,000,000 years ago" [emphasis mine].[9]

We now have, therefore, a picture of all the matter in the universe concentrated in one mass at some finite time ago. However, we can say something more regarding this original "lump" of matter which Lemaitre envisioned long ago and termed the "primeval atom." In the first place, according to Lovell, it contained the entire material of the universe and had a density which was inconceivably great — "at least a hundred million tons per cubic centimetre."[10] This original lump with its tremendous density has led astronomers to refer to the concept as the "superdense state" theory of the origin of the universe. George Schweitzer observed:

> This lump had a temperature that was extremely hot and underwent a explosion which hurled the matter and radiation outward. The matter, which was initially neutrons, interacted at the superhot temperature to produce atoms. As the expansion continued outward, the temperature decreased and the atoms

7. Hubble, Edwin: in the Annual Sigma Xi Address before the American Association for the Advancement of Science, 30 December, 1941, reported in *Science*, vol.95, 1942, p.212-15.
8. Coulson, C. A., "The Age of the Universe," *The Listener*, BBC, London, 21 May, 1953, p.839.
9. von Weizsacker, C. F., *The Relevance of Science: Creation and Cosmogony*, Collins, London, 1964, p.147.
10. Lovell, A. C. B., *The Individual and the Universe*, (BBC Reith Lectures, 1958) Oxford University Press, 1959, p.88.

> cooled to form clouds of gas. Some of these clouds, under the action of local turbulence, then condensed to form the planets, stars, galaxies and galaxial clusters. The galaxial clusters are still expanding from the force of the explosion [...] .
>
> The superdense state theory is one theory which explains in a fairly adequate way the things we know about the universe. It does not violate any presently accepted physical law. It accounts for the recession of the galaxial clusters; is fairly successful in predicting the abundances of the elements; and it provides a date for the universe which agrees with the age of the earth, our galaxy and the universe as determined by other methods.[11]

In the second place, we know that the total available energy in the universe is being dissipated as the universe expands until, presumably, the whole vast system will "die a heat death." This steady loss of organization is referred to as an increase in entropy—one might almost term it an increase in disorganization. If this process has been operative since the creation, we must assume that at first the initial primeval mass was totally organized. Referring to this, Eddington said:

> Travelling backwards into the past we find a world with more and more organization. If there is no barrier to stop us earlier, we must reach a moment when the energy of the world was wholly organized with none of the random element in it. It is impossible to go back any further under the present system of natural law. I do not think the phrase "wholly organized" begs the question.
>
> The organization we are concerned with is exactly definable, and there is a limit at which it becomes perfect. There is not an infinite series of states of higher and still higher organization; nor, I think, is the limit one which is ultimately approached more and more slowly [...].
>
> There is no doubt that the scheme of physics as it has stood for the last three-quarters of a century postulates a date at which either the entities of the Universe were created in a state of high organization, or pre-existing entities were endowed with that organization which they have been squandering ever since. Moreover, this organization is admittedly the antithesis of chance. It is something which could not occur fortuitously.[12]

I think it is important to note that Eddington then added, "It has been quoted as scientific proof of the intervention of the Creator at a time not infinitely remote from today."[13] And then he said, with complete honesty, "It is one of those conclusions from which we can see no logical escape—only it suffers from the drawback that it is incredible."

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11. Schweitzer, George K., "The Origin of the Universe" in *Evolution and Christian Thought Today*, edited by Russell L. Mixter, Eerdmans, Grand Rapids, Michigan, 1959, p.42, 43.
12. Eddington, Sir Arthur, *The Nature of the Physical World*, Cambridge University Press, 1930, p.84.
13. *Ibid.*, p.84, 85.

George Gamow has written illuminatingly of the initial stages of this "explosion" which seems to have started off the present expansion of the universe. In 1948 he wrote:

> According to our calculations, the formation of elements must have started five minutes after the maximum compression of the Universe. It was fully accomplished, in all essentials, about 10 minutes later, by the time that the destiny of matter had dropped below the minimum necessary for nuclear-building processes. All the elements were created in that critical ten minutes, and their relative abundance in the Universe has remained essentially constant throughout the billions of years of subsequent expansion.[14]

In 1954 Gamow expanded this precise statement as follows:

> During the first few minutes of the Universe's existence, matter must have consisted only of protons, neutrons and electrons, for any group of particles that combined momentarily into a composite nucleus would immediately have dissociated into its components at the extremely high temperature. One can call the mixture of particles *ylem* (pronounced *eelem*)—the name that Aristotle gave to primordial matter. As the Universe went on expanding and the temperature of *ylem* dropped, protons and neutrons began to stick together, forming deuterons (nuclei of heavy hydrogen), tritons (still heavier hydrogen), helium and heavier elements.
>
> On the basis of what we know about the behaviour of nuclear particles and of the assumptions about the rate of temperature and density changes in the expanding Universe, one can calculate the net result of all the possible nuclear reactions that must have taken place during those early minutes of the Universe's history. The time available for the formation of the elements must have been very short, for two reasons: (1) the free neutrons in the original *ylem* would have decayed rapidly, and (2) the temperature quickly dropped below the level at which nuclear reactions could take place. The mean life of a neutron is known to be only about 12 minutes; hence half an hour after expansion had started there would have been practically no neutrons left if they had not been combined in atomic nuclei. Favourable temperature conditions lasted about the same length of time. Thus all the chemical elements must have been formed in that half-hour.[15]

14. Gamow, George, "Galaxies in Flight" in *Scientific American*, July, 1948, p.24. Some details of the theoretical background for Gamow's ten-minute estimate will be found in Dennis W. Sciama, *Modern Cosmology*, Cambridge University Press, 1971, pp.164-75.
15. Gamow, George, "Modern Cosmology," *Scientific American*, March, 1954, pp.61ff.

The temperature of this superdense primordial mass must have been in the neighbourhood of a few billion degrees, and at such a heat the mass itself could be more precisely conceived of as a source of pure energy rather than material substance.[16] One cannot speak of the energy as being located somewhere in the universe, for it *was* the universe. Furthermore, when we are dealing with energy, it is quite meaningless to speak of "*dimensions*." Years ago, when Jeans wrote his classic little work, *The Mysterious Universe*, he pointed out that even now the material substance which we touch and weigh is least substantial than appears to common sense, since it is not at all certain that electrons, for example, are actually '*particles*' in spite of the fact that we refer to them as such. They are more accurately described, perhaps, as locations of energy. Jeans in his characteristically eloquent way stated that

> [...] the tendency of modern physics is to resolve the whole material universe into waves, and nothing but waves. These waves are of two kinds: bottled-up waves, which we call matter, and unbottled waves, which we call radiation or light. If annihilation of matter occurs, the process is merely that of unbottling imprisoned wave-energy and setting it free to travel through space. These concepts reduce the whole Universe to a world of light, potential or existent [...].[17]

Jeans may perhaps have allowed his eloquence to rob him in some measure of precision, and some of his views are now widely repudiated. Nevertheless, the evidence points firmly to the conclusion that what we think of as the solid substance or material of the Universe may not in reality be solid at all, but rather an expression of pure energy. The atom bomb is sufficient proof of this. Matter can apparently be annihilated in the sense that its substance dissolves into energy instead. Sir Richard Tute years ago pointed out that "the modern scientist recognizes that physical reality is produced by super-physical agencies, which must be so designated because they can never be observed."[18]

Edward McCrady, President of the University of the South, said:

> So many evidences have come from so many directions and have converged with such remarkable unanimity upon the conclusion that the material Universe came into existence all at once in a great creative act some billions of years ago that it would require either a lot of new evidence or a special prejudice to hold any other opinion. All that we know now about the recession of the spiral nebulae, the dispersion of star clusters, the separation of binary stars, [...] the relation of radioactive isotopes to their stable daughters in meteorites and in the crust of the earth, and the relative abundance of the different elements throughout the Universe, tells the same story. If today we do not

16. Taylor, Hugh S., *Religious Perspectives in College Teaching: in the Physical Sciences*, Hazen Foundation, New Haven, 1950?, p.16.
17. Jeans, Sir James, *The Mysterious Universe*, Cambridge University Press, 1931, p.77f.
18. Tute, Sir Richard, "Photomicrography" in Comments and Criticisms, *Scientific Monthly*, October, 1946. p.322.

> believe in creation, it is in spite of, not on account of the testimony of Science. And I mean creation by supernatural means —that is, by processes quite literally outside the laws of nature.[19]

I do not think that Sir Richard Tute meant any more by his statement than that the agencies which produce physical reality were at present beyond definition. But I believe that McCrady was being much more forthright and was really admitting that we must go outside of nature as we know it into the spiritual order to find the Creator. Both men agree in this, as would Jeans also, namely, that physical reality is not the ultimate reality: that which lies behind is some kind of non-physical Power or Agency. In the Epistle to the Hebrews this truth was recorded quite precisely almost two thousand years ago in these words (Hebrews 11:3):

> Through faith we understand that the worlds were formed by the Word of God, so that things which are seen were not made of things which do appear.

The extent to which the solid substance of reality is now being recognized as far less substantial than a gross materialism would like to think it is, is pointed up by a remark by von Weizsacker made in Switzerland, in which he said:

> The concept of the particle is itself just a description of a connection which exists between phenomena, and if I may jump from a very cautious and skilled language into strict metaphysical expression, I see no reason why what we call matter should not be 'spirit.' If I put it in terms of traditional metaphysics, matter *is* spirit [...] [my emphasis].[20]

The idea of creation, of something out of nothing, is of course incomprehensible to the scientific mind. Its rejection as a useful concept accounts in large measure for the popularity of the theory of evolution, which seems to postpone the need for it. It is of course only a postponement, because even a perfectly unbroken chain of minute evolutionary stages must still have a beginning somewhere, and pushing it further and further back into the past doesn't really provide an alternative explanation. Curiously enough, even Thomas Huxley himself—Darwin's watchdog and chief defender—recognized the propriety of retaining the concept of creation. He said:

> It seemed to me then (as it does now) that 'creation' in the ordinary sense of the word, is perfectly conceivable. I find no difficulty in conceiving that, at some former period, this universe was not in existence and that it made its appearance . . . instantaneously, in consequence of the will of a pre-existing

19. McCrady, Edward, *Religious Perspectives in College Teaching: in Biology*. Hazen Foundation, New Haven, 1951, pp.13, 14.
20. von Weiszacker, C. F.: quoted by W. H. Thorpe in his concluding remarks, "Retrospect" in *Beyond Reductionism*, (Alpbach Symposium), edited by A. Koestler and J. R. Smythies, Hutchinson, London, 1969, p.434.

> Being. Then, as now, the so-called *a priori* arguments against the existence of God, and (given this existence) against the possibility of creative acts, appeared to me to be devoid of reasonable foundation. I had not then and I have not now, the smallest *a priori* objection to raise against the account of the creation of animals and plants given in *Paradise Lost*, in which Milton so vividly embodies the natural sense of Genesis. Far be it from me to say that it is untrue because it is (scientifically considered) impossible.[21]

Huxley's remarks show that the intellectual climate of his day was not as strongly materialistic and anti-supernaturalistic as it is today. But the pure materialist, who will accept as reasonable only what he can *conceive*, still finds himself on the horns of a dilemma when it comes to a question of origins. As Sir Theodore Fox put it:

> To contemplate the Universe is to stand even more abashed. For somehow, at sometime, all that we see and touch and hear must have emerged from *nothing*. To us this transformation of nothing into something is contrary to reason; and the creation of the Universe is a mystery that man may never be able to understand.[22]

We are faced with two incomprehensibles, one of which we *must* accept—incomprehensible though it is. For either the Universe must always have existed and there must never have been a time, no matter how distant in the past, at which it did not exist; or, there must have been some moment in the past at which it did not exist and then suddenly *did* exist. Neither of these concepts is really comprehensible. And Fox is quite right when he adds that we must beware of making excessive claims for any system of thought, such as the scientific one is, which finds itself totally unable to grapple with the only two alternatives there are by which to describe the origin of the universe.

Even in the less all-embracing question of the supposed evolutionary origin of living forms, earlier writers like Thomas Huxley appear to me to have been more honest with themselves than most of today's authorities. Thus Herbert Spencer, in his *Principles of Biology*, in grappling with the problem of how a peacock's tail came to acquire its elaborate pattern, made an attempt to estimate what today would be called the amount of 'information' that must be present in the peahens's egg in order to produce the pattern of just one single feather of the adult tail. He admitted frankly that this "organizing process transcends conception. It is not enough to say we cannot know it; we must say we cannot even *conceive* it." [emphasis mine][23]

It is hard to know whether Professor Hoyle evolved his Steady State theory of the Universe in a conscious or unconscious attempt to escape from the dilemma of a beginning and therefore of a Creation, or whether it was the result of a

21. Huxley, Thomas: see Leonard Huxley, *Life and Letters of Thomas Henry Huxley*, New York, Macmillan, 1903, vol.1, p.243.
22. Fox, Sir Theodore, "The Purposes of Medicine," Harverian Oration for 1965, *The Lancet*, 29 October, 1965, p.804.
23. Spencer, Herbert: quoted by Sir Peter B. Medawar, *The Art of the Soluble*, Methuen, London, 1967, p.46.

brilliant mind seeking objectively to understand and to structure the data of astronomy. Observing that the retreating galaxies were accelerating to such speeds as they fled from the original point of explosion that they must soon pass entirely out of range of any detecting instrument man can make, and must have been doing this for countless eons: and observing at the same time that in spite of this flight into oblivion the apparent density of the universe has remained more or less constant—or so it seemed—he proposed that hydrogen atoms attenuated extremely thinly through space were for some reason being constantly coagulated here and there into fresh "lumps." These congealings led to the continuous formation of new galaxies which made up for those at the outer rim of space which were simply disappearing. So that the observable Universe was really in a steady state.

Whatever may have prompted Hoyle to formulate a theory which, because it evaded the concept of a point in time at which the Universe began, was very widely accepted, the fact remains that he has now abandoned it. With an integrity that one might always hope for among scientists, yet which one all too infrequently encounters, Hoyle finally admitted: "From the data I have presented here [i.e., at Cambridge] it seems likely that the idea will now have to be discarded at any rate in the form that it has become widely known as "the Steady State Universe."[24] In The *New Scientist* a report was published of a Congress of Astronomers held in Florence, Italy, in 1969 in which the Steady State concept was "officially" discarded.[25]

No humanly conceived cosmology has survived unchallenged for very long, and it has been noted on several occasions that such cosmologies of more recent centuries survive for a shorter and shorter period of time. So it seems possible that the Expanding Universe concept will ultimately be replaced in due course also. But at the present time [i.e., early 1970's] it is rather widely accepted as the most likely account, and it certainly accords with Scripture to this extent at least, that it requires a very specific initial moment of creation, and it suggests that there must be an end one day.

At the moment, the concept of an expanding universe based on the Red Shift phenomenon seems to have "emerged as a front runner."[26]

The recent discovery of microwaves, short radio-like waves from outer space, seems also to confirm the present Expanding Universe cosmology, since the best current explanation of them is that they represent radiation left over from the initial "explosion."[27]

The British astronomer, Dennis W. Sciama, in his *Modern Cosmology* has provided a very useful survey of the evidence pro and con of both the Steady State and Expanding Universe concepts. He believes from the present evidence that "there is no longer any difficulty in supposing that the Universe was once

24. Hoyle, Fred: see Robert Ardrey, *The Territorial Imperative*, New York, Delta Books, 1966, p.326.
25. Congress of Astronomers: *New Scientist*, 22 May, 1969, p.431. See Hoyle's own statement, "Recent developments in Cosmology", *Nature*, 9 Oct., 1965, p.113.
26. "The Most Distant Object Ever Seen" in *New Scientist*, 12 April, 1973, p.73.
27. Townes, Charles H., "How and Why Did It All Begin?" in *Journal of American Scientific Affiliation*, vol.24, no.1, 1972, p.2. See also Robert C. Newman, "Hierarchical Cosmologies: New Trend?" on pages 4-7 of the same issue of this journal.

very dense" and he essentially supports Gamow's Big Bang hypothesis.[28] It appear that the evidence as a whole has now been judged by the great majority of European astronomers as clearly favouring the Big Bang cosmology as against the Steady State theory of Hoyle. Dr. Peter Stubbs, science editor of the *New Scientist*, reported the findings of the European Physical Society's Inaugural Conference held in Florence in May,1969, by saying:

> The sum total of work on radio source counts and quasars now argues strongly against the steady state theory of Hoyle, Bondi, and Gold, and attractive as this may be from a philosophical angle, it now looks as if it must give place to a version of the Big Bang model of the Universe.[29]

The only other concept that has seriously challenged the Big Bang concept is known as the Cyclic theory, which proposes that the universe has expanded and contracted successively any number of times, and that we are living at this moment in a cycle of expansion. This theory is discussed in one of the Harvard books on Astronomy entitled *Galaxies*, written by H. Shapley in 1943.[30] It is found to be so seriously contradicted by the experimental data of astrophysics that it is no longer accepted by astronomers as a whole.

At the present moment the concept of an initial creation followed by an explosive expansion holds the field.

28. Sciama, Dennis W., *Modern Cosmology*, Cambridge University Press, 1971, pp.46, 156-57. Stanley L. Jaki in his *Relevance of Physics* (University of Chicago Press, 1966, pp.210-235 especially) has some thoroughly worthwhile and salutary observations to make regarding the shifts in opinion which have occurred over the past couple of centuries and more especially over the past fifty years on the question of a finite versus an infinite universe.
29. Stubbs, Peter "Physics in Florence" in *New Scientist*, 24 April, 1969, p.173.
30. Shapley, H., *Galaxies*, Blakiston, Philadelphia, 1943, pp. 207-219.

Chapter 2

The Immensity of God's Handiwork

The picture of the shape of the universe can be elaborated as a mechanical model by using the analogy of an exploding bomb referred to by von Weizsacker and considering what must happen to the fragments which are thus forcibly blown apart. A second or two after the explosion of a bomb in free space, fragments will all be flying apart from each other and there will nothing left of the exploded substance in the centre where the bomb first went off. Under more or less ideal conditions, the fragments leave this point of origin at approximately the same speed so that viewing the situation in successive moments of time, we observe something in the nature of an expanding sphere which is entirely hollow inside, and of which the thickness of the wall representing the space occupied by the particles of the original bomb fly outward. The best way to illustrate this process is diagrammatically; shown on the next page.

In Figure 1 we have the superdense original Uratom. In Figure 2 a few seconds later, expansion has begun. In Figure 3 the outward movement of all the particles leads to the clearance of a space in the very centre which is being left vacant. It should be understood these diagrams show a cross section of the universe which therefore may give the false impression that we are dealing with a *ring*. In point of fact, we are dealing with an expanding *sphere*, not a ring. In Figure 4 this "cavity" is naturally enlarging as the particles fly outward. Meanwhile the fragments themselves move out with more or less equal force and speed so that they maintain their position in a comparatively narrow band and assume the shape of the shell of an expanding ball which has a very definite thickness (marked *t* in the diagram below), the shell itself now being comprised of all the original matter which was in the Uratom before it began its expansion.

Assuming that no more matter is being created, the expanding shell will do one of two things: it will become thinner as expansion continues in the same way that a rubber balloon becomes thinner as it is blown larger, or it will maintain its thickness as a shell by the simple expedient of having the particles spaced more and more distantly from each other so that the material of the universe is attenuated.

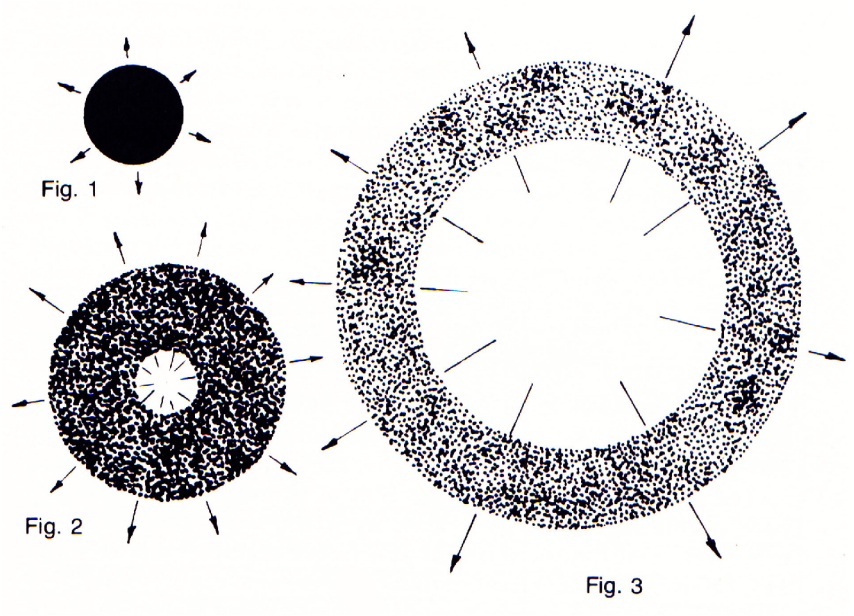
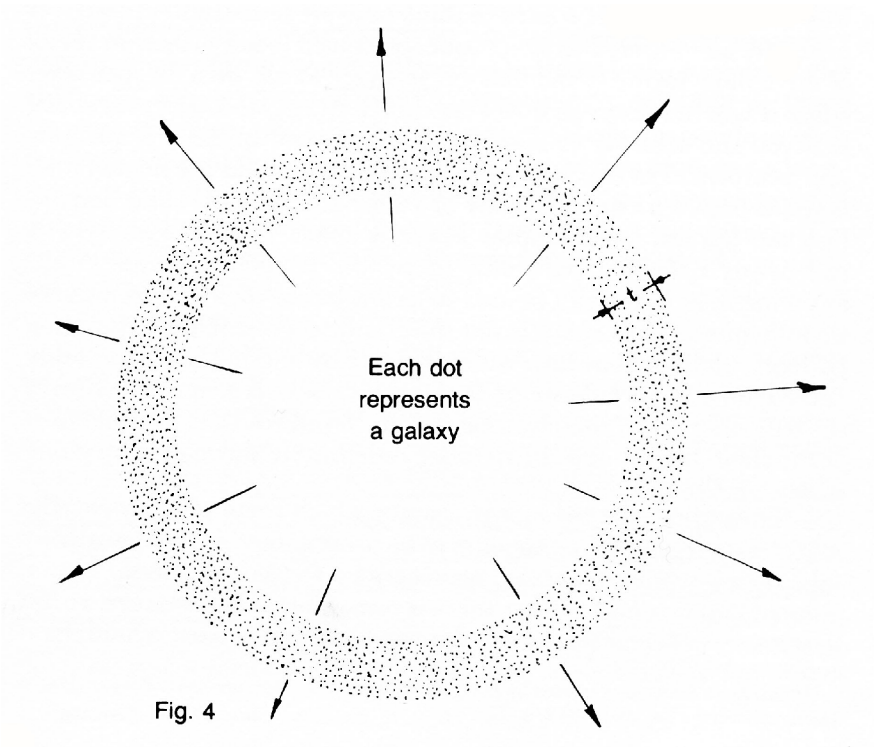


Fig. 1
Fig. 2
Fig. 3


Each dot
represents
a galaxy
Fig. 4

As Sir Arthur Eddington put it:

> We can picture the stars and galaxies as embedded in the surface of a rubber balloon which is being steadily inflated; so that, apart from individual motions and the effects of their ordinary gravitational attraction for one another, celestial objects are becoming farther and farther apart simply by inflation.[31]

It is important to bear in mind in this picture of an "expanding universe" that the universe, strictly speaking, is not some kind giant space like a box with no top or bottom and with the sides knocked out. The universe is the film of the expanding balloon. There is nothing inside of it and, as it continues to expand, successively takes up its position at a larger diameter where there was nothing before. It is hard to think of *empty* space, and indeed it is probably an entirely incorrect concept; thus it is not proper to speak of the hollow inside of the balloon as space at all. Strictly speaking, space is where matter is, however thinly attenuated. There is space between the orbiting electrons and the central nucleus of protons and neutrons. There is space between one atom and the next. There is space between one solid body of atoms and the next solid body—like two apples, for example. There is space wherever an area sufficiently occupied by atoms or by the particles of atoms that anything in between can be said to be subject to their electromagnetic influences. Thus space is not the emptiness inside the expanding balloon, nor is it that into which the expanding balloon is steadily encroaching by its enlargement outward. Space is strictly the film of the balloon itself. It therefore has a finite depth which is the thickness of the shell, but an object can move indefinitely through it by going round and round.

Thus arises the concept of a space which is curved. And all the material in the universe appears to be occupying this comparatively thin shell—which, however, preserves its shape like the skin of the inflated balloon, not because there is some kind of air pressure within it, but because repellent forces between the particles act to hold them in a kind of negative tension and to drive them further and further apart, thus causing the whole shell to expand at an ever-increasing speed. It is apparent that the rate of expansion is so great even now that galaxies diametrically opposite each other in this vast shell are already flying apart at speeds approaching the speed of light.

It seems that ultimately this giant balloon must either reach a point of equilibrium where there is no energy left for it to push itself any further—a condition which would be one of total entropy or, in slightly different terms, a heat death—or something might happen to reduce these tremendous forces which drive the galaxies apart suddenly and dramatically to zero. Then, like a pricked balloon —or better still, a pricked *bubble*—the whole gigantic universe would collapse upon itself and "fold up like a garment." Indeed, the writer of the Epistle to the Hebrews tells us that the heavens (which are the work of His hands) "shall perish [...] and they shall wax old as does a garment; and as a vesture shall [God] fold them up, and they shall be changed" (Hebrews 1:10-12).

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31. Eddington, Sir Arthur: quoted by J. W. N. Sullivan, *Limitations of Science*, Penguin Books Harmondsworth, England, 1938, p.27.

By all present standards of measurement, the universe is indeed growing old. If the picture which we have presented of the universe as being the film of a bubble or the shell of a balloon is valid, what better descriptive phrase could one possibly apply to the necessary consequence which would follow if God suddenly withdrew the energy by which He sustains it all, than that it would fold up like a garment. How apt this all is! Scripture is not likely to provide us with scientific information wherever we can, by our own God-given intelligence, extract it for ourselves. But whenever we have completed our extraction and arrived at some fairly secure conclusion, it is amazing how frequently we discover that the Word of God anticipated our findings and got there first with a quite explicit and completely appropriate statement!

Now, the nature of light is still not precisely understood and can be best accounted for in contradictory terms by saying that in some ways it behaves as though it were a wave phenomenon and in other ways as though it were a particle phenomenon, the particles being called photons. As far back as 1873 Maxwell had shown that light radiation would exert a pressure on any surface upon which it fell.[32] Subsequently, it was shown that a target "flinched" under the impact of radiation from a bright light just as though a bullet had been fired into it. It is also found that a photographic plate exposed to light increases its weight as though something had landed upon it. All these phenomena suggest that light has some kind of mass. What kind of mass is involved is hard to conceive, but it does appear subject to magnetic forces, for it is bent in the presence of a magnetic field. If the magnetic field through which the beam of light is passing is curved in the way that space of the Universe which we have been considering is curved, then a beam of light will not travel "straight" but will follow the curve like a train following a long slow curve predetermined for it by the railway tracks.

Thus light reaching us from some of the distant galaxies does not reach us by striking across the balloon by way of a short-cut but is channelled round the shell itself. Indeed, according to Eddington, some of the nebulae that we see in the heavens which are at tremendous distances from us, millions of light-years away, may possibly be so far around in the curvature of space that their light is reaching us from the other side and we are actually seeing the back of them.[33] This possibility had led to the perfectly sane observation that if we looked in exactly the right direction and could see far enough, we should see the back of our own head! In point of fact, however this is *quite* impossible because the circumference of this whole universe is so great that millions of years before the light reflected from the back of our head could travel all the way around until it finally reached our eyes, we should long since have disappeared from the scene.

The scale of magnitude involved here is inconceivably great. Ordinary terms of measurement—feet and yards and miles—become totally inadequate, and we have to fall back upon the use of a scale involving light-years. A light-year is the distance which light would travel in one year while moving at a speed of 186,000 miles per second. It works out at a distance of approximately 6,000,000,000,000 miles. Some of the distant galaxies are believed to be millions of light-years away—not millions of miles merely, millions of light-years! Moreover, the

32. Maxwell: see Sir James Jeans, *The Mysterious Universe*, Cambridge University Press, 1931, p.55.

33. Eddington, Sir Arthur: quoted by J. W. N. Sullivan, *Limitations of Science*,Penguin Books, Harmondsworth, England, 1938, p.27.

universe has already expanded to such a size and the distances have become so great that probably the greater part of it has long since passed beyond our observational powers. The light from these most distant galaxies simply will never reach us.

Matching these inconceivable distances are inconceivable quantities of material. As George K. Schweitzer said:

> Our sun is one of about 100,000,000 000 stars which make up a giant community of stars known as a galaxy [...].
>
> Our galaxy is a member of a small cluster of 19 galaxies. They occupy a region over 3 million light-years in diameter. Nearest in space to our cluster are a few other galaxial clusters. The first large cluster is about 30 million light-years from us, and it contains over 1000 galaxies. On and on out into space in all directions cluster after cluster can be seen, as far out as telescopes can reach. Over a billion galaxies can now be observed. (This gives a total of 100,000,000,000,000,000,000,000 stars, or 100 sextillion stars).[34]

And in this vast immensity of space and substance, our little sun is therefore but a tiny fragment, and our little world an even more minute particle. Can such a particle have any significance?

It is a curious thing that man should find a peculiar delight in minimizing his own significance in the universe. He seems to find an odd satisfaction in underscoring the hugeness of everything by contrast with his own mere 160 pounds, and the enormous time-scale by contrast with his own three score and ten years. So thoroughly has the philosophy of materialism impregnated our thinking that we have come to measure ourselves and our personal worth in *quantitative* terms, in terms of years and pounds! No wonder our insignificance strikes us so forcibly. A few years ago, J. W. N. Sullivan put it this way:

> The vast extent of the Universe, both in space and time, is, from the human point of view, completely aimless. Those immense lumps of matter, in their millions of millions, incessantly pouring out an inconceivably furious energy for millions and millions of years, seem to be completely pointless. For a fleeting moment man has been permitted to stare at this gigantic and meaningless display.
>
> Long before the process comes to an end, man will have vanished from the scene, and the rest of the performance will take place in the unthinkable night of the absence of all consciousness.[35]

But just suppose our value is not to be measured quantitatively at all. With very few exceptions—and Bertrand Russell is a notable one—men have always recognized that it is quality and not quantity which gives stature to the

34. Schweitzer, George K., "The Origin of the Universe" in *Evolution and Christian Thought Today*, edited by Russell Mixter, Eerdman's, Grand Rapids, Michigan, 1959, p.36.
35. Sullivan, J.W.N., *Limitations of Science*, Penguin Books, Harmondsworth, England, 1938, p.33.

individual. Even the making of this judgment itself is evidence of a capacity in man which cannot be accounted for in any of the terms by which we measure the immensity of the universe. Indeed, if we were merely part of the universe in the sense that animals are part of it, or plants or rock formations or even molecules, we should never have troubled ourselves with searching out its immensities in the first place. Those who loudly proclaim that man is an insignificant by-product are, by their very proclamation, bearing a tacit witness to the fact that they themselves are not a product of it at all, but are standing outside of it and making a judgment about it. There is no question that Scripture in a thousand ways singles out the individual as being something other than, more valuable than, and of vastly greater significance to God himself than the mere chemicals of which his body and even his brain are composed. He may look up at these tremendous galaxies and wonder at his own tiny size. But he has this advantage: galaxies don't know that he is down here, but he knows they are up there.

The question arises, then, whether such a creature could have been created as part of some other kind of Universe, a Universe in keeping with his physical dimensions and his span of years. Is this tremendous display of power unnecessarily wasteful—one might almost say, flamboyant? Certainly, we have no reason now, in the light of what we know, to doubt the power of the Creator. But what about His wisdom? Could man have been introduced into a more modest cosmos in terms of size and age? I think the answer to this is not difficult. God has infinite resources and there must be other alternatives that He might have chosen. But evidently He had a reason for creating such a universe, and since *reasonableness* is a concept which only has meaning in terms of man's thinking processes, we ought to be able to follow God's thinking to some extent and to grasp something of the rationale of His adopting such a plan.

Chapter 3

The Wisdom of God as Designer

The earth is marvelously suited as a habitation for man. In another Doorway Paper we have noted that a combination of exceptional circumstances has guaranteed an environment which, if we do not destroy it ourselves, permits man to exercise all his faculties to the maximum of their potential.[36] So many phenomena have conspired toward the provision of this habitat that it is difficult to believe it can be accidental. Even if there are millions of other planets in the universe which are of a similar size and general structure, it does not lessen the fact of its extraordinary fitness. As Lawrence Henderson wrote many years ago, "In fundamental characteristics the actual environment is the *fittest possible* abode for life" [my emphasis].[37] And as Harold Blum observed:

> The stage upon which living systems bowed their debut was set by all the preceding events in the history of the earth or, for that matter, of the Universe [...]. This aspect of fitness is not, then, universal, but exists only in relation to the planet earth, or to planets that are very nearly like the earth.[38]

It is customary in popular articles to stress the view that the universe must contain untold thousands of planets similar to our own earth upon which life may have similarly evolved. But this may not be as simple as such expansive enthusiasms would suggest. The basic constituents of the universe are *not* the substances which compose our earth and make it a suitable place for life. As Fred Hoyle put it, "You must understand that, cosmically speaking, the room you are now sitting in is made of the wrong stuff. You yourself are a rarity. You are a cosmic collector's piece."[39] Hoyle elaborated on this as follows:

> Apart from hydrogen and helium, all other elements are virtually rare, all over the universe. In the sum they amount to only about 1% of the total mass. Contrast this with the earth and the other planets where hydrogen and helium make only about the same contribution as highly complex atoms like iron, calcium,

36. Custance, A. C., "The Preparation of the Earth for Man," Part I in *Evolution or Creation?* vol.IV, of The Doorway Papers.
37. Henderson, Lawrence: quoted by Harold F. Blum, *Time's Arrow and Evolution*, Princeton University Press, 1951, p.60.
38. Blum, Harold F., *ibid*, pp.76, 85.
39. Hoyle, Fred, *Harper's Magazine*, April 1951, p.64.

> silica, magnesium, and aluminum. The contrast brings out two important points.
>
> First we see that material torn from the sun would not be at all suitable for the formation of the planets as we know them. Its composition would be hopelessly wrong. And our second point in this contrast is that it is the sun that is normal and the earth that is the speck. The interstellar gas and most of the stars are composed of material like the sun, not like the earth.[40]

This is what Hoyle means when he speaks of the earth as being made of the "wrong stuff." It's the right stuff all right, from our point of view; but it is almost unbelievably exceptional in its constitution. It is in fact very difficult to account for it. The materials out of which we ourselves are made (carbon, etc.) are extremely rare substances in the universe; the substances we rely upon for our technical civilization are equally rare (iron, aluminum, etc.); and even the very oxygen we must have to live is little more than a trace element. We assume these are to be found everywhere. They are not everywhere.

Carl Sagan of Harvard said:

> The universe is made up of hydrogen and helium. Everything else is a trace constituent. Of these trace constituents, only carbon, nitrogen, and oxygen are both reactive and relatively abundant. But even these abundances are about one one-thousandth that of hydrogen. The abundance of something like phosphorus is several orders of magnitude less.[41]

Dennis W. Sciama notes that an abundance of measurements have shown that, roughly speaking, 92 percent of the atoms in our galaxy are hydrogen, 8 percent are helium, and only 0.001 percent are heavier elements. "On this view the Earth itself, which has lost most of its hydrogen by escape from its weak gravitational field, is a mere impurity speck."[42]

In a paper appearing in a symposium published in Europe in 1968, G. G. Simpson, writing under the title "Some Cosmic Aspects of Evolution," discussed the possibility of life, such as we know it, appearing on other planets in the universe—of which it is believed there may be very great numbers. He concluded by saying:

> The chances that anything like man, or for that matter like any other terrestrial species except perhaps the most primitive, exists elsewhere in the universe are, I think, the same as the chances that any other planet has had exactly the same history as the earth—and as its inhabitants—*in every essential detail* for two billion years or more. In my opinion these chances are effectively nil for the nine hundred million planets of Shapley's minimum, or even for Hoyle's less reasonable billions of billions. I therefore

40. *Ibid*.
41. Sagan, Carl, "Primordial Ultraviolet Synthesis of Nucleotide Phosphates" in *The Origin of Pre-Biological Systems*, edited by Sidney W. Fox, Academic Press, New York, 1965, pp.207 ff.
42. Sciama, Dennis W., *Modern Cosmology*, Cambridge University Press, 1971, p.149.

> earnestly doubt whether there are man-like beings waiting to greet us anywhere in the accessible universe. The opposite opinion, even though it has been advanced by some eminent and sensible men, seems to me to underestimate either the complexity or the rigidity of historical causation [emphasis mine].[43]

More recently still, Carl Sagan has reiterated this statement by Simpson, saying:

> If we started the earth all over again, even with the same physical conditions, and just let random factors operate, we would never get anything remotely resembling human beings. There are just too many accidents in our evolutionary past for things closely resembling human beings to arise anywhere else.[44]

This, then, is the considered opinion of some of the world's most informed experts in these fields. The earth and all that makes it a fit habitation for man is an extraordinary creation. It must by all odds be unique. And its subsequent history seems equally exceptional. If the concurrence of so many interlocking "exceptional circumstances" is purely accidental, then surely faith in chance is faith in an even greater miracle than the faith of the Christian who believes it is all evidence of divine design with *man* in view.

The earth is indeed a very special body in the universe, and yet there is every reason to believe that we can correctly assess the rest of the universe from it by the same standards of reference. The experiments we perform in our laboratories do reflect faithfully what seem to be the governing laws operating out there in the vast reaches of space. It is as though we were indeed part of the universe and yet a *unique* part of it. Fred Hoyle, according to a recent report, "has been able to produce cosmological theories which predict that the outcome of physical *experiments performed in laboratories here on Earth is affected by the structure of the entire Universe*" [emphasis mine].[45]

Sir James Jeans was of the opinion that the earth is in fact peculiarly suited for human occupation, and not merely for animals. He said:

> The old physics showed us a Universe which looked more like a prison than a dwelling place. The new physics shows us a Universe which looks as though it might conceivably form a suitable dwelling place for free men—and not a mere shelter for brutes [...].[46]

Virtually everything about the earth seems to mark it off as though it were the object of special design. It is not a bit surprising that the astronauts, in their orbiting vehicles or standing on the moon, looked back at their proper home and

43. Simpson, G. G., in *Evolution and Hominization*, edited by C. Kurth, Fischer, Stuttgart, 2nd edition, 1968, p.15.
44. Sagan, Carl, in *Time*, 13 December, 1971, p.43.
45. Hoyle, Fred: quoted in section "Monitor", *New Scientist*, I9 June, 1969, p.623.
46. Jeans, Sir James, *Physics and Philosophy*, Cambridge University Press, 1943, p.216.

were overwhelmed with its beauty. And surely this was not merely the response of wanderers longing for "the fields of home." The earth is indeed an object of unique fitness, a fitness which is more than merely physicochemical and thermal suitability (though these are essential): it is a fitness of sheer beauty as well. But it *is* also uniquely fitted for *life*, and part of its fitness is borrowed, as it were, from its setting within the framework of the rest of the universe. Russell W. Maatman stated this eloquently:

> At the molecular level, there is only one element, carbon, which comprises the skeleton of the long-chain molecules found in all living things. Living things are similar to each other in this respect because no other element is capable of forming long chains; and this relation between the elements can in turn be shown (using quantum mechanics) to exist because of the very nature of the Universe. Likewise, at the microscopic level, God made similar structures in living creatures because only these structures can carry out the function intended for them. Again, the basic reason a certain function can be carried out by only one structure lies in the very nature of the Universe.[47]

Sir Cyril N. Hinshelwood, in an address in England in 1948, seems to have gone even further when he said: "It may not be wholly unreasonable to fancy that to almost every element there falls some unique and perhaps indispensable role in the economy of Nature."[48]

Now, the *size* of our earth is important because it plays a critical role in establishing the kind of atmosphere we live in, an atmosphere with just the right gases to support a high order of life. The *distance* of the earth from the sun determines its mean temperature, and this range of temperature is quite critical. Carbon chains which constitute an essential component of flexible living tissue can only form and survive within the range of temperature that is true for the earth. A little closer to the sun and these chains would be unstable, and little further away and they would be inflexible. The *rate of revolution* of the earth seems to be important for the maintenance in a suitable form of the air we breathe because the alternating periods of light and dark are required by plants as they act to re-generate the atmosphere which we, by the very act of respiration, cause to de-generate. The *proportion of land to water* surface seems to be ideally suited to maintain a constant circulation of moist air to irrigate the land. The *tilt* of the earth's axis is sufficient to produce seasonal variations which, if they did not exist, would almost certainly allow certain forms of disease-causing bacteria to multiply continuously and bring about the virtual disabling, if not death, of man and perhaps of animals also. Epidemics have restraints placed upon their continuance by the changing of the seasons.

The more carefully we examine the total milieu in which we live, the more evident it is that an extraordinary chain of events has led to the appearance of a

47. Maatman, Russell W., "Dialogue: Inerrancy, Revelation and Evolution", *Journal of the American Scientific Affiliation*, vol. 24, no.2, 1972, p.88.

48. Hinshelwood, C. N., President's Address to Chemical Society entitled "Some Aspects of the Chemistry of Hydrocarbons," reported in *Journal of the Chemical Society*, Part 1, 1948, p.531.

world such as ours, as though the whole object of its existence was that it might be a habitation for man. Indeed, Isaiah 45:18 tells us expressly that this is so: "For thus saith the Lord who created the heavens, God Himself who formed the earth and made it; He has established it. He created it not in vain, He formed it to be inhabited."

It is evident that one might get around the feeling of insignificance in living on such a tiny globe in such a vast universe by making the *earth* of some greatly expanded size. But from the foregoing, it is evident that such an alternative could not be made to work if life, as we now know it, was to be the object. Many poisonous gases would have been retained inimical to life by the gravitational forces of such a large body; and these same gravitational forces would have made us weigh hundreds or even perhaps thousands of times as much as we do. All that we know about the stuff of which we are made tells us that we could not be what we are if our weight was multiplied very greatly. The strength of the tissues simply could not sustain the mechanical loads imposed upon a free-standing figure.

However, there are other reasons why the size of things on the earth could not be departed from by very much and man still be what he is. In a quite fascinating paper by F. W. Went, entitled "The Size of Man," the author began by saying:

> In the following article, I want to show how important his physical size is for man and how many of his attainments, such as the development of technology, were possible only because of his specific size. In the course of these considerations, it will become clear that many physiological and mechanical processes have grave limitations in relation to size.[49]

The author first considered the world of insects and showed that any increase in size beyond a definite point would mean that creatures would have to have an entirely different internal condition, including the possession of heart and lungs. Slightly larger animals which do possess these organs were then considered, and it was shown in an intriguing way that the limitations of their capacity for cultural achievement would be very great indeed. Went concluded: "I believe that [...] a good case can be made for considering man's physical size as the critical factor which made it possible him to develop a technology and to use fire."[50] Went then elaborated how the use of fire is limited to man.

> Let us consider for a moment the dimensional limitations of fire. A flame cannot be smaller than several millimeters in length (and even then is relatively unstable), and requires a volatile combustible material, such as gas or alcohol. Non-volatile combustible material such as wood or coal has a much larger critical mass for combustion. The reason for the lower limit of flame size is that the ignition point of gases and vapours lies rather high, usually many hundreds of degrees Centigrade [...].
>
> Interestingly enough, a wood or coal fire above the critical size produces just the right amount of heat to warm man in a

49. Went, F. W., "The Size of Man" in *American Scientist*, vol.56, no.4, 1968, p.400.
50. *Ibid.*, p.404.

> cave or a room or a camping site. But ants or small rodents would have to keep too far away to make a fire economical, or rather, they would be unable to bring up enough wood to keep the fire going.
>
> So, animals below a certain size have been forced to adopt other methods of keeping warm, by very high food intake or by continuous activity or by allowing the deep body temperature to fall and becoming dormant—or by limiting their habitat to areas within the temperate zone. Because man is able to make a fire on account of his hands and completely vertical posture, he can be completely ubiquitous.[51]

The author then dealt with the question of kinetic energy, and he showed that these considerations actually provide us with a clue as to the optimum size of man as a free-standing animal.

> A two-metre-tall man (about six feet), when tripping, will have a kinetic energy upon hitting the ground which is 20 to 100 times greater than a small child who learns to walk. This explains why it is safe for a child to learn to walk; whereas adults occasionally break a bone when tripping, children never do.
>
> If a man were twice as tall as he is now, his kinetic energy in falling would be so great (32 times more than at normal size) that it would not be safe for him to walk upright. Consequently man is the tallest creature which could reasonably walk upright on two legs. The larger mammals can become taller because they are more stable on their four legs.[52]

The author examined other alternatives—men three feet high, for instance—and showed that such dwarfs could not have developed sufficient muscular energy to exploit the environment to anything like the extent which is necessary for the creation of modern technology. Interestingly enough, he showed how even many of the cultural aspects of man's technology, such as the making and using of books, are all influenced by the size of man's body, and that, contrary to what one might suppose, it is surprisingly difficult to construct a workable "world" to any other proportions—even in the final minimum size of typefaces for printing. Even the plants (especially grains) which man makes use of for food have a size which is appropriate to his size and probably could not be made much larger to suit a creature fashioned on a larger scale.

Thus man is small enough to be able to stand erect as a habit of life. Because of the size of the earth and its limited gravitational forces his two legs will nicely carry the weight of his body. Yet he is large enough to handle fire and to extract from the environment substances necessary to create a civilization which permits him to have dominion over the earth. His size is not an indifferent consideration.

The other alternative would be to make the *universe* much smaller. But I have a feeling that if it were so constructed, if it were not expanding, if we once found ourselves able to comprehend it altogether—measuring it, weighing it, surveying

51. *Ibid.*
52. *Ibid.*, p.407.

it, and finally defining its fixed limits—we might find ourselves strangely disturbed as though imprisoned. Our sense of the greatness of God might suffer severely. Even in the matter of time, if we really were able to prove that it was only yesterday, as it were, that the universe came into being, we might feel a disturbing sense of instability. Without knowing exactly why, we do derive a great deal of comfort out of the concept of God as "the Ancient of Days" (Daniel 7:22, "Until the Ancient of days came, and judgment was given to the saints of the most High; and the time came that the saints possessed the kingdom."). Moreover, no matter how big a thing is, if we have once "walked around it," it is apt to become surprisingly small. And since we judge the greatness of men in part by the magnitude of their works, I believe it is fundamentally true that our perception of the power of God is conditioned by the magnitude of His creation.

But I think the contemplation of the universe impresses the mind with something more than merely its magnitude. It impresses us with a certain orderliness, with a manifest "rule of law." So manifest is this to those who are trained to perceive it in depth that people might say, as Sir James Jeans said:

> To-day there is a wide measure of agreement which on the physical side of science approaches almost to unanimity, that the stream of knowledge is heading towards a non-mechanical reality: the Universe begins to look more like a great thought than a great machine. Mind no longer looks like an accidental intruder into the realm of matter; we are beginning to suspect that we ought rather to hail it as the Creator and governor of the realm of matter [...]. We discover that the Universe shows evidence of a designing or controlling Power that has something in common with our own minds.[53]

Oddly enough, it seldom seems to occur to modern cosmologists as surprising that there should exist in the universe a creature so unique and so distinct from the rest of it as to be able to stand apart and contemplate it and size it up. Julian Huxley does note that in man "matter has somehow become conscious of itself," but this is merely to describe what is self-evident.[54] It tells us neither why this came about nor how it came about. Something entirely new has been imposed on material substance in the appearance of man, who not merely has some kind of consciousness but is *conscious* of his consciousness. One could think of the response of water to temperature as a kind of low-grade "consciousness" of the environment, or the tropisms of plants which cause them to turn their faces to the sun or to the sudden freezing of a small animal when it detects its enemy. But one can hardly say that the water "knows" it is becoming solid, or the flower that it is twisting its stem, or the animal that it responded in a particular way as opposed to some other alternative way. But man is able to reflect upon all these things and is very much aware of his own reflections—and can be disturbed or encouraged by them.

It is the fact that with our puny minds we can make some sense out of such a vast display that makes the whole subject of cosmology so stimulating. I think God intended it to be so. I think He delights to have us discover with excitement

53. Jeans, Sir James, in his Rede Lecture at Cambridge, reported in *The Times*, London, 5 November, 1930.
54. Huxley, Julian, *Rationalist Annual*, 1946, p.87.

something of the way in which He has put it all together in His grand design. Thomas More expressed it well when, in 1515, he wrote:

> In their study of nature's secrets, men not only find wonderful pleasures for themselves, but they believe that they please the Author and Maker of Nature. For they think that, in the manner of other artificers, God has exposed the machinery of the Universe to man's view because man alone is able to contemplate it and that therefore a careful observer and eager admirer of His workmanship is dearer to Him than a dull and unmoved being looks upon this great spectacle like an animal incapable of reflection.[55]

Even when we descend from our lofty contemplation of the heavens and dig deeply into the earth, we may still find wherewith to enjoy the discovery of what God has done in secret. Hugh Miller wrote many years ago in speaking of the fossil shells and fishes which have characterized that segment of the rocks known as the Old Red Sandstone:

> Nor does it lessen the wonder that their nicer ornaments should yield their beauty only to the microscope. There is unity of character in every scale, plate and fin [...] and yet the unassisted eye fails to discover the finer evidences of this unity; it would seem as if the adorable Architect had wrought it out in secret with reference to the Divine idea alone [...].
>
> Sir Thomas Lawrence, who finished with the most consummate care a picture intended for a semi-barbarous foreign court, was asked why he took so much pains with a piece destined, perhaps, never to come under the eye of a connoisseur. "I cannot help it," he replied, "I do the best I can, unable, through a tyrant feeling that will not brook offense to do anything less." It would be perhaps overbold to attribute any such over-mastering feeling to the Creator Himself. Yet it is certain that among His creatures well nigh all approximations towards perfection owe their origin to this feeling, though God in all His works is His own Master.[56]

If in the course of time, their beauty is buried in the earth, God sees fit to uncover these rocks so as to disclose them again for those who search, and if He masks their beauty by their very minuteness, He gives to man the power to build a microscope so that one day he may discover it. The millions of flowers that bloom unseen, and which thus appear to be entirely wasted until we find them, give us the assurance that we shall not find in God's Universe ugliness where beauty can replace it.

It seems now, therefore, that we are just beginning to discern also something of His wisdom, and rather wonderfully to discern this wisdom more particularly

55. More, Thomas, *Utopia*, translated by H. V. S. Ogden, Appleton-Century-Crofts, New York 1949, p.55.
56. Miller, Hugh, *The Old Red Sandstone*, Nimmo, Hay and Mitchell, Edinburgh, 1889, p.113.

as it relates to our own existence. In an article entitled "Our Universe: the Known and the Unknown," John A. Wheeler wrote:

> No one [...] can fail to find thought-provoking a suggestion made by Dicke, half-jokingly, half seriously. "What sense does it have," he asks, "to speak about a Universe unless that Universe contains intelligent beings?"
>
> But intelligence implies a brain. And a brain cannot come into being without life. As the foundation for life no biochemist sees any alternative but DNA. But DNA demands carbon for its construction. Carbon in turn comes into being by thermonuclear combustion in the stars. Thermonuclear combustion demands billions of years in time.
>
> But according to general relativity a Universe cannot provide billions of years of time unless it also has billions of light-years of extent. On this view it is not the Universe that has dominion over man, but man who governs the size of the Universe.[57]

Julian Huxley saw man as unique above all other living creatures by reason of his power of conceptual thought.[58] It is this faculty which makes man capable of entering into fellowship with God and returning His love. And this appears to be the fundamental reason God created man in the first place. If, as Wheeler proposes, the universe itself is essential for the existence of the earth, and the earth for the existence of man, then God created the universe in order that He might create man. But a creature with conceptual thought is a creature with a series of unique requirements. For one does not have thought, where man is concerned, without a brain, and thought does not find expression without language involving the use of symbols and hands that can manipulate and ears that can sort out the sounds of language. And tied together with these, in a causal chain of necessities, is a whole series of further requirements which may be summed-up in terms of freedoms and capacities that are uniquely true of man only. Julian Huxley seems to have been aware of these necessities, even though he attributed them to a process of blind evolution. Thus he wrote:

> There is only one group of animals which fulfills these conditions—a terrestrial offshoot of the higher Primates. Thus, not merely has conceptual thought been evolved only in man: it could not have evolved except in man [...].
>
> Conceptual thought on this planet is inevitably associated with a particular type of Primate body and Primate brain.[59]

We see, then, that the idea of a universe created for man makes very good sense. In the first place, it seems in some way to have been necessary to proceed by some such route toward the provision of a habitation for him, and it seems

57. Wheeler, John A., "Our Universe: the Known and the Unknown" in *American Scientist*, Spring, 1968, p.18.
58. Huxley, Julian: quoted by E. L. Mascall, *The Importance of Being Human*, Columbia University Press, 1958, p.6.
59. HuxIey, Julian: quoted by Mascall, *ibid.*, p.7.

equally certain that only by creating such a creature as man, and placing him in this prepared environment, could God achieve His purpose of finding a response to His own love outside of Himself. The way in which He thus secured response through a series of events which He foreordained to be part of human history and for the completion of which He Himself entered for a short season within the space-and-time frame which He had created for man, is the subject of another Doorway Paper.[60] The object of this paper has been to show that in the final analysis the meaning of the universe, the reason for its creation in the way that it was created, is best found in the existence of man himself, a unique creature made in the image of God that he might be able to share God's thoughts. As one perceptive writer put it, "The Cosmos was pregnant with man."

60. Custance, A. C., "A Christian World View: The Framework of History," Part V in *Noah's Three Sons*, vol. I in The Doorway Papers.

PART II

SCIENTIFIC DETERMINISM
and
DIVINE INTERVENTION

[Doorway Paper #44, first issued 1972]

Introduction

My thesis is deceptively simple in a way, yet it could be badly misunderstood and misrepresented. And it may of course be quite wrong. I am trying to deal with the fact that scientists (especially biologists) are constantly pushing their researches *with success* into areas which hitherto have been held to be in some sense "sacred" in the Christian view, especially in the manipulation and potential re-engineering of living things, including man.

Little by little, *all* life is being "reduced" to inanimate components, as though there is essentially no difference between the living and the non-living. Animals are being reduced to the status of mere machines for the conversion of one kind of energy into another; and in the final analysis man is being viewed in the same light. Every advance made in the laboratory seems to underscore this as the inevitable "ultimate finding."

What are we to do with the facts regarding the nature of life which are thus emerging, other than to argue that they are being misinterpreted? Unfortunately for this plea, much of the new knowledge hardly *needs* interpretation: it speaks for itself in no uncertain terms. Life is indeed mechanism to a surprising degree. This is the fact I have tried to deal with in the light of Scripture. How do we relate mechanism to divine intervention?

Where I fear I shall leave myself open to misunderstanding is that I may seem to be inviting the concept of evolution to take over my thinking by the back door, as it were. In my own mind, I have no intention of doing this. I am persuaded that the evidence presented, especially in chapter 2, is established fact. For the most part it is not open to alternative interpretations. It is potentially verifiable *experimentally* in any laboratory at any time, though some very elegant techniques are required which not all laboratories are equipped to perform. In living things mechanism is a fact.

In the question of evolution, I believe the situation is entirely different. Here we have virtually no clinching proof whatever. We have all kinds of circumstantial evidence which can be interpreted to support evolution, but its meaning is equivocal. For if God created it all in the first place, and then created man in His own image with a mind capable of thinking His thoughts after Him, we can just as easily interpret the facts as evidence of economy of design. We recognize the rationale of a machine designed by an engineer because we have a mind which operates like the engineer's. If our minds work in some sense as God's mind does because He made them to do so, it is only to be expected we should be able to discern the nature of His design, too. On the other hand, in view of the tremendous number of missing links between Phyla, Classes, Orders, Families, and Genera, which are universally admitted, the vast array of living forms looks much more like a bunch of disconnected twigs than a tree. The

evolutionists find it necessary to arbitrarily tie these twigs together: but those who believe in Creation can accept the facts as they are. Perhaps the twigs never were a tree.

I suggest, in the light of the facts presented in this paper, that God must have designed a mechanism with tremendous potential which could be used again and again in the subsequent creation of living forms.[1] All these created forms operate on the same basic formula, but with different coded messages written in their DNA that are analogous to different languages which nevertheless use the same alphabet. Just as English, French, German, and Italian all use a common alphabet so that a single print shop can set the type for each from a common font, and yet produce copy unintelligible except to those for whom the particular language is native, so the DNA code appears to be a universal font of type, but the messages "printed out" by it may be specifically separate and non-convertible. Each original DNA "language" was therefore designed to separate out different lines, i.e., different kinds of living forms, which no more make sense when crossed than it would make sense to scramble pages of English, French, and German books and bind the unrelated pages between a single cover. Anyone who could identify the letters of the alphabet but not read the different languages might be misled into supposing it was all one book simply because the letters throughout were the same.

All analogies are faulty. This one is, no doubt. But I mean suggest by it that the DNA code for each species or kind—whatever name seems most acceptable for un-mateable lines animals—was *specifically* created by God so that a confused message results when such lines are crossed, leading to a non-sense which defeats the attempt. Confusion of relationships in the animal world is thereby guarded against without the need to design thousands of different mechanisms.

Plenty of room was allowed for varieties to arise within a species by changing the spelling of the words while maintaining the identity of the language. And I suggest that it was part of God's plan that man should make use of this potential— which of course he did long before he discovered the secret of how the mechanism operates. I suggest that the mechanism is God's design and that, except where sin has disturbed it, it is still as perfect as when He first created it as a base for all living things, including man. This accounts for the evidence of mechanism.

Yet I believe that the message in man was once different in some way, a message which made man potentially an immortal creature physiologically, not subject to death. Man "poisoned" himself, as it were in Eden; and the poison disturbed the original code and reduced man's body to something less than it was, something which in our present state of knowledge is not distinguishable in many respects from the bodies of other animals. It reduced man to the status of a mortal creature where previously he possessed the potential to live on indefinitely. Even after the Fall, his viability was still extraordinary in terms of life-span until the

1. A beautiful example of a single basic mechanism adapted to a million different end-uses is contractile muscle tissue. The point is remarked upon by J. D. Bernal in his paper, "Molecular Matrices for Living Systems," [in *The Origin of Pre-biological Systems*, edited by Sidney W. Fox, Academic Press, New York, 1965, p.79]. He says, "All striated muscle is built on an almost identical pattern in the existing and presumably in the earlier phyla." Mechanically it is a structure whereby contraction expands the muscle! Bernal describes it as "a marvelous contrivance of vernier-operated crossbars. An interesting point is that this ingenious device seems to have been invented, so to speak, only once and has been taken over by all the different phyla." What a *faith* in evolution this is!

time of the Flood. But the Fall did not convert man as a person into a mere animal with superior intelligence.[2] He has still a distinguishing component in his total make-up which animals do not share, a component which is dealt with in this paper and which makes not only his origin but also his destiny different from that of all other creatures.

I propose that mechanism does characterize God's created order, not only in its inanimate elements but even in its living ones. I propose, moreover, that this mechanism is so perfect that God need not as a rule intervene in it and will not therefore actually be discernible by any scientific research into its workings. But when man sinned, he introduced a disruptive element which has so upset the mechanism in *certain areas* that God must now intervene redemptively to maintain it against a total breakdown. In these areas natural science will find itself up against imponderables with which it is not equipped to deal, for *here* God is at work in a supernatural way.

In a manner of speaking, I am not yet committing myself to a firm position: I'm just thinking out loud. This expression of my thoughts regarding the mechanism of living things is tentative. It may have implications that more acute minds will detect, which will condemn it as a premature and non-viable approach to a difficult problem. It is a problem to be wrestled with.

2. For a full treatment on the author's thoughts, see Part II, "The Nature of the Forbidden Fruit"; Part III, "If Adam Had Not Died"; and Part IV, "The Virgin Birth and the Incarnation" in *The Virgin Birth and the Incarnation*, vol.V in The Doorway Papers, Zondervan publication.

Chapter 1

The Nature of the Conflict

1. The Significance of Imperfection

The determination of science to reduce every phenomenon to physics and chemistry, to "sticks and strings," has been called appropriately its "implacable offensive".[3] The goal is to demonstrate that *all is mechanism* and that God is an unnecessary hypothesis. And many Christian people are disturbed.

It does not trouble us merely because it is a form of opposition to our faith. It troubles us, as much as anything, because it has prove so successful ever since the offensive began, and because it seems likely to succeed even more dramatically in the near future. When will it end? It did not seem worrisome to see the forces of inanimate nature being conquered one by one, for it was possible to interpret this as a fulfilment of the command to have dominion over the earth. It was when the same method began to prove equally successful in the realm of living things that we were worried, for surely here, if no where else, God has certain unique and direct prerogatives. Could it be that we have been wrong in this?

Now that science is proving itself equally effective as a tool of "reduction" here also, the time has come for some serious reflection as to what it all signifies. How far will the offensive go, and how successful will it prove to be in creating life itself, even human life? Shall we also see human beings created out of non-living substance by man himself?

When the offensive began, there were many gaps in understanding, many areas of ignorance, many apparently impassable hurdles that seemed beyond the competence of the scientific method. And Christians were well able to relax and say, "These are the limitations of science: here is where God must be called in." But as these gaps were closed one by one, the room for divine intervention was steadily reduced until it seemed that the only place left for the Creator was as the supplier of the raw materials at the very beginning. Even this was soon challenged by the demonstration that matter is really only a manifestation of energy—energy "congealed," as Sir James Jeans put it, and not solid substance at all. Heisenberg said: "All the elementary particles are made of the same substance, which we may call energy or universal matter; they are just different forms in which matter can

3. An apt phrase coined by E. M. Forster and quoted by Leslie Paul, *The Annihilation of Man*, Harcourt, Brace, New York, 1945, p.160.

appear."[4] So the Creator was once more pushed back another step until He became merely the power supply, the source of energy if not the energy itself, virtually depersonalized, "the ground of all being" of Tillich, and little else.

Yet, the child of God knows that God really exists and that He is the rewarder of those who diligently seek Him (Hebrews 11:6, "But without faith it is impossible to please him: for he that cometh to God must believe that he is, and that he is a rewarder of them that diligently seek him."); that He is a merciful Father to all who find Him through the mediation of the Lord Jesus Christ; that He is personal and compassionate and a very present help in time of trouble. By experience the Christian finds that his life can be as luminously filled with divine interferences as the life of any of the Old Testament saints. And such interferences often involve the re-ordering of events firmly rooted in the physical world, so that we know God does and can intervene and we know that the nature of His intervention has all the earmarks of personal concern and specific purpose, and sometimes of miracle. God is clearly still at work within the created order, it seems to us.

How, then, do we orient ourselves toward a mechanistic view of reality which must have some truth in it to succeed so well, and yet which seems to leave no room for God anywhere at all? How do we square it with what is equally undeniable in Christian life, namely, the fact of supernatural intervention in the very same arena?

Is reconciliation possible on a rational basis? Or must we separate the two lines of evidence and say that one belongs in the realm of demonstrable fact and the other in the less certain realm of faith only? Does the one kind of truth apply in the world of Christian experience and a conflicting kind of truth in the realm of scientific endeavour, so that reconciliation is logically impossible because a different kind of logic applies in each? The one says, Reality can be explained without any concept of divine interference, and the other says, Divine interference is a fact of Christian experience.

This faith is certainly not an illusion.

I believe that in a few simple statements of Scripture there is a answer to this dilemma—one that can bring a tremendous sense of intellectual satisfaction and spiritual encouragement. The answer hinges upon the implications of two statements in Scripture, one in the Old Testament and the other in the New, which appear to be obvious enough in their meaning but which may have a more profound significance than is immediately apparent.

The first one is in Genesis 2:1-3, which we shall deal with now, the second is in John 5:17, which we shall deal with later. They appear to be contradictory, but in fact they are not. Genesis 2:1-reads as follows:

> And the Heavens and the Earth were finished and all their host, and by the seventh day God had ended His work which He had been doing, and He ceased on the seventh day from all His work which He had done, and God blessed the seventh day and

4. Heisenberg, Werner, in *The Listener*, vol.63, London, l960, p.139.

> set it apart, because that on it He had rested from all His work which God had created and made.

The meaning *seems* clear enough. But is it? Why would God "rest" Because He was weary? Surely not! The words must have some other meaning than merely to reflect our own weariness at the end of the week of intense activity. Indeed, the Hebrew word rendered "rest" is not bound at all to any idea of fatigue. It means rather "to disengage," "to terminate active involvement in," or simply as the New English Bible has it here, "to cease from." God did not stop work because He was tired, but because He had finished what He was preparing.

Could this mean, perhaps, that the "machinery" of nature had been so perfectly designed, so effectively ordered, and so wisely appointed that it could now be left to run by itself, being endowed with all the means of self-regulation, with all the feedback systems and servo-mechanisms with which even human creations can be supplied in order to make further maintenance and supervision of them virtually unnecessary? Even man can do this in a limited way, as was done in designing and building the Alouette satellite, developed by the Canadian government, which has had such an extraordinarily successful unattended life. Could not God have done the same, only on a far grander scale?

An electric power generating station, for example, can be designed to run virtually unattended, needing for the most part only routine inspection with perhaps some occasional adjustment. The superintendent could conceivably be there on the job for only a few minutes each day, and the rest of the time a casual visitor to the plant would find nothing but mechanism. These few exceptional occasions when the superintendent must be personally present would be the only times in which there were any evidence of anything other than a self-regulating system; and such occasions of intervention would be due solely to the fact that the mechanism itself is an imperfect one, one that needs adjustment or oiling or replacement of worn-out parts or used-up components.

If we assume that what God does is perfect (Psalm 18:30) and requires no such subsequent readjustment of its mechanism, then there need be no evidence whatever of any Person behind it—except as its Architect in the first place. In such an electric power plant—assuming that the power input (water or fissionable material, for example) is unlimited, and that the machine is never subject to failure —there never need be any superintendent present at all. The machine will serve the purpose for which it was designed, unattended. This is, in fact, Newton's watchmaker, the Mechanic who wound up His device and left it to run by itself, unattended.

The problem is that a useful analogy can become a dangerous invitation. The Creator who is no longer attending His machine comes to be viewed not merely as absent but as non-existent. Leibnitz discussed the tendency which had become common in Newtonian circles, to conceive of the relation between God and the universe as analogous to that of a watchmaker to a watch which he has constructed and which, having been set going, continues to function for some time at any rate without any necessity for the actual presence or attention of its originator. As Whittaker observed, "Such a conception led inevitably to the idea of an absentee God, Who having created the world had left it to run its own

course without further divine intervention and Who was therefore for practical purposes non-existent."[5]

There is no question of the reality of this danger. it should be recognized that *the more perfect the work of the designer and builder, the less evidence of his actual presence would there be in the end-product*. Moreover, if the individual who examines this end-product has such tools of research and such methodology as to allow him to deal effectively only with this kind of mechanism, then he can of necessity perceive nothing else. And insofar as he *perfects* his tools and his methods to deal most precisely with these aspects of the subject, with the pure mechanics of it, to that extent he will be the more certainly limited in what he can perceive. This is equally true whether the mechanism is living or non-living.

There might therefore be two reasons why science is unable detect the presence of the Creator in and behind His creation. *The first, because his instruments are not designed to give this kind of information and the second, because the mechanism is so perfectly designed that it could be safely left to run itself.* The strictly scientific method of research, therefore, leads necessarily away from rather than toward the discovery of God.

In physiology, for example, we dissect the body, or we experiment with it only as an electrochemical machine, and our findings confirm the effectiveness of our tools of research and our methodology by giving us the only kind of information we looking for. But as Paul Weiss, recognizing this aspect of the inherent limitation of the scientific method, observed:

> Maybe our concept of our nervous system is equally inadequate and insufficient, because so long as you use only electrical instruments, you get electrical answers; if you use chemical detectors, you get chemical answers and if you determine numerical and geometrical values, you get numerical and geometrical answers. So perhaps we have not yet found the particular kind of instrument that tells us the next unknown.[6]

The important thing to recognize is that the very perfection of God's handiwork is what deceives us. When we examine the work of man's hands—what might best be termed his handicrafts—we can readily distinguish between them and machine-made products. We recognize them by their very imperfections. If a craftsman happened to produce an absolutely flawless piece of work, we might very well suspect it to be a forgery, a machine-made object posing as a handicraft. This is because an essential element of the character of man's craftsmanship is its freedom from the bondage of machine-like perfection. This imperfection we call "character." But we do this only because we know that all man's handiwork is imperfect. By contrast, God's handiwork is perfect, so that it is easily confused with what we recognize as machine-like.

I suggest that it is inherent in any such perfected system that the more perfect it is, the less evidence there will be for the presence of a Superintendent. The very lack of evidence of any such Presence when it is examined by tools appropriate

5. Whittaker, E. T., "Aristotle, Newton, and Einstein," in *Science* , vol.98, 1943, p.270.
6. Weiss, Paul, in a discussion of "Aspects of Consciousness" by J. R. Smythies, in *Beyond Reductionism*, edited by A. Koestler and J. R. Smythies, Hutchinson, London, 1969, p.252.

to pure mechanism, is proof in itself that God's work is perfect and *not that it is not God's work*. Were we to discover faults in the mechanism, we should either have to say that God's work is not perfect or that something has damaged the mechanism since it was created. Moreover, the more precise our understanding of the mechanism, the more likely is God's absence to be confirmed.

Purely scientific understanding will exclude the Designer to the extent that (1) the design of the mechanism is perfect, and (2) our understanding is precise and correct. Contrary therefore to what one might expect, complete understanding of the mechanism is just as likely to create atheists as believers.

If the Superintendent happens to be discovered "on the job," it is only a demonstration that the mechanism is in need of occasional adjustment or repair—in short, that it is imperfect. The absence of any evidence of a Superintendent on the job is therefore a *compliment* rather than a *challenge* to the Creator!

If we do begin to find things that are faulty in the mechanism, then we have problems: How could a perfect God have made a faulty device? And the fact is that there is some evidence of fault in the mechanism. The question is, Does this mean that it was badly designed in the first place? Or that it was never designed at all but happened by accident? Or that *something happened to it subsequently to disrupt it*? The answer to this is of profound importance to the Christian. In point of fact, he can really make only one choice. He cannot believe God's handiwork is faulty, nor can he believe that this whole complex cosmos is purely accidental and to no purpose. So he concludes that something must have gone wrong only after the mechanism had been designed and put into operation.

Scripture tells us what went wrong: the disruption was introduced when man fell. Sin is the disturbing element, beginning its destructive effects in man, and through him thereafter in one way or another acting upon and upsetting much of what would otherwise have continued as a faultless self-regulating mechanism. It did not apparently disrupt the whole mechanism in all its workings. It is enough, by analogy, that a watch get some dirt into it to disturb its time-telling ability; it is not necessary that the whole watch be destroyed in all its parts, much less that the mainspring be broken. And it can be corrected by cleaning. This, as I see it, is somewhat like the situation in the Natural Order. The "dirt" is the effect of man's fall.

The question then arises as to whether we can separate out the disruptive element in each situation and categorize the kinds of areas in which it may be expected to have an effect and the areas where it will have no effect. It is becoming increasingly apparent to anyone who has followed scientific research over the past twenty-five years or so that at least in the realm of natural law we are still witnessing the operation of an essentially perfect mechanism capable of carrying on unattended and with no evidence of the disruptive effect of sin. Here at least, God still has no need to intervene. Indeed, "*natural law*" *simply becomes a descriptive term for that part of the created order which still operates undisturbed by the consequences of man's fallen nature.*

And clearly God doesn't need to intervene here at all, though He can do so under very special circumstances where miracle is then manifestly involved. Intervention is always redemptive in character; what is undisturbed and

unaffected by sin requires no redemptive intervention, simply because it is still operating perfectly as God meant it to.

The extent to which natural law, or more simply "mechanism" has continued to operate with unfailing precision is almost beyond belief. However tragic the consequences of the fall of man have been in terms of human history (and man's handling of his own environment), there is no question that the original mechanism has remained remarkably intact; it is even proving unexpectedly resilient in its powers of recovery from the disturbing influences of human misbehaviour.[7] In the next chapter we shall try to give some concrete examples, now clearly established, in which mechanism entirely governs events even where until quite recently it was believed by many informed people that some other kinds of forces were at work, forces more directly under the superintendence of God. But for the present it is only necessary to say that we can now rather precisely map out the kinds of areas in which disruption of the originally perfect mechanism has made itself felt, and the kinds of areas which it has apparently had no effect whatever.

Though sin has spread like a disease far beyond its carrier, man, yet its influences are still confined. Wherever these influences have been felt, God must now constantly intervene to re-order, re-organize re-new, restore, repair, regenerate —in short, *redeem*. The effect of the fall of man has been to so upset the original order that from Eden forward God has had to go to work again redemptively, to prevent the whole fabric from becoming a chaos. I believe this is the significance of the Lord's words in John 5:17: "Hitherto My Father works, and so do I [...]."

2. Life: An Elusive Definition

Now, it is when we come to deal with living things that the sorting out of the evidence for the disruptive effects of man's fall upon the natural order becomes a problem. While the building blocks, the molecules of living substance, obey the strict laws of cause and effect characteristic of the rest of the unattended mechanism, the aggregates of them begin to take on a new character in which the whole becomes more than merely the sum of its parts. There should surely be some sharply defined border between non-living and living substance. Yet it still escapes us, and the only thing that we can say at the moment is that it appears to have more to do with relationships (i.e., organization) than with substances *per se*.

Plants have all the earmarks of mechanism when studied carefully. All their movements appear to be initiated by and responsive to physicochemical forces; yet they are alive. And some very lowly forms of animal life seem equally to be mere machines for converting energy, though here, too, we find evidence of some kind of a "ghost in the machine," to use Koestler's phrase (though the phrase is older than Koestler).[8] Life can *seem* to be pure mechanism. As W. H. Thorpe pointed out, "There is no firm evidence whatever against, and an immense amount of evidence for, the view that the 'ordinary' laws of physics and chemistry are holding within the organism just as they do within a man-made machine."[9]

7. Reports from England show that many species of birds and fish which have not been observed in the Thames for thirty or forty years are now returning as a result of pollution control upstream.
8. Koestler, Arthur, *The Ghost in the Machine*, Hutchinson, London, 1967.
9. Thorpe, W. H., *Animal Nature and Human Nature*, Methuen, London, 1974, p.18.

A molecule of something ingested by an animal could be traced through the process of digestion until it lodged somewhere in living tissue and became one with it. But at what point does that molecule become alive? Obviously it has more to do with the organization of the tissue than the tissue itself: so the nature of life still eludes us. It is true that we have now progressed far enough to manufacture synthetic DNA—though, thus far, only with the help of the natural product derived from something that is already alive. The question remains whether the synthetic DNA is really alive in itself or more like the reflection in a mirror which has all the appearance of being alive but none of the reality. As Commoner said, "DNA may not be the secret of life: life may be the secret of DNA."[10] Yet as we shall see, even in these basic elements of living stuff, natural law seems still to play the governing role and pure mechanism looms large.

Perhaps before man sinned and after the work of the six days had been perfected and life had been injected into the whole system with the creation of living things, this stream of life could be conducted thereafter from biosystem to biosystem, riding upon a long line of carriers which were themselves designed to obey the strict regime of natural law—a circumstance which allows us to push our researches more and more deeply into these carrier systems only to find that at no point does there seem to be anything to them beyond mechanism, except that some spark derived from the main fire lights them with life if they are correctly put together. As Sir Arthur Eddington said in seeking to define life, we may say that one *and* one make two, or "this *and* that" constitute life, yet it is the meaning of the *and* that is critical.[11] Life is more than the sum of its parts.

Was such the original design of the Architect who created it all? Was it so perfect in every way that it would all have continued to seem to be pure machine with no evidence of the presence of any Superintendent if sin had not intruded? Reverting to our analogy of the hydroelectric plant, we may say that sin, acting as some disruptive agent in the mechanism, has forced the Superintendent to stay on the job. But now, the fault is not with the machinery but with the dirt that has intruded into it. It is a form of sabotage.

We know now that in non-living as well as in living things are certain elements of freedom. Heisenberg's Principle of Indeterminacy rests upon the fact that atoms behave individually as though they were not *completely* bound always to do the same thing: though in concert these freedoms cancel out and leave us with a strictly deterministic mechanism. With living things, even at the molecular level, there also exist certain freedoms which allow for variation in the developing organism, though in time we may discover that this kind of freedom is less indeterminate than it now appears to be: the very fact that mutations are reversible seems to me to suggest this.[12]

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10. Commoner, Barry, "DNA and the Chemistry of Inheritance" in *American Scientist*, vol.52, 1964, p.387.

11. Eddington, Sir Arthur, *The Nature of the Physical World*, University of Michigan Press, Ann Arbor, 1958, p.104.

12. Reversal of mutations, a fact known for many years: see, for example, R. Goldschmidt "Das Mutations problem" in Zeitschrift f. *Ind. Abstamm.* XXX, 1923; also G. R. deBeer, *Embryos and Ancestors*, Clarendon Press, Oxford, 1951, pp.96-97, for examples; also D. Lewis and L. K Crowe, "The Theory of Revertible Mutations" in *Nature*, 12 Sept., 1953, p.501. G. G. Simpson wrote: "The elementary processes of evolution at the genetic level are all reversible. This is notably true of mutations [...]." (*This View of Life*, Harcourt, Brace and World, New York, 1964 pp.244-45). In discussing the subject, Waddington suggested that some law governs this reversibility (*Beyond Reductionism*,edited by A. Koestler and J. R. Smythies, Hutchinson, London, 1969, p.370). R. L. Wysong reports the discovery that when DNA is

But perhaps in living things at the very beginning there were some "freedoms" from pure mechanical determinism built into their functioning so that the appointed "keeper," unfallen man in the person of Adam, could explore and exploit their potential for variation and development. Even in ecological terms, the randomness of nature's planting of its own seeds would allow him to re-organize things into a garden with an imposed order laid upon them to enhance the beauty of the natural order. Similarly, in terms of genetics, the freedom of the sharing process in the fertilization of the ovum by the sperm would allow man to vary the end-result—for example, to breed dogs to afford different kinds of pleasure—without upsetting the machinery in any way. Because of the way it has been designed, this perfect mechanism need not mean absolute determinism. An unfallen keeper (Adam before he sinned) was put in charge (Genesis 2:15) of an undisturbed natural order, but this does not require us to believe that all subsequent history was necessarily *predetermined*, though the elements of the natural order could still be mechanistic at certain levels. God built these freedoms into His creation for man's pleasure; and to make it possible for him to exploit them, He allowed man certain freedoms himself.

But man abused his own freedom, and he has ever since abused the freedoms which exist in the created order and is likely to continue to do so. Every advance in his ability to exploit these freedoms only tends to increase the consequences of the Fall and to endanger the whole fabric. It is only where these freedoms exist that he can effect disruption. He cannot abuse things like gravity, for example. Gravity can be ignored to man's hurt, but it is unchanging. As Simpson put it, "Gravity has no history."[13] Natural law remains, whatever we do: mechanism continues to operate in a perfectly deterministic and authoritarian way. We can do nothing to change it except to exploit its very predictableness for our own benefit and then to abuse that benefit. We do. And we shall continue to disrupt God's intent by manipulating the freedoms that were built into the system—especially where living things are concerned, for here the freedoms are most evident, having been most liberally introduced by the Creator.

Thus we read of plans now to re-engineer human beings even as we have already engineered some rather unnatural forms of animal life (as for example, dachshunds!). The potential is there, undoubtedly. This fact has to be admitted in the light of present knowledge. It is foolish to deny the possibility of test-tube babies and cloned communities of people in the light of what we know, although I think there may be one barrier here which we shall consider in chapter 3. Perhaps God will step in before this happens and either put an end to human ambition, or perhaps actually allow man to proceed until he learns the appalling possibilities there are when a fallen creature with high intelligence learns to manipulate a perfect mechanism with a potential as immense as its original Architect built into it.

Let me recapitulate very simply the essential point I have been trying to make in all this preamble. Then in the next chapter 1 will show just how all-pervasive

injured by a mutagenic agent and its "letter" sequence is upset, the normal sequence may be restored by a kind of "biochemical first aid kit" present in the cell; the aberrant sequence is enzymatically cut out of the chain and replaced by the original sequence (*The Creation-Evolution Controversy*, Inquiry Press, East Lansing, Michigan, 1976, p.109).

13. Simpson, G. G. *Biology and Man*, Harcourt, Brace and World, New York, 1969, p.9.

this concept of mechanism has proved to be in every area in which we have any certain knowledge.

What I am proposing—and I am doing so tentatively because there may be implications in all this which, when they become clear, will show that this is not the way to go—is this: what the Bible means when it says that after so many days of work God *rested* (i.e., stopped work, having finished what He was doing) is that He had in fact created and finished (Genesis 2:1-3) a perfect mechanism—the Natural Order. It was self-sustaining, self-regulating, self-correcting, deterministic in appearance, uniform in principle of action, servo-mechanized with countless interlocking feedback channels, and autonomous to such a degree that if a scientist had examined it with the finest research tools and the most sophisticated methodology, he would have found no evidence of God as superintendent over it at all. God had so perfected it that He could "cease from it." It was *finished* work. It could be counted upon to run itself indefinitely.

Even after the introduction of man, still unfallen, there would be no evidence of God *in the machine itself*. There would be evidence of intelligent intervention, for man himself (with God's permission) would act upon it to introduce order in his own way. A row of poplars, instead of the chance plantings of nature; flat stones set out in orderly lines to mark out pathways; some exuberant growths converted into hedges; certain wildflowers tamed and cultivated to bring out their special character; fields of vegetation instead of nondescript patches of verdure; and so on. In short, one would have seen a special kind of formal order imposed on what is otherwise precisely ordered only in the individual and not in the aggregate (for example, the shape of the leaf as opposed to the shape of the tree). One would, in fact, have suspected a gardener was at work, dressing his garden and achieving dominion or control over the natural order, bending it to serve his own particular delights but not with selfish motives, nor disruptively.

Yet one would still find no evidence of direct *divine* interference, only an extraordinarily beautifully adapted mechanism designed in the non-living, not only to remain orderly and thus to allow for precise control, but designed also to form the vehicle for life itself. Then man sinned—and there was introduced into the whole scheme a new element, an element of disorder, disruption, decay, and unnatural death. At that moment God had to step in once more and go to work, not only to preserve it against total disruption, but to redeem it. And because of the noetic effects of sin which limit man's powers of perception and prevent him from seeing with any certainty what lies *behind* the natural order, He has also to reveal certain things which man needs to know about himself and his origin and his destiny, which he is not able to discover for himself merely by observation and reflection.

Because the fallen nature of man has introduced elements into the working of the machine for which it was not designed to compensate automatically, God's interventions in a redemptive capacity have always appeared to be of a different order and not susceptible to natural law. They do not belong within the order of natural phenomena but are super-natural. For those who by experience of second birth have been enabled to recognize this aspect of redemptive intervention, the intervention is clear and undoubted; but such intervention is not after the pattern of the original "ceased-from" order of nature and therefore not discoverable by tools and methods which have been designed solely for the latter. So they are

unrecognized and unconsidered, and usually denied altogether—on the grounds that there is no scientific evidence for them.

The very perfection of the whole original order in its "*ceased-from*" aspect ensures that instruments and methods designed specifically to explore it will give valid and effective understanding with genuinely predictive insights and possibilities of control. Science can, and does, successfully manipulate these natural laws and duplicates their effects; without a shadow of doubt, time will broaden and deepen these areas of successful manipulation, thus demonstrating the validity of science's understandings. But in the very nature of the case it dare not or cannot admit the existence of any other kind of force or agency than natural law. The credo of science is, and must remain, that where mystery persists in nature, more knowledge or more time or better tools are required—*and nothing else*. As Howard Becker put it, "The faith of science is that the answer to any persisting problem is simply more science."[14] There can be no admission of supernatural agency or activity in any research program that is to be fruitful in the laboratory. As Joseph Needham said many years ago:

> Biologists find that their work is possible only if they define life as a dynamic equilibrium in a polyphasic system consisting of proteins, fats, carbohydrates, lipoids, cycloses, and water.[15]

Thus it has come about that a purely mechanistic philosophy, which to the Christian seems so totally "unbelieving," has nevertheless allowed tremendous advances to be made by scientific research in the understanding of the perfection of God's handiwork. However, it is only the mechanism itself that is thus elucidated, not the *meaning* of it. The evidence that the machine has been disturbed by sin is either not recognized or is ignored—or simply denied.

14. Becker, Howard, in a special lecture given to the Department of Anthropology, University of Toronto, "Science, Culture and Society," 1954.
15. Needham, Joseph: quoted by Theodore H. Savory, *Mechanistic Behaviour and Animal Biology*, Watts, London, 1936, title page.

Chapter 2

Evidences of Mechanism

This chapter is really little more than a catalogue of the successive victories of the implacable offensive, a record of the steady progress made by science toward reducing all phenomena to mechanism, including the "stuff of life" itself, and even the formation of brain. Consider such a statement as the following from Paul W. Weiss of the Rockefeller Institute for Medical Research, made at a meeting of the National Academy of Sciences in Washington in 1956:

> At the moment of its creation or very soon after, each of the millions of cells that make up a living organism seems to know its destiny. It knows whether it will become an eye or a leg or a chicken feather. It knows also how to find and group itself in proper arrangement with other like cells to make up the living fabric of eyes, legs, feathers, skin, and so on. Cells dissociated from the chicken and separated from their original site and from each other, days before feather germs had appeared, got together and made feathers.
>
> Our experiment implies that a random assortment of skin cells that never had been part of a feather, can as a group, set up conditions—a "field"—which will then cause members of the group to move and grow in concert and in accordance with a typical pattern of organogenesis.[16]

Weiss speaks of these cells as though they had a mind of their own. It is possible that they do,[17] but I do not think he would assent to this. He is merely speaking in the "as if" sense of knowing. It *looks* that way, but in fact it is part of the constitution, the "very fabric of the Universe" as Theodosius Dobzhansky would say, to act as they do.[18] Monod calls this "endowment with purpose or project" *teleonomy*. It is *teleology* come in again by the back door, because there is no other truly descriptive phrase that fits: only it would not do to use the term *teleology* any more, although Dobzhansky prefers it to teleonomy. The only alternative he feels (quoting Monod) is an absolutely mechanistic view that

16. Weiss, Paul W., "Cracking Life's Code," *Science News Letter*, 5 May, 1956, p.275.
17. See A. C. Custance, "The Subconscious and the Forgiveness of Sin", Part IV, chapter 2, in *Man in Adam and in Christ*, vol.III in The Doorway Papers, Zondervan Publication.
18. Dobzhansky, Theodosius: see his review of Jacques Monod's *Chance and Necessity* (Knopf, New York, 1971) in *Science*, vol.175, 1972, p.49, 50.

"leaves nothing in place of that precious bond [that once existed between man and nature] but an anxious quest in a frozen universe of solitude."

I think my own first realization of what mechanism means in respect to living organisms came when I read a book by T. H. Savory, *Mechanistic Behaviour and Animal Biology*, published in 1936. He described how, if a wasp is cut into three pieces, its decapitated head will still bite, its thorax will still walk about by itself, and the abdomen though without legs or head will still effectively sting whatever touches it in the appropriate manner. And all of this behaviour is, as the author observed, "apparently full of an evident and even formidable purposiveness,"[19] which nevertheless cannot possibly be there.

Not long afterward, I happened one day to see the severed limb of a "daddy-long-legs," totally disconnected from the rest of the body, but still trying desperately to walk! It kept up the movement for an extraordinarily long time.

As the years went by, I learned of more and more examples of apparently purposive behaviour in creatures so mutilated that they cannot possibly have had any guiding consciousness. For example, it is possible surgically to disconnect a frog's brain from the rest of its body, an operation called a decerebration. (A slightly different operation which has much the same end-result is termed "decortication." We shall have occasion to refer to the effects of both kinds of operation.) Now, a decapitated frog will still behave with every appearance of deliberate purposefulness in quite complex ways, as though it makes no difference whether it has a mind or not. Purposeful activity can clearly be entirely mindless.

If a drop of acid is placed on a front leg, such a frog will seek to remove it with the hind foot on the same side. If this hind leg is artificially restrained, it will try instead to remove the acid with the opposite hind leg.[20] Here we have all the appearance of minded, purposeful, deliberate activity directed toward an end that is clearly evident to the observer. The frog itself need not have had any previous experience of such a situation. Its activity must therefore be entirely mechanical, since it has no brain to make it consciously purposive. The whole complex performance is reflex and electrochemical in nature.

Experimental decerebration of animals has been conducted for years, and the behaviour of these abused creatures has never failed to amaze those who perform such experiments. A decorticate bird will fly, perch, and even eat if appropriately presented with food.[21] A decorticate dog will run on a treadmill, rise to its feet on the approach of its keeper if lying down, and will accept or reject foods depending upon their taste as though being aware of the difference.[22]

A decerebrate cat, if held upside down and dropped from a height, will turn itself in midair and land on its feet.[23] Such a cat will raise its young, growl when provoked, and purr when pleased. It remains highly responsive to scratchings

19. Savory, T. H., *Mechanistic Behaviour and Animal Biology*, Watts, London, 1936.

20. Decapitated frog: operation performed by the German physiologist Edouard Pfluger, referred to by A. Koestler, *The Ghost in the Machine*, Hutchinson, London, 1967, p.175.

21. Decorticate birds: A. J. Carlson and V. Johnson, *The Machinery of the Body*, University of Chicago Press, 1947, revised edition, p.422. See also W. B. Cannon, *The Way of an Investigator*, Hafner, New York, 1968, p.121.

22. Decorticate dogs: G. H. Bell, J. N. Davidson, and H. Scarborough, *Textbook of Physiology and Biochemistry*, Livingstone, Edinburgh, 1954, p.860.

23. Decerebrate cat: Sir Charles Sherrington, *Man on His Nature*, Cambridge University Press, 1963, p.149.

and other mouse sounds![24] Like the dog, it will walk around, apparently with purpose, perhaps guided entirely by reflex responses to light and dark objects or to smell. Not a few animals will run around for a surprising length of time with their heads cut off. Even during embryonic development, animals like rabbits can be decapitated and yet continue to develop to full term; growth of the rest of the organism is evidently not interfered with.[25]

Although I cannot now recover the source of my information, I have read of prisoners of war in the Pacific area during World War II who were given a chance to run for their lives and then were decapitated with a sword at the moment they began to run. The victims would take at least a dozen full paces at some speed before crashing to the ground—to the amusement of their captors.

Children may be born without a cerebrum and survive for several years with a responsiveness that gives a powerful impression of conscious awareness, such as following movement with their eyes.[26] Such infants may still smile and coo when fondled and cry when roughly handled.[27] These tragic creatures are conceived and come into the world like any other baby, so that it would seem as though the laws which God has built into the natural order are such that, regardless of the end-result, the union of the sperm and the ovum under proper conditions will inevitably lead to the development of a living thing, even when that end-result is tragic, i.e., a living *object* and nothing more. There is strictly nobody at home.

We are therefore led to conclude that a great deal of what we have attributed directly to God's activity in supplying some kind of vital soul, which thereafter acts out its will through the living body, may not always be "soul" at all. It may be simply the action of electrochemical forces, without *conscious* purpose, fulfilling merely the laws of nature in a strictly mechanistic cause-and-effect manner. This statement may not altogether apply in the case of human beings, as will be considered later, but there is much evidence that it is essentially the truth in the animal world below man, in spite of all appearances to the contrary. I do not at all share the appalling vision of Lord Adrian of England who said that "our final goal is to bring human behaviour within the framework of the physical sciences"![28] That is a frightful goal.

Animal lovers will object at once to this low estimate, and admittedly those animals which associate with man closely, especially dogs, seem to challenge very strongly such a mechanistic view. Yet it must be borne in mind that even some of the most admired characteristics of those lovable animals may be completely abolished by a simple operation. As Fritz Kahn has observed, by severing the olfactory nerves of the dog so that it loses all sense of smell, it becomes quite unable to recognize its own master and in fact loses, as Kahn puts it, all exhibitions of loyalty which are so characteristic of dogginess.[29]

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24. Decerebrate cat: H. C. Bazett and E.G. Penfield, "A study of the Sherrington Decerebrate Animal in the Chronic as well as the Acute Condition" in *Brain*, vol.45, 1922, p.218, 261.
25. Rabbit embryos: A. Jost, *Comte Rendu*, Pari), vol.225, p.322-24; referred to in *Annual Review of Physiology*, edited by Victor Hall, vol.11, 1947, p.33.
26. Decerebrate children: see a photograph of such a child in fig.46 in *Textbook of Physiology and Biochemistry*, G. H. Bell, J. N. Davidson, & H. Scarborough, Livingstone, Edinburgh, 1954, chap 46, p.20.
27. Anencephalic children: J. D. French, "The Reticular Formation" in *Scientific American*, May, 1957, p.56.
28. Adrian, Lord, "The Brain as Physics" in *Science Journal*, May, 1967, p.3.
29. Kahn, Fritz, *Man in Structure and Function*, translated from German by George Rosen, Knopf, New York, 1960, vol.2, p.605.

Conscious behaviour seems to be limited to those forms of activity which are not instinctive, i.e., not entirely mechanistic. Human behaviour is superimposed upon behaviour natural to animals only in those areas which are non-instinctive. To the extent that an animal's behaviour is *more* instinctive, to that extent it is more bound by the rule of law and less open to human influence at the level of consciousness. Domesticated animals are obviously animals in which the dominance of mechanism in behaviour has been reduced by human intervention, and it would be reasonable to suppose that some animals are more susceptible to this kind of intervention. For example, the dog is clearly more domesticated than the cat; therefore as they are now, after centuries of close companionship with man, dogs are far less dominated by instinct than are cats—even though the latter have probably been associated with man almost as long as dogs. In other words, it is hard to believe that there is no consciousness of behaviour in cats, but even *harder* to believe that there is no consciousness of behaviour in dogs. The greater human intervention in the life of the latter has superimposed conscious behaviour upon the unconscious behaviour of instinct to a greater extent than with the former. All that is unconscious behaviour, in either species, is instinctive and wholly mechanistic. By contrast, it seems highly unlikely that there is any truly mechanistic or instinctive behaviour in man,[30] though there is plenty of evidence of conditioned reflex activity—activity which is engendered by experience and not encoded in the genes.

It has been pointed out that the best examples of life which are purely mechanistic are to be found among plants. We are familiar with the way in which some plants will keep turning toward the sun throughout the day and will close when the sun goes down. The action is so slow that very few people were aware of it until modern techniques of phase photography made it possible for the viewer to witness the action, which originally took ten to twelve hours, flashed on the screen in a matter of ten or twelve seconds. To watch a patch of such flowers all open together and turn through perhaps ninety degrees in unison and then close at the same time gives one a powerful impression of purposive activity: and I mean, not merely action with a purpose, but action with a conscious purpose. Yet we know for a fact that all such plant tropisms are chemically governed.

It is the speeding up of the activity and the fact that all the plants are doing the same thing that makes the impression upon the mind, looking for all the world like a group of people watching a tennis match! It seems quite likely that the impression of purposeful activity in some of the very low forms of life may also be due to the fact that we observe it only under a microscope, where magnification gives an apparent acceleration to the activity. One has to be cautious, therefore, about being deceived by appearances, since many living things perform complex manoeuvres which are entirely without consciousness yet are nevertheless very similar to manoeuvres which *we* can only perform by an act of will—such as following a moving object by turning with it.

Normal plant movements are slow, but there are some that are extremely rapid. Their very speed of response gives an even more lively impression of consciousness of events. The Venus-flytrap, a carnivorous plant which feeds on

30. Instincts in man: a very useful summary of the current position regarding this is given by H. J. S. Guntrip, "The Bearing of Recent Developments in Psycho-Analysis on the Psychology of Religion" in *Transactions of the Victoria Institute*, vol. 85, 1953, p.67-80.

the protein of captured insects, is a good example. It has leaves so formed that they can close very rapidly on any insects which land on their surface. The insect is then digested by the plant, which secretes a pepsinic chemical for this purpose, very similar to the chemical in the stomach of animals which serves the same purpose. The plant is subject, of course, to the chance falling of inanimate bits and pieces on its leafy trap, but it does not close on such pieces. Study has shown that whatever lands on the leaf must make two specific contacts, spaced from 1.5 to 20 seconds apart before the trap is sprung.[31] Since living things are certain to move after landing, whereas dead things like bits of wood do not move, there is a built-in safety device which prevents the plant from "swallowing" and trying to digest what is indigestible. The trap is sprung within half a second after the second touch! Watching this performance, it is hard to persuade oneself that the response is entirely without conscious direction. But it seems certain at present that plants have no consciousness in the sense that human beings speak of consciousness, and therefore they are not acting with deliberation but entirely mechanistically.

This mechanistic chain appears to start in living things right from the beginning, at the cellular level. We know now a great deal about how the fundamental substance of all living tissue, protein, is manufactured in the cell. It is an extraordinarily complex and beautifully ordered mechanism. Starting from scratch with the basic amino acids, protein is mechanically and systematically synthesized at the rate of approximately one finished molecule in every one and a half minutes. And this is going on simultaneously at billions of sites in the body. It is truly a factory working at capacity. Allfrey and Mirsky observed: "This impressive feat [...] is testimony to the efficiency of the protein synthetic mechanism of the cell."[32] And this process continues hour after hour, year after year, virtually (though not quite) without miscue. The duplication is so accurate, in fact, that the rate of error would correspond to the making of less than a single spelling mistake involving but one letter in the printing of an entire set of the *Encyclopaedia Britannica*.[33] Jacques Monod himself underscores "the extreme efficiency of the chemical machinery of living things from the 'simplest' to the most complex."[34]

To start this factory in operation and to initiate the process of development of a new organism, there must already be at least one living organism in existence, and in a very large class of living things there must be two. The "marrying" of these two, the sperm and the ovum, can be carried out in a test tube, *in vitro* as it is termed, almost as successfully as in nature; the whole mechanism is away to a good start even though such a fertilization process is in these circumstances artificially arranged. The two components have only to be brought together, under the right conditions, and fertilization is automatic. Even the *human* sperm and ovum will under such conditions unite and initiate the process of embryonic development. It is not a mystical union, though it is still surrounded with much mystery. The very fact that such manipulation is possible at all indicates that we are dealing with a mechanism, but it is a mechanism the manipulation of which

31. Venus-flytrap: Victor A. Gruelach, "Plant Movement," *Scientific American*, February, 1955, p.106.
32. AIlfrey, V. G., and Mirsky, A. E., "How Cells Make Molecules," *Scientific American*, September, 1961, p.82.
33. Watson, James, *The Molecular Biology of the Gene*, Benjamin, New York, 2nd edition, 1970, p.297.
34. Monod, Jacques, *Chance and Necessity*, Collins, London, 1972, p.65.

introduces very serious and challenging questions for the Christian who has hitherto believed that children are the gift of God. It is perfectly true that these *in vitro* human fertilizations have been carried only a certain distance along the road to full development; and it is true that they leave large moral questions yet unanswered. Nevertheless, there is little doubt that the operation has been performed in the laboratory.

I believe the first successful operation with a human ovum was undertaken by Daniele Petrucci in Italy, who devised an artificial womb in which the resulting embryo lived and grew for twenty-nine days.[35] A second similar experiment was continued successfully for fifty-eight days. He obtained the female ovum by removing it surgically at the right moment and then admitting male sperm, one of which fertilized the egg. In both cases he terminated the experiment for one reason or another and as a consequence caused a furor in his native country. His initial object was to provide *organs* which, for technical reasons (the weak antigenic properties of embryonic tissue), would be less likely to be rejected by the host if transplanted. The fact is that any scientist who undertakes to induce the generation of life by such a means is going to have to face the possibility of also practising infanticide if his "creation" turns out to be developing in any way along undesirable lines. In 1968-69 Edwards, Bavister, and Steptoe performed similar experiments in England and found convincing evidence that eighteen out of fifty-six human eggs had been fertilized in vitro by the introduction of human sperm.[36]

What may be true of animals, which by manipulation have been brought to *full term*, may not prove to be true of human bodies, though it is possible that we shall see human bodies coming to birth in this way. I say *bodies* advisedly here because I believe there is need to take into account certain revealed statements in Scripture relative to the nature of man as *man* in contrast to the rest of the animal creation. But to the extent that man has a body which is designed to operate in many ways precisely as the animal body operates, it is likely that it is subject to the same natural laws and can be treated equally as a mechanism. That there is something *more* is not in question here, and we shall explore this later: it is only that there is much that is the same. It is this aspect with which biology concerns itself. In scientific research, the ghost in the machine must be ignored if the method is to be successful in dealing with the machine which houses the ghost. As Joseph Needham put it, many years ago:

> Mechanism is the backbone of scientific thought in biology, since in science we have to act as if the mechanistic theory of life were true, but we are in no way committed to it as a metaphysically valid statement.
>
> Scientific progress can be made only by those who experiment as if mechanism is true.[37]

35. Petrucci, Daniele, "Producing Transplantable Human Tissue in the Laboratory" in *Discovery*, vol.22, July, 1961, pp.278-83.
36. Edwards, R. G.; Bavister, B. D.; and Steptoe, P.C., "Early Stages of Fertilization in Vitro of Human Oocytes Matured in Vitro" in *Nature*, 15 February, 1969, pp.632-35.
37. Needham, Joseph: quoted by T. H. Savory, *Mechanistic Behaviour and Animal Biology*, Watts, London, 1936, p.170.

This is the methodological basis of all such research. But it does not mean that by demonstrating mechanism we are also necessarily proving that animals are in fact machines and *nothing more*. Such a statement is very different from reliance on the concept of mechanism as a fertile hypothesis; yet, as Sir P. Chalmers Mitchell put it, a few years after Needham:

> If we scrutinize our generalizations and do not extend them to a class of facts from which they were not derived, we shall find no logical ground to infer the existence of any but physical events in the world of living things. I agree that the phenomena of living things have not yet been fully interpreted in terms of the inorganic. But I note that every positive addition to biological knowledge during the past one hundred years, from the identification of Mendelian factors in heredity, the artificial fertilization of ova, and the other achievements of biochemistry, to Sir Charles Sherrington's explanation of mammalian reflexes, has been a diminution of the residuum to which it is possible to apply vitalistic conceptions.[38]

It cannot be denied that every advance has only tended to confirm the correctness, from the experimental point of view, of the decision wrapped up in the great "Manifesto" of Ludwig, von Helmholtz and duBois-Reymond when they argued that "all the activities of living material, including consciousness, are ultimately to be explained in terms of physics and chemistry."[39] This statement has been the Apostles' Creed of all the life sciences since that time, and it has proved fruitful as the basis of experimental research.

The concept of mechanism in living things was implicit at least two hundred years ago. In 1785 Lavoisier discovered by experiment that about the same amount of energy was released from a unit quantity of food whether it was burned in the laboratory or metabolized in the body of a man or an animal. His penetrating conclusion was that "life is a mechanical function."[40]

In 1828 Friedrich Wohler synthesized the first organic compound, urea, proving that organic compounds can be constructed out of non-living substances. In 1953-54 Stanley Miller and Harold Urey performed the simple experiment of circulating a mixture of water vapour, methane, ammonia, and hydrogen, all of which gases were believed to have been present in the early atmosphere of the earth, in the presence of a continuing electric spark. They carried this on for one week and by a refined method of analysis found that they had acquired a mixture of amino acids, glycine, and alanine—the simplest amino acid and the most prevalent in protein, which is the fundamental stuff of living things. The experiment has since been repeated in Germany and in Russia, at Yale, at the Oakridge Laboratory, and by P. H. Abelson in Washington, using different mixtures and always coming up with these organic substances. So this was not a "freak accident". Evidently nature has been designed in such a way that under the proper conditions, some at least of the building materials of living substance will

38. Mitchell, Sir P. Chalmers: quoted by T. H. Savory, *ibid*., p.xii.
39. Manifesto: noted by Chauncey D. Leake, "Perspectives of Adaptation: Historical Backgrounds" in *Handbook of Physiology*, vol. 4, edited by D. B. Dill *et al*., American Physiological Society, 1964, p.6.
40. Lavoisier: Magnus Pyke, "Is Biology Chemistry?" in *Discovery*, March, 1958, p.98.

come into being as a natural consequence. This does not prove that life would occur spontaneously, since these substances in themselves *are dead*.[41] What it does show is that the design of the universe is such as to allow for the appearance of life within the framework of its basic materials.

Ultimately Miller found as many as five of the twenty main amino acids present in quite large quantities in the mixture of products from his "atmosphere". Since then, continuing experimentation has shown that probably fifteen or more of the amino acids can be made by very similar methods. This still does not give us living substance, but it is a pointer.

Moreover, continued experimentation has shown that life has tremendous powers of persistence once generated. Living things of very simple nature can be mutilated in extraordinary ways and yet re-organize themselves and, as it were, survive the ordeal. It has been found that if *plasmodium* of slime mould is allowed to pass through a fine sieve, dividing the organism into very small pieces, it will still re-organize itself on the other side of the sieve and appear once again as viable as ever.[42] If, however, the *plasmodium* is *forced* through the sieve, it is apparently not able to survive the ordeal, even though analysis of its substance and structure has not revealed any difference from the substance and structure of the organism which passed through the sieve at its own speed. Thus, at this level life has extraordinary flexibility in surviving mechanical dispersion, a characteristic which one might have expected to find in non-living substance but not where life is concerned.

One more illustration will underscore this observation. Some forms of life are extraordinarily resistant to being killed by freezing. Roundworms have survived in laboratory experiments at temperatures of -450° F.[43] And springtails have revived after three years' freezing in a glacier. The low temperature seems to have no effect on these living creatures than it would have upon the substance of their bodies if it were simply non-living material. During the Chicago Darwin Centennial Celebrations (which were subsequently published in three volumes under the title *Evolution After Darwin*), in one of the discussions Hans Gaffron spoke about the problem of defining life in the face of this kind of evidence. He said:

> One may freeze a cell at such low temperature that every reaction ceases. No one could distinguish this cell from a dead one. To see whether it is alive or has the capacity of being alive, one would have to bring the cell back to normal temperature to see whether it still does what it is expected to do: to grow and, particularly, to multiply. So the essence of life is found in the process of living and not in any constituents of living cells [...].

41. Shapley, Harlow, in *Evolution After Darwin*, edited by Sol Tax and Charles Callender, University of Chicago Press, vol.III, 1960, p.77, 78, in a panel discussion on "The Origin of Life", chaired by Harlow Shapley and Hans Gaffron.
42. Plasmodium of slime mold: A. R. Moore, "On the Cytoplasmic Framework of Plasmodium" in *Science Reports*, Tohukuo Imperial University, Japan, 4th series, vol.8, pp.189, 191.
43. *Living World of Animals*, L. H. Matthews and R. Carrington, editors, Reader's Digest Publication, London, 1970, p.242.

> When defrosted, the dead cell will disintegrate and the dormant cell will multiply.[44]

Even more remarkable are some experiments reported recently in the journal *Science*, conducted by Jeon, Lorch and Danielli, who took apart individual amoeba and re-assembled them, not merely re-assembling the parts belonging to each other (the "envelope," the cytoplasm, and the nucleus), but assembling parts from different amoeba.[45] Eighty percent of the re-assembled cells were normal and behaved and reproduced in such a way as to be indistinguishable from cells of the original clone. Either life can literally be taken apart, reduced to its physical components, and re-assembled, or in this particular instance one of the components (the nucleus?) was actually the carrier of the life principle which, not itself having been dismantled into its components, survived the dis-assembly of its environment (the cytoplasm and the envelope).[46] Whatever the explanation, living substance is hardy stuff!

One of the great problems in biology at this level is understanding how one particular cell, the ovum, can multiply and differentiate into other kinds of cells as the embryo begins to lay out the plan of the body and cells become organs. It seems likely that here, also, there is an in-built mechanism which makes it unnecessary to call upon some vital force outside of the cell's own inner constitution. Recent experiments have suggested that the cells themselves do not, as it were, have a "mind" to differentiate appropriately, but do so only in the right context. Cells will develop into a particular tissue or organ if located or re-located in the right position with respect to the other related developing organs.

If part of the tissue of an eye bud is removed and cultivated appropriately, it will develop into a normal eye, though on a smaller scale, as though the cells have some innate instructions so to do;[47] but whether they will develop in this way or not depends upon their maturity. If they have not begun to show the characteristics of an eye bud, they can be removed and transplanted somewhere else and will then co-operate with the surrounding tissue as it is developing into some other organ. Whatever the mechanism is, it is clear that it is very perfectly engineered within the structure of the living cell.

The present view is that it is *organization* which gives it this tremendous potential for becoming alive and serving its special purpose. The mere reproduction by artificial means of the chemical and physical components of a cell would not seem to be the same thing as producing a cell with potential for life and subsequent orderly differentiation. But once this potential has been introduced, from there on the whole process seems to be characteristically a super-refined mechanism. The embryo as it develops appears to be *loaded* with such self-regulating mechanisms. So strong is this power to re-organize that kidney tissue can be minced up and yet under appropriate conditions will re-organize

44. Gaffron, Hans, *Evolution After Darwin*, edited by Sol Tax and Charles Callender, Chicago University Press, 1960, vol.III, p.72.

45. Jeon, K. W., Lorch, I. J., and Danielli, J. F., "Re-Assembly of Living Cells From Dissociated Components" in *Science*, vol.167, 1970, p.1626.

46. I think the remark of Prof. W. H. Thorpe is apropos: "To be precise, you must know, as completely as it is possible to know, the properties of the individual components before you investigate the resulting properties when they are acting together" (in *Beyond Reductionism*, edited by A. Koestler and J. R. Smythies, Hutchinson, London, 1969, p.420).

47. Koestler, Arthur, *The Ghost in the Machine*, Hutchinson, London, 1967, p.131

itself into true kidney tissue. In fact, it has been possible, experimentally, to produce normal embryonic kidneys by mincing, pooling, and scrambling kidney tissues from several *different* embryos.[48] The organizing properties of these tissues survive not only disintegration but also mixing.

It has been known for many years that a heart will continue to pulsate after being removed from the body, provided it is appropriately nourished. What has been recently discovered, however, is that *cells* have an in-built individual rhythmic pulsing of their own. If a number of these cells, cultivated *in vitro*, are allowed to associate, though each of them has its own established rhythm they will unite and co-ordinate their pulsing so that they beat in unison. Refined experiments have shown that although the pulse rate of these individual cells is built-in, when they begin to organize themselves into aggregates they will surrender their individuality and adopt the same pulse rate.[49] One has to conclude that in some way the whole mechanism of pulsation, so essential to living things with a circulation, is built-in from the very first cell which initiates the process of formation of that vital organ, the heart.

Perhaps even more extraordinary, in a way, is the finding that the brain itself will continue to "function," at least insofar as the electroencephalogram (EEG) can be recorded from it, even after it has been removed entirely from its original owner. Some of the EEG tracings obtained in this way from rhesus monkeys have proved to be indistinguishable from those of an animal which is not only alive but wide awake. In some cases, apparently, such brain preparations, if the auditory nerves are left intact, will respond to clicking sounds which would have been of significance to the live animal.[50] In England one medical journal has carried correspondence from animal lovers who believe that these experiments should be outlawed until we have some way of knowing whether such exposed brains may not in some way be experiencing excruciating pain. Such an event could only be possible, one supposes, if the brain *per se* was a seat of consciousness in the human sense of the word. At any rate, it seems rather likely at the present moment that these responses and output signals are purely mechanical, i.e., electrochemical, in nature.

Experiment has carried the mechanistic concept even further. Lapham and Markesbery found that single cells teased apart from human embryo brains of varying gestational ages (10-19 weeks), which were available because of surgical removal for the purpose of terminating pregnancy, can be cultivated *in vitro* and will develop normal brain tissue.[51] These *single* cells develop the same character as brain cells in the embryo that comes to full term *in vivo*, within what seems to be very nearly the same time period. The authors observe:

> The characteristics [of these cultured brain cells] suggest that regulatory mechanisms operate *in vitro* which influence not only developmental phenomena within cells but also those expressed

48. Weiss, Paul, and Taylor, A. C., "Reconstitution of Complete Organs From Single-Cell Suspensions of Chick Embryos in Advanced Stages of Differentiation" in *Proceedings of National Academy of Sciences*, vol.46, no.9, September, 1960, p.1177-85.
49. Harary, Isaac, "Heart Cells in Vitro" in *Scientific American*, May, 1962, pp.141-52.
50. Reported from *The New York Times Service*, 8 June, 1964, under the heading "Bodyless Brain."
51. Lapham, L. W., and W. R. Markesbery, "Human Fetal Cerebellar Cortex: Organization and Maturation of Cells in Vitro" in *Science*, vol.173, I971, p.829-32.

> in the organization of cells to form a tissue with definable architectural relationships.[52]

Similar experiments have been just as successfully conducted by others.[53] Nicholas Seeds of the University of Colorado Medical Centre was able to verify in mouse brain cells of embryonic origin the formation of synapses by which nerve cells communicate with each other.[54] Integration as a functioning organism was evidently part of the potential of these individual cells.

Medawar notes that if a leg bone is broken and, due to circumstances, cannot knit properly, it may actually form an articulated joint, a joint which is anatomically almost perfect. Thus Medawar asks:

> What better evidence could there be that joints, with all the niceties of their patterns of articulation, are shaped by use?
>
> Yet they are not so. For all their fitness to mechanical purposes, the patterns of bone and bones are not, in the first instance (in the embryo) moulded by the demands of use; the evidence of remodelling and regeneration shows that they *could* be so, and that under special circumstances they are so; but bones will not develop in an anatomically almost perfect fashion when deprived of innervation or transplanted into positions where they can neither move nor be moved.[55]

The explanation usually offered for such characteristics of cellular life is that there is some kind of *instruction* within the cell, a pre-arranged programme. But obviously these instructions can be changed since cells can be moved and develop differently provided that they are moved early enough. It is *conceivable* that the message encoded in the cell is such that one kind of development will occur at one stage of its life history and under one set of environmental conditions, and another kind of development at a later period under another set of environmental conditions. Successive cell divisions might involve some loss of instructions with time, but then we have the anomaly of loss of instruction resulting in a development which is increasingly more complex in its character. At present, the whole thing is a profound mystery; yet it is entirely mechanically predetermined to this extent that the end result is predictable to a remarkable degree, provided the conditions of development are sufficiently understood.

The situation is even more confused by the discovery that forms of life such as *Drosophila melanogaster* and *Drosophila simulans*, which look so alike that it takes a very clever taxonomist to distinguish between them visually, have nevertheless been found to have extraordinarily large differences in their reiterated DNA, that is to say, in the base material which carries the encoded information which is supposedly determining the form of the adult insect. As Waddington remarked: "Now what this means, why it has happened, how it has happened, we have not

52. *Ibid.*, p.832.
53. See *Proceedings of National Academy of Science*, vol.68, 1971, p.3219.
54. Seeds, Nicholas, "A Brain Re-Wires Itself in a Test-Tube," being a note in *New Scientist*, 6 January, 1972, p.6. See also "Reassembling the Brain" in *New Scientist*, 6 April, 1972, p.12.
55. Medawar, Sir Peter B., *The Art of the Soluble*, Methuen, London, 1967, p.26.

yet the beginning of an idea."[56] I feel compelled to point out that this finding creates serious problems for current evolutionary theory because it presupposes a *dis*-connection, in a manner of speaking, between genotype and phenotype. It reflects the problem which the fact of convergence also brings up, since in this case we have animals with entirely unrelated genetic background nevertheless developing extraordinarily similar body structures. Indeed, in the discussion Waddington himself admitted that homology—i.e., similar structure in different animals (which Darwin believed to be evidence of relationship between different species)—may very well have little significance from the point view of the geneticist. As he said, "Personally, I rather doubt if it retains much value."[57] In one quarter at least, doubts are being raised as to whether the information encoded in the DNA really is responsible for the characteristics of the adult organism. No doubt the two are causally related, but the question is whether, by knowing the DNA message, one could automatically predict the structure and character of the organism that will develop. Polanyi put it this way:

> A book or any other object bearing a pattern that communicates information is essentially *irreducible* to physics and chemistry [...]. We must refuse to regard the pattern by which DNA spreads information as part of its chemical properties. [my emphasis][58]

There is no question that law governs the growth of cells into organs and these laws can be quite precisely stated up to a certain point. Living tissue, like non-living tissue, is law-bound. Harlow Shapley argues that the whole system is so completely mechanistic, that, to quote his words, "there is no need to explain the origin of life in terms of the miraculous or the supernatural. Life occurs automatically when ever the conditions are right. It will not only emerge but persist and evolve."[59] Long before this, in 1877, Haeckel had said that once the chemical components of a cell—carbon, hydrogen, nitrogen, and sulphur—are properly united, they produce the soul and body of the animated world and suitably nursed become man".[60]

Presumably God has no need, once having ordained these laws and set them in operation, to superintend every stage in order to maintain the system as a whole. Because there have been certain freedoms built in which allow alternative lines of development, apparently for man to exploit, the future was not predetermined completely from the first. Laplace was not correct when he said that if at some given moment one knew all the laws governing the universe and the precise state of things at that moment, one could predict the whole course of events in the future. But this does not mean that anything happens or ever has

56. Waddington, C. H., in *Beyond Reductionism*, edited by A. Koestler and J. R. Smythies, Hutchinson, London, 1969, p.392.
57. *Ibid*.
58. Polanyi, Michael, "Life Transcends Physics and Chemistry" in *Chemical & Engineering News*, 21 August, 1967, p.62.
59. Shapley, Harlow, in *Science News Letter*, 3 July, 1965, p.10.
60. Ernst Hacekel: quoted by Stanley L. Jaki, *The Relevance of Physics*, University of Chicago Press, 1966, p.310.

happened in a haphazard way. Strict natural law has governed the whole process, except where miracle is concerned.

We now know that many of the building blocks of living substance have been constructed to operate mechanistically, and the mechanism can be reconstructed by man. There is no reason to suppose that the rest of the blocks are fundamentally different. If the spark of life can be induced into them from something already alive, such blocks become part of the stream. Individual cells apparently have built-in capabilities of forming even such complex tissue as heart or brain quite automatically. They do it on their own initiative. Aggregates can organize themselves to form organisms where such organs are needed. Physically taken apart, cells can reconstitute themselves and will re-group into aggregates and carry on as before. And so complex is the potential of cellular organization that a pure mindless aggregate will behave with every appearance of mind control, though the organism so behaving has no brain whatever to support its purposeful behaviour.

Such mechanisms are clearly *designed* to do these things, and it is absurd to argue, as some scientists do, that complexities of such a nature are fortuitous. This is not a healthy skepticism, it is a form of credulity that is really "without excuse" (Romans 1:20).

In conclusion, the system which God initiated was so perfectly designed as to need no constant attention. It is self-regulating in operation to a surprising degree. Thus the penetration of a spermatozoon into an ovum produces a living organism because this is the way God has appointed the natural law to operate. And because it *is* a natural law, the effect follows the cause wherever the operation is suitably performed, whether in a glass test-tube or in the body. One cannot suppose that in the latter case God has stepped in to guarantee a fruitful result, whereas in the laboratory the event in some way evades His supervision. I think one has to accept the fact that conception, in the final analysis, is a mechanism which will work unfailingly in man as in animals wherever the "rules" are followed. It is simply part of His duly appointed order. It is not in this aspect of procreation that God proffers His "gift." I suggest that the gift of which Scripture speaks in this connection (Psalm 127:3) must come later in the over-all process of the emergence of a new human being. It is not life itself which constitutes the gift, for animals have life by essentially the same processes. It is the spirit given to the body which is the gift of God. One kind of spirit is given to an animal and another kind of spirit is given to a man, and the difference, according to Scripture, is observable in their destiny. The "spirit" of the animal, being derived in some way from its body and being appropriate to it, returns with the body to the dust (Ecclesiastes 3:21). In contrast, the spirit *given* to man returns to God (Ecclesiastes 12:7). The two spirits are qualitatively different. It is conceivable that the spirit of the animal arises automatically out of the living substance which organizes itself to give it its special form and character. By contrast Scripture seems to tell us that man's spirit is a creation of God (Ecclesiastes 12:7). Its different destiny implies a different origin.[61]

61. See further on this, A. C. Custance, "The Nature of the Soul," [Part 6 in *The Virgin Birth and the Incarnation*, vol.V of The Doorway Papers, Zondervan Publications] where I have listed from Scripture many passages which indicate that man is a body/spirit entity, that when a created human spirit is given to a procreated human body prepared for it, there emerges what in Scripture is termed the soul

It follows from this, if we are correct, that there is a fundamental difference between man and any other animal—the difference being not so much in the constitution of his body as a living thing, but of his whole being—body and spirit—as a *person*. The possibility must therefore be faced, I think, that while science may yet succeed in bringing to full term a *human* body generated artificially by the manipulation of sperm and ovum, nevertheless it will lack a truly *human* spirit. Such a creature would be a fabrication with appalling potential, an un-ensouled hulk, a tragic monstrosity. It is conceivable that we might end up with a human-bodied but animal-spirited monster with terrifying consequences. It would be a kind of ape-man, ape in spirit though man in body and central nervous system, anthropoid but not human. It might even be a creature such as may have occupied the scene prior to the creation of man, only having a body more completely human-like than any supposed missing link so far discovered—endowed with an entirely animal soul being equipped with a spirit derived from or emerging out of its animal body, but with the potential (in terms of intelligence) of a central nervous system equal to that with which man is now equipped.

We are already able within certain limits to "custom build" animals with certain characteristics and even certain types of character. We do this with pets, with horses, and with cattle. And even now a lamb has been brought a long way toward maturity in an artificial womb. In a study which created considerable discussion, Sheldon was able to establish with a high degree of probability that human temperament is either related to or reacts upon or reflects in some way human physique,[62] and it seems almost certain that in the near future men will attempt to engineer individual character by artificially manipulating types of human physique. Leon Kass has predicted with disturbing prophetic insight some of the possibilities.[63] We ought not to be taken by surprise.

of man.

62. Sheldon, W. H., *The Varieties of the Human Physique*, Harper, New York, 1946. Some fifty thousand individuals were measured and interviewed. These were divided into three physical types, and the correlation between body type and temperament for the three groups averaged 0.80.

63. Kass, Leon, "The New Biology: What Price Relieving Man's Estate?" in *Science*, vol.174, 1971, p.779-88.

Chapter 3

Some Tentative Conclusions

We see that there is much evidence of mechanism in nature. The fact is undeniable. The processes of life itself as well as much of the behaviour of living things are largely determined by laws which are not different from those that govern reactions in the realm of physics and chemistry and electricity. It seems that Lavoisier was close to the truth in saying that all life is ultimately chemistry and subject to the same rigid determinisms of chemistry.

The current climate of opinion among biologists is exemplified in a volume by Dean H. Kenyon and Gary Steinman with the interesting title *Biochemical Predestination*. The authors explain their title by saying, with respect to the origin of life, that the coming together of the molecules which lead to the development of the living cell is predetermined by the physico-chemical properties possessed by the "simplest starting compounds" from which these living systems evolved. In other words, "the ultimate characteristics of the living cell can be traced back to the nature of the starting compounds from which it was produced. Therefore we should not look upon the appearance and development of the living cell as an improbable phenomenon but rather as one which followed a definite course governed and promoted by the properties of the simplest compounds through which the process began."[64] It was all predestined, by which they mean that once the basic component atoms had come into being and had formed themselves into simple compounds, the appearance of life was automatic

Now the essential truth of this end-result may be admitted readily enough provided we allow that God designed and created the elements out of which the compounds "formed themselves" according to laws of combination for which God had designed them to begin with. Thus we too can re-create in the laboratory the same kinds of compounds by producing the appropriate environmental conditions. But at this point we run into a serious oversimplification of the matter.

Prof. Hans Gaffron of the University of Chicago presented one of the opening papers in the 1955 Darwin Centennial celebration conference held in that city. His subject was "The Origin of Life." This conference called together some of the world's leading authorities in a number of fields with a vested interest in Darwinism in its broader aspects, including Harlow Shapley of Harvard, Sir Charles Galton Darwin (grandson of Charles), Sir Julian Huxley, Bernard Rensch (of Munster), and a number of others. The discussions were reported in full.

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64. Kenyon, Dean R., and Steinman, Gary, *Biochemical Predestination*, McGraw-Hill, New York, 1969, p.265, 266.

In the discussion of Gaffron's paper, it was natural that mention should be made of Miller's early experiment in which a number of amino acids essential to life had been artificially produced in a laboratory in a simulated early earth environment. There was an interesting exchange in this connection between Shapley and Gaffron which was reported as follows:

> *Shapley*: "It is marvellous. I predicted not long ago—a year ago—that this Miller experiment is something the youth of our own high schools and secondary schools in general might do within a very few years. Two weeks ago at Dayton Ohio, I was told of a youth who actually carried it through. Now I don't think he has fully analysed the organic material involved, but he carried out the Miller experiment in the high school laboratory. And this is going to become commonplace."[65]

To which Gaffron replied at once: "Unfortunately!" And then he explained:

> Because, contrary to notions which are becoming popular, it does not solve the problem of life. *These substances are quite dead*. From the point of view of a misleading oversimplification, it would have been even better if we had not found anything so easy to do, because then the difficulty of the true question would not have been obscured at the very beginning [my emphasis].

This was a most appropriate warning. Merely to assemble the components does not give us a living substance unless something else is added. The components themselves, even when all are present and ordered and arranged in the correct manner, do not constitute *life*. They constitute the housing but not the occupant, the framework but not the animation. A moment's thought makes this obvious: when a body has just died, for a few seconds at least, the organization remains even though animation has gone. It is a vast oversimplification to say that life is "nothing but" physics and chemistry.

In what is perhaps his most widely read book, *Man on His Nature*, Sir Charles Sherrington poses the question, "Why, if life is potentially in the atoms themselves, does an organism even die?" And he can reply only in the words of one of his confessed medical heroes, Jean Francois Fernal (1497-1558): "You omit the 'cause'; the cause is withdrawal of the 'principle of life'."[66] Subsequently Sherrington agrees that perhaps it is better to accept the dualism implicit in this statement and leave it at that.

If the principle of continuity, so important to all evolutionary theory, is rigidly maintained, life must be resident not merely in the particles when placed in a certain relationship to one another, but also (in some very lowly form) in each of the particles individually before they come together. This principle of continuity is quite fundamental in evolutionary philosophy, as Arthur O. Lovejoy pointed out in his well known study, *The Great Chain of Being*.[67] There can be no

65. Shapley, H. and H. Gaffron, in a panel discussion on "The Origin of Life" in *Evolution After Darwin*, edited by Sol Tax and Charles Callender, University of Chicago Press, Vol.III, 1960, p.78.
66. Sherrington, Sir Charles, *Man on His Nature*, Cambridge University Press, 1963, p.76.
67. Lovejoy, Arthur O., *The Great Chain of Being*, Harper & Row, New York, 1936.

discontinuities, no new factors introduced into the system which were not already latently present in the components The consequence of this logic has been openly admitted by a number of notable bioscientists in recent years. Even atoms themselves must to some diminutive degree, be considered *alive*.

Theodosius Dobzhansky, reviewing Jacques Monod's *Chance and Necessity*, referred to several biologists, including Bernard Rensch, who ascribe some rudimentary forms of life, sensation, and even volition to entities such as molecules, atoms, and subatomic particles. He wrote: "This is vitalism made to stand on its head".[68] What else can one believe if one will not accept the fact that God is the creator *and* the sustainer of all life, and not merely the creator of the building blocks which form the housing for it.

We thus have more than one problem of origins here. The building blocks had to be fashioned appropriately to accommodate life, and the life principle then had to be introduced into the building. We have here two separate occasions of "divine intervention" to reckon with. The attempt to make the principle of life inherent in the elements themselves is a manoeuvre which is intended to evade the problem of the origin of life; but it merely shifts it back one step and adds it to the problem of the origin of matter itself. And it becomes unreasonable, because much of that which has just died is still composed of the same elements as are essential to living systems, and clearly the living system can be reduced to non-living components.

We run into the same problem in considering consciousness. Whence did consciousness arise? Consciousness must be distinguished from *irritability*, which is a characteristic of all life: plants show "irritability" by their tropisms and even more remarkably by the muscular activity of the Venus flytrap, but this cannot be equated with consciousness. For plants do not have a central nervous system that would permit them to take avoiding action when hurt. It is clearly a mark of benevolence on the part of the Creator that plants do not suffer pain, for it would serve only to make their lives unbearable. Imagine trees feeling the cut of the axe, flowers the wrench of the gatherer, grass the trampling of many feet or the teeth of the sheep or cattle which tear at it. So the irritability of all living things is necessary for response (of root systems, etc.) and co-operation (for pollination, etc.) and indeed for survival: but *consciousness* could only be a useless and insufferable burden, for it necessarily includes the feeling of pain. This is why we use anaesthetics before operating on people or animals, but not on plants—as in pruning a tree.

Now, again, if the principle of continuity is to be preserved at all costs, we cannot ask, At what point was consciousness introduced? It must always have been there, latent in every atom, just as life must have been.

In a paper dealing with these issues, Cyril Ponnamperuma felt it necessary to make the following sweeping statement which he must know nevertheless is by no means as unanimously accepted as his words suggest:

> Today we are gradually learning to accept the Oparin-Haldane hypothesis that life is only a special and

68. Dobzhansky, Theodosius, in *Science,* vol.175, 1972, 49. See also Bernard Rensch, *Evolution Above the Species Level*, Methuen, London, 1959.

> complicated property of matter and that *au fond* there is no difference between a living organism and lifeless matter.[69]

This statement, which appeared in the prestigious British journal, *Nature*, brought an exchange of Letters to the Editor, one of which was from D. F. Lawden of New Zealand. Lawden wrote:

> If consciousness is a characteristic of this aggregate of matter, by the principle of continuity it must also be a feature of every aggregate and ultimately of the fundamental particles. If this were not the case, at some level in the hierarchy mentioned earlier, consciousness would arise discontinuously and it would be possible to draw a sharp dividing line separating conscious from unconscious forms of matter.[70]

So we are again faced with another problem of "origins." When did consciousness arise? We are driven to conclude either that atoms and even subatomic particles are "conscious" and not merely responsive to one another, or that the introduction of consciousness at some later stage is a third "divine intervention." Both life and consciousness are found in all creatures capable of moving themselves even in the lowliest unicellular forms, as H. S. Jennings demonstrated so aptly.[71]

Sherrington struggled with this problem too. He wrote:

> We have, it may seem, to admit that energy and mind are phenomena of two categories. *Mind* as attaching to any unicellular life would seem to be unrecognizable to observation; but I would not feel that permits me to affirm it is not there [Sherrington was not aware of Jenning's work]. Indeed I would think that, since mind appears in the developing soma, this amounts to showing that it is potential in the ovum (and sperm) from which the soma sprang.
>
> The appearance of recognizable mind in the soma would not be creation *de novo* but a development of mind from [the] unrecognizable into [the] recognizable.[72]

In short, mind is present in all matter, only it is not recognizable as such until it reaches a certain level of complexity. Such are the lengths to which scientists must go in order to avoid the slightest admission of evolutionary discontinuity or divine intervention.

Seymour Kety, chief of the Laboratory of Clinical Science, National Institute of Mental Health, Bethesda, in a paper entitled, "A Biologist Examines the Mind and Behaviour," supports the determination to reduce everything to chemistry and physics. He quotes with approval Claude Bernard, who had observed that

69. Ponnamperuma, Cyril, "Chemical Evolution and the Origin of Life," *Nature*, 25 January, 1964, p.340.
70. Lawden, D. F., letter to the editor, *Nature*, 25 April, 1964, p.412.
71. Jennings, H. S., *Behvaiour of the Lower Organisms*, Columbia University, Biological Series, X, Columbia University Press, 1915.
72. Sherrington, Sir Charles, *Man on His Nature*, Cambridge University Press, 1963, p.251.

"determinism in the conditions of vital phenomena should be one of the axioms of experimenting physicians [...]. Determinism becomes the foundation of all scientific progress."[73] But then Kety comments frankly, "Although I share this faith, I cannot avoid pointing out that it is in fact *faith* rather than proof which forms the basis of this Olympian generalization."

Kety then proceeds to reduce "mind" to brain, and brain to electrochemical machinery. He points out that this machine operates with a power consumption of about twenty watts, and he observes that the difference between the fully conscious brain and the brain in a coma is a difference of power consumption amounting to about seven or eight watts! This seems to quantify consciousness; but he is fair enough to confess, "I am not at all sure that this proves the physical nature of consciousness".

So we seem to be driven increasingly to a recognition of at least in three places, in the scheme of things with which science considers itself uniquely competent to deal, at which God must be presumed to be actively involved, not merely at some time in the past (though this is true of the origin of matter) but continuously ever since. For *life* is His to grant or withhold, since "in Him we *live*." And consciousness rests in the animating spirit that He is free at will to introduce or take back to Himself since "in Him we live and *move*". And sometimes it is removed from those who once had it without at the same time removing the principle of life, thus demonstrating that the two can be considered as independent phenomena. And finally we perhaps have to add a fourth point of intervention with the appearance of self-conscious life, since "in Him we live and move and have our *being*" (Acts 17:28). But having said all this, we have by no means exhausted the places where divine intervention has been observed throughout history.

The Bible shows that God did, and still does, intervene providentially in the course of events to overrule them according to His own good pleasure. At times miracle, as well as the providential overriding of human behaviour, is clearly to be seen. The raising of Lazarus was manifestly a case of miracle; the provision of the great fish which saved Jonah was clearly a case of Providence, where timing was crucial. The first defied the natural order, the second overruled the actions of both a man and an animal to bring them together at the right moment. Providence, as I see it, is the divine supervision of the freedoms which exist in the natural order without interfering with natural law. Miracle, by contrast, does interfere in the operation of natural law, sometimes to suspend it (the floating of Elisha's axe head in 2 Kings 1:7, for example), sometimes to accelerate it (the turning of water into wine in John 2:1-11, for example), and sometimes to reverse it (as in the case of Lazarus, John 11).

Some may feel that all our experience of God's intervention on our behalf is miraculous. Personally I don't think it is. It may be super-natural, but it is not un-natural; it is really only what we would expect, knowing our heavenly Father for what He is. Though we cannot predict what He will do in any particular circumstance, we ought not to be the least bit surprised when He *does* act. In my own experience I have often, in a time of need, prayed that the Lord would do such-and-such a thing to help me, and then made some quick calculations as to the likely people from whom the help will come . . . and my calculations have

73. Kety, Seymour S., "A Biologist Examines the Mind and Behaviour," *Science*, vol.132, 1960, p.1863.

almost always been wrong! But afterward, when help has come, it has always seemed in retrospect to have come from the very best possible source. Thus, when we come to reflect upon the ways in which God intervenes in our lives in a redemptive way, we find that strict logic breaks down—that past experience may give us confidence when we ask, but seldom supplies us with the kind of predictive insights that a few experiments in a laboratory can supply in the realm of natural law. We are clearly dealing with two separate areas in which God is operating—the one being strictly cause-and-effect, which is so perfect and precise that we cannot actually see His operation at all, and the other in which the element of freedom makes all our standard methods of achieving understanding by the use of reason and logic quite inadequate.

In John's Gospel we find evidence that on more than one occasion the Lord deliberately healed people on the Sabbath day, much to the annoyance of the Jewish authorities. In one particular place (John 5:17), by way of partial explanation of this circumstance the Lord said, "My Father works hitherto and I work [...]." The word *hitherto* is found in the original Greek as two words which together mean "up to the present moment," i.e., "until now." I think it means a little bit more than simply that the Father had been working now and then throughout history. I suggest that the Lord really intended, by His action (healing on the Sabbath day) and by His explanation, to say that from the moment Adam fell and the disruptive effect of sin was introduced into the natural order, God has been actively engaged continuously throughout history, constantly at work in a way which, if man had not fallen, He would not have needed to be. The cessation from work which followed immediately upon the completion of the six days of Genesis would have continued to this day. As a consequence, the pattern of six days of work followed by rest— which was based upon God's original program and was appointed as a guide for human behaviour thereafter—had broken down so that redemptive activity had to be carried on whether it was a working day or a rest day, whether it was a weekday or a Sabbath. It seems to me very evident that the healing miracles of the Lord were often deliberately structured to show that the repair necessary to organisms which might otherwise have operated mechanistically and faultlessly was necessitated because of the disruptive effects of the Fall, of the presence of sin in life. Hence, the Lord could repair the damage equally well by saying either "Be healed" or "Your sins be forgiven you" (Mark 2:3-12).

I think that we must assume from the statements made in Genesis 3 that there was some need for Adam to be on guard, though in his unfallen nature he was living in a perfect natural order. Perhaps there was a *potential* disrupter in existence, Satan. As long as a man remained sinless, the natural order was safe, for Satan was existing as it were in a vacuum, sealed off by man's purity and virtue from effecting any evil design in the created order. But once man sinned, Satan was free to act again effectively within the material order through man—a circumstance which may well be reflected in the desire of evil spirits for human embodiment, they being evidently largely impotent except through material agency. Satan tempted Eve through the serpent and the fruit. If Adam and Eve had not succumbed either then or later, and their descendants had likewise preserved their virtue, his power to do evil would surely have been rendered ineffectual; neither Satan nor man would have disrupted the natural order.

In that golden period of the world's history before man fell, God had so ordered nature and natural law that they needed no divine intervention. Yet they were capable of being acted upon usefully by man to draw out their potential for good, the good of himself and the rest of the creation. But once man introduced the element of sin into the world, not only did he disturb the natural order thereafter, but Satan also had acquired in man a mediating agent for the working out of his own hostile designs. The interaction of these two agencies of disruption has turned what might have been a global paradise into a vale of tears. When He shared this vale of tears with us, the Lord constantly acted to restore and correct and re-organize—to repair what had been damaged. He did not replace the order; it could still go wrong again. Thus He warned the paralytic in John 5:14 not to repeat the cause of his paralysis, for it would leave him worse off than ever if he did. And Lazarus returned to the grave again in the end. One day there *will be* a replacement, a new heaven and a new earth (Revelation 21:1, "And I saw a new heaven and a new earth: for the first heaven and the first earth were passed away; and there was no more sea.").

Now, all this results from the fact that, since God had created a man endowed with a measure of freedom of action, the created order over which he was given command naturally had to allow for some degree of freedom also, otherwise the one would have been inappropriate to the other. The building-in of some indeterminacy—an indeterminacy which appears to exist even at the very basic level of the behaviour of the elementary particles of matter—does not mean that there is anything wrong with the machine. Actually, if we deliberately try to construct a machine that, when it is working *properly*, functions with a degree of randomness, we find it difficult to succeed![74] We have all kinds of machines that *don't* work properly—but not by design. Such machines are unpredictable in performance by accident, but unintentionally. When we try to design one on purpose, we run into unexpected problems. What we tend to overlook is that there is a peculiar refinement to any mechanism which leaves the way open for *some* freedoms and yet operates perfectly unless it is deliberately disturbed. The natural order is exquisitely refined, the introduction of indeterminacy at the atomic level in no way disrupting the web of life itself. It only looks faulty because of human interference for ill.

Recent research in the coding mechanism of living things has shown that the transcription of the code may sometimes go wrong here and there. These errors in transcription are what have in the past been labelled mutations. But even here there seem to be some limitations, and it cannot be said that they are entirely uncontrolled by law, since it is known that many mutations can be reversed. The reversal precisely restores the original order.[75] It all appears to be random, yet perhaps when we know enough we shall find some more profound law governing it all. Meanwhile, the freedom is there in embryo; when it comes to light in the order of living things, we can appreciate what potential was wrapped up in the

74. This was in connection with experiments in extrasensory perception. The prejudice of mechanistically oriented scientists against the whole concept of ESP has been so strong that it has driven them to demand a degree of randomization of the target sequence which is far more rigorous than would be asked normally. The problem has been to devise a means of predicting such completely randomized programming in order to avoid the slightest departure from true randomness. See *New Scientist*, "ESP-New evidence?", 16 October, 1969, p.107.

75. *Ibid*. See footnote 12.

original stuff for a creature such as man to exploit. It is undoubtedly the basis upon which is built the present fascinating variety of life. As Bateson said, in 1914, the emergence of this variety is like "the unpacking of an original complex which contained within itself the whole range of diversity which living things present."[76] Or as Medawar more recently put it, "The genetical mechanism is such that there are deep resources of hidden variation, of possible animals only awaiting the occasion to become real."[77]

The child of God finds no difficulty in seeing purpose and design everywhere, whereas the scientist appears to be much more sceptical about such things. However, in fairness to the latter, it should be said that their skepticism is not *necessarily* a reflection of any incapacity to exercise faith. G. G. Simpson put it this way:

> A second point often left implicit but requiring meticulous attention is that the materials of science are literally material. The observations of science are of material, physically or objectively observable phenomena. Its relationships are material, natural relationships.
>
> This is not to say that science necessarily denies the existence of non-material or super-natural relationships, but only that, whether or not they exist, they are not the business of science.
>
> This requires, if you like, a measure of self-discipline among scientists, a recognition that their methods do not work properly in the absence of this restriction.[78]

More recently, W. H. Thorpe, writing in *The New Scientist*, notes that Theodosius Dobzhansky in his book, *The Biology of Ultimate Concern*, has also acknowledged the fact that science takes only a limited view of reality. As Thorpe puts it:

> There is a lack of understanding or realization of the fact that science by itself cannot give a coherent world picture, and that merely to believe in and have faith in science requires faith in something else which guarantees the value of our experience of the world and of ourselves. All this calls to my mind a current jest to the effect that a humanist is a person without any invisible means of support!
>
> Put another way, it all ties up with the humanist's alleged disbelief in the supernatural. I am convinced that what we perceive as the "natural world" is both natural and yet at the same time a dependent part of a supernatural world—the supernatural including that which is independent of the natural

76. Bateson, W., Inaugural address: Australian meeting of the British Association, in *Nature*, vol.93, 1914, p.640.
77. Medawar, Sir Peter B., *The Uniqueness of the Individual*, Basic Books, New York, 1957, p.15.
78. Simpson, G. G., "Biology and the Nature of Science" in *Science*, vol.139, 1963, p.82.

> and which underpins our basic faith in the value and significance of our total experience.[79]

And to quote one more of the great figures in the gallery of science, Claude Bernard, as noted with approval by Ernst Mayr in *Science*:

> There is, so to speak, a pre-established design of each being and of each organ of such a kind that each phenomenon by itself depends upon the general forces of nature but when taken in connection with the others, it seems directed by some invisible guide on the road it follows and is led to the place it occupies.
>
> We admit that the life phenomena are attached to physicochemical manifestations, but it is true that the essential is not explained thereby; for no fortuitous coming together of physicochemical phenomena can construct each organism after a plan and a fixed design (which are foreseen in advance) [...].
>
> Determinism can never be [anything] but physicochemical determinism. The vital force and life belong to the metaphysical world.[80]

Although Mayr would probably like to evade the implications of Bernard's statement, he agrees that for all the advances made in our understanding of life processes, the answer to the question "What is life?" still eludes us. Toward the end of his article, he has this observation, which is relevant to what we have been saying about the existence of "freedoms":

> In view of the high number of multiple pathways possible for most biological processes (except for the purely physicochemical ones) and in view of the randomness of many of the biological processes, particularly on the molecular level (as well as for other reasons), causality in biological systems is not predictive, or at best is only statistically predictive.[81]

There is no escaping the fact that whether we want to or not, we must bifurcate our view of reality in order to come to grips with it in a way that is intellectually satisfying. When the time comes to design any experiment from which we hope to derive understanding in quantitative terms, we cannot take God into the laboratory. It is perfectly true that this may make logical nonsense out of scientific activity itself, for the biologist who is studying an organism which he commits himself to believing (for experimental purposes) is a purely physicochemical mechanism is *himself* a physicochemical mechanism by his own standards of assessment. We thus have the curious anomaly of a mechanism which has consciousness studying a mechanism operating on the same principle as himself to which he *denies* the possibility of consciousness. But as George

79. Thorpe, W. H., reviewing *The Humanist Outlook*, edited by A. J. Ayer, in *New Scientist*, 20 March, 1969, p.646.
80. Mayr, Ernst, "Cause and Effect in Biology" in *Science*, vol.134, 1961, p.1503.
81. *Ibid.*, p.1506.

Corner of the Department of Embryology, Carnegie Institute, Washington, observed:

> We anatomists, physiologists, and biochemists are for practical reasons bound to work on the assumption that the animals and parts of animals we study are indeed mechanisms. We must try as hard as we can to bring all animal and human behaviour under observation and measurement. If the premature acceptance of non-physical "vitalistic" forces leads us to abandon physical and chemical investigation, we shall only wander in a no man's land of conjecture.[82]

But the temptation to reintroduce some conscious guiding hand is still almost overwhelming. For all his insistence on strict determinism, Jacques Monod speaks eloquently of the complexity of living systems:

> From a glance at a diagram condensing what is now known of cellular metabolism we can tell that even if at each step each enzyme carried out its job perfectly, the sum of their activities could only be chaos were they not somehow interlocked so as to form a coherent system. We have indeed the plainest evidence of the extreme efficiency of the chemical machinery of living beings, from the "simplest" to the most complex.[83]

And this extraordinary efficiency prompts Monod to say:

> These phenomena, prodigious in their complexity and their efficiency in carrying out a preset program, clearly invite the hypothesis that they are guided by the exercise of somehow "cognitive" functions. The nineteenth-century physicist James Clerk Maxwell attributed such a function to his microscopic demon.[84]

It is indeed a challenging exercise to toe the line of strict reductionism in the face of the evidence. Although biologists today take this stance, it is strange that for more than a century the older biologists did not feel duty-bound to be practising atheists, yet they laid the foundations of our modern understandings. It obviously is possible to be an effective biologist without being effectively an atheist. The plea that science demands absolute exclusion of religious convictions is really only a cover-up for the present spirit of rejection of God in life and self-serving indifference to any eternal verities. Science is now pursued without reference to the overwhelming evidence of design in *Nature* and the very word *Nature* is beginning to appear without a capital, as though there was a horror of acknowledging even a guiding force—let alone a guiding Person. As Susanne Langer puts it,

82. Corner, George W., "A Glimpse of Incomprehensibles" in *Annual Report of the Smithsonian Institute*, 1954, Publication 4190, Washington, 1955, p.243.
83. Monod, Jacques, *Chance and Necessity*, Collins, London, 1972, p.65.
84. *Ibid.*, p.63.

> Purpose and admirable ingenuity can only be imputed to an agent, which is none other than the "unscientific" and disavowed God, transvested into a goddess named "Nature" (with a capital N).[85]

Thereafter, as far as she herself can escape the habit of centuries, she tries to drop the capital N!

As Aldous Huxley pointed out some years ago, scientists quite properly for their own purposes have found that they can with a very high degree of success ignore that side of reality which their instruments and methods were not designed to handle.[86] The picture of reality which they construct is quite coherent and there is no denying the success of the method. The public, impressed by this success, has gone one step further and tended to deny what the scientists have merely ignored. But the scientists themselves are part of the public, so that they too have frequently tended to take the same second step and thus to reinforce public opinion. While the Christian continues to struggle much less successfully with his own spiritual life, the scientist strides forward with confidence in his handling of the material side of life. Since nothing succeeds like success, it has seemed increasingly, until recent years, that the scientific approach was the only promising one, and accordingly those who dealt with human nature—the psychologists, psychiatrists, and sociologists—all adopted the same approach. So long as they adopted the strictly objective approach of the physical sciences, they were tentatively accepted into the scientific community. But only by effectively making psychology a branch of biology could they approach the desired measure of precision. Thus, by reducing psychology to the terms of physiology and pharmacology, it was possible to build a body of truly scientific knowledge with some predictive value. Unfortunately, this body of knowledge seemed to bear little relationship to the problems created by human nature in real life. Yet the feeling persists that the success achieved by "exact" science will only be reflected in the social sciences by adopting the same methods and the same basic premises, and the result has been to dehumanize man so that he ceases to be a person and becomes a reacting thing, interesting chiefly because of his complexity.

Leon Kass has eloquently underscored the dangers involved in treating man objectively in this way. He suggests that before we begin to re-engineer human beings in the light of the latest biological findings we should ask, "What is a good man?" and "What is a good life for man?"[87] And he acknowledges that while these questions about means and ends "are never *unimportant* or irrelevant, they have rarely been *more* important or more relevant." He traces with compelling logic the probable consequences of adopting the principle that man should automatically undertake to do whatever he now finds he can do merely because it is possible, underscoring, as many others have done, the frightening prospect that we shall yet live to see the realization of society re-engineered along the lines of Huxley's *Brave New World* or Orwell's *1984*.

Increasingly it is becoming apparent that the scientific method has profound limitations when it is applied to the solution of human problems. I believe there

85. Langer, Susanne, *Mind: An Essay on Human Feeling*, The Johns Hopkins University Press, Baltimore, 1967, vol.1, p.361.
86. Huxley, Aldous, *Science, Liberty, and Peace*, Harper & Brothers, New York, 1946, pp.35-37.
87. Kass, Leon, "The New Biology: What Price Relieving Man's Estate?", *Science*, vol.174, 1971, p.779.

are at least two reasons for this. To begin with, sin—which is responsible for these problems in the first place—has not merely disturbed the machine itself but has fatally damaged man's intellectual understanding and made him curiously unaware of his own limitations in this area.

The second reason is that in the very nature of the case, the scientific method demands that the investigator be strictly objective, dissociating himself entirely from the phenomena which he is investigating. Precisely the opposite is needed in the human situation. Objectivity simply will not work, a difficulty compounded because the investigator is himself part of the problem. Sin is in every *act* and in every *thought*: and God is acting supernaturally and in a redemptive way so that the pattern of human behaviour is seldom amenable to reduction to those terms appropriate to the rest of the workings of nature where sin has not disrupted the original integrity of God's creation. There are two orders—the one which is untouched by sin where natural law continues to operate predictably, and the other where the disruption of sin has left its mark. The problem of marking the boundary remains. These two "kingdoms," as it were, are not easily distinguished except empirically and in a particular situation. Wherever the scientific method is entirely effective in achieving understanding and control, there we are clearly dealing with the still self-regulating and "ceased-from" realm of God's creation. Where such tools and methods are not successful, where they fail dismally (as recent history has shown in the area of human behaviour) there we have entered the realm in which God must become, and is, super-naturally active to preserve His creation from total ruin. Did He not intervene either directly or through some chosen vessel, corruption would probably become total, disorder would be everywhere apparent, and evil would be manifest in its most vicious forms, as implied in 2 Thessalonians 2:7-8, "For the mystery of iniquity doth already work: only he who now letteth will let, until he be taken out of the way. And then shall that Wicked be revealed, whom the Lord shall consume with the spirit of his mouth, and shall destroy with the brightness of his coming:"

These two kingdoms co-exist, therefore, for they can be thought of as kingdoms: the realm where God's sovereignty (natural law) is still wholly operative, and that other area where spiritual evil, whether originating with man or Satan, has still much success in disrupting the purposes of God. From Scripture we surmise that not only the non-living but even the animal world still remains for the most part within the first kingdom: it is man who seems to stand apart from it, alien to it.[88] Unredeemed, he is not part of the kingdom of God. Only when reborn can he either perceive or enter again into God's kingdom (John 3:3, 7) and become a member of it, a citizen of it, obedient to its originally appointed laws, with these laws written in his heart (Hebrews 8:10) as they are written "within" all creatures below him which continue to be guided by instinct. For instinct is surely nothing less than the law of God written within them,[89] built into their life style and perfectly designed for it, ideal both for them individually and unfailingly good for the whole economy of nature save where man's sin disrupts its normal operation.

88. See A. C. Custance, "Nature as Part of the Kingdom of God," Part II in *Man in Adam and in Christ*, vol.III of The Doorway Papers.

89. Fabre termed instinct in animals "inspired activity." On this, see W. R. Thompson, "The World of Jean Henri Fabre" in *Canadian Etymologist*, vol.96, no.1, 2, 1964, p.70.

Before man sinned, there was presumably only one order, one realm, all things and all creatures being then part of the kingdom of God. Unfallen man was free to intervene in the working out of the laws of this unified kingdom, not to correct it, but to explore its wonders and to exploit its potential. No miracles, in the sense of departures from natural law, were called for, because no corrective measures were needed, since miracle is related to redemption from the effects of sin and sin had not yet entered.

Harmony reigned everywhere—perfect obedience to perfect law which was perfect freedom. Nothing was outside this precise and orderly system which nevertheless allowed some freedoms, designed by God to support man's freedom to use nature and to govern it and to re-arrange it for his own special pleasure and benefit. In this way he was invited to dress the Garden and have dominion over the earth.

Our present mastery over the forces of nature would probably have seemed merely child's play had history continued from Adam to this day without the chaos introduced by man's fallen nature. There would not have been, as there are now, areas of untamed wilderness, areas of desiccated desert, areas of uninhabitability due to infestation with insects or disease or wild animals inimical to man; rather, there would have been a beautiful garden where all is peace and where the lamb and the wolf would lie down together, and the lion and the ox would eat straw side by side. Then would man have fulfilled his original calling of dressing and keeping the Garden of Eden, enlarging its borders until it covered the earth. The process of doing so would have matured his spirit, turning innocence into virtue, until he could be translated into a higher order of existence without experiencing death, passing straight into glory free from sadness or pain or fear. This seems to have been the option which was offered to the first Adam in the Garden of Eden as it was to the Second Adam on the Mount of Transfiguration.[90]

While I think such an approach to the problem of mechanism and divine intervention may possibly help to bring some satisfaction to the intellect, there are more important reasons for seeking a resolution. In the final analysis, the philosophy underlying the theory of evolution is fundamentally mechanistic. Everything that exists, including man, is rooted in the physical order of things; man is essentially no different from the animals from which he is derived, and animals are essentially nothing more than specialized forms of matter.

There are three consequences if this is true. First of all, man is an animal and if he chooses to behave like an animal, he cannot be judged. The setting up of moral standards by which to judge human behaviour is a purely artificial device arising solely from the fact that man's animal mind has become so complex that he has found it necessary for his own preservation to adopt certain agreed-upon standards of social behaviour. Morals become merely *mores*, and morality is purely utilitarian.

The second important thing is that since the whole gigantic spectacle is fortuitous and without foreseen purpose, life is fundamentally meaningless. Bertrand Russell believed this wholeheartedly, and his faith is shared by a very

90. See A. C. Custance, "If Adam Had Not Died," Part III in *The Virgin Birth and the Incarnation*, vol.V of The Doorway Papers.

large number of otherwise well behaved and honourably intentioned philosophers and scientists who have reflected upon their own presuppositions with honesty.

This is starkly revealed in Jacques Monod's book, *Chance and Necessity*. Monod speaks, as Dobzhansky puts it, "with admirable clarity, and *eloquence verging on pathos*, of the mechanistic, materialistic philosophy explicitly shared by most of the present 'establishment' in the biological sciences."[91] Monod holds that "no other science has quite the same significance for man [as biology]; none has already so heavily contributed to the shaping of modern thought, profoundly and definitively affected as it has been in every domain—philosophy, religion, politics—by the advent of the theory of evolution." Monod sees "pure chance, absolutely free but blind, at the very root of this stupendous edifice of evolution [...]." He concludes: "Man knows at last that he is alone in the universe's unfeeling immensity out of which he emerged only by chance."[92]

How pathetic such a conclusion is—a conclusion based on the scientific method, which by its own very structure is limited to insight into only part of the total picture, leaving us, as Monod says "nothing [...] but an anxious quest in a frozen universe of solitude."[93]

The third thing is that if men are merely animals, they will die like animals, and it is absurd to suppose that there can be any prospect of a hereafter with either the promise of rewards to encourage or punishment to discourage as we walk through this vale of tears. There will be no final balancing of accounts. We must insist on our rights *now*, in this life.

The fact is that once ideas are lodged in the mind and are assented to as logically compelling, it is almost impossible for the thoughtful individual to avoid working them out to their ultimate conclusion. People who start by accepting evolution as a philosophy, even though they are filled with idealism (a heritage of a vital Christian faith of their own or of their predecessors), all too often find their faith is dimmed and their idealism is surrendered. The step from a little doubt to no faith may take a long time to make, but it is apt to be made in the end, whether deliberately or merely by default.

Scripture is an adequate revelation of that which man could not discover unaided. If its statements are taken and believed with complete seriousness, the child of God who rests upon it has the only defence capable of preserving his faith in the face of the implacable offensive of science. Science may tell us the mechanism of it all: Scripture tells us about the *meaning* of it all.

91. Monod: quoted by Theodosius Dobzhansky, in his review of Monod, *Chance and Necessity*, in *Science*, vol.175, 1972, p.49, 50.
92. Monod, Jacques, *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, translated by Austryn Wainhouse, Collins, London, 1972, p.167.
93. *Ibid.*, p.158.

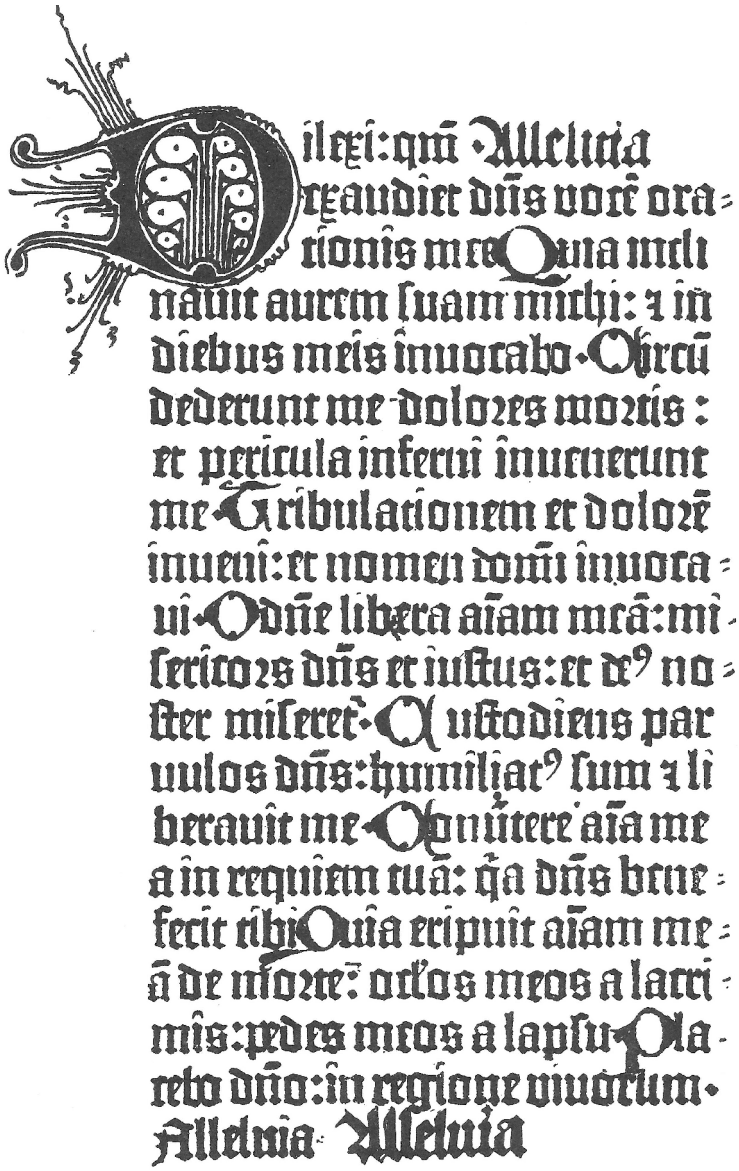
PART III

THE MEDIEVAL SYNTHESIS: MODERN FRAGMENTATION OF THOUGHT

[Doorway Paper #12, first issued 1965]

When we find ourselves entertaining an opinion about the basis of which there is a quality of feeling which tells us that to inquire into it would be absurd, obviously unnecessary, unprofitable, undesirable, bad form, or wicked, we may know that that opinion is a non-rational one, and probably therefore founded upon inadequate evidence.

Quoted from Trotter, by Ralph Gerard
in *Scientific Monthly*, June, 1946


Dilexi: quõ Alleluia
exaudiet dñs vocẽ ora-
tionis mee Quia incli
nauit aurem suam michi: et in
diebus meis inuocabo. Circũ
dederunt me dolores mortis:
et pericula inferni inuenerunt
me. Tribulationem et dolorẽ
inueni: et nomen domini inuoca-
ui. O dñe libera aiam meã: mi-
sericors dñs et iustus: et de⁹ no-
ster miseret. Custodiens par
uulos dñs: humiliat⁹ sum et li
berauit me. Conuertere aia me
a in requiem tuã: qa dñs bene-
fecit tibi. Quia eripuit aiam me-
ã de morte: oculos meos a lacri-
mis: pedes meos a lapsu. Pla-
ceo dño: in regione viuorum.
Alleluia. Alleluia

A half column from the Psalter in Pfister's Bible printed in the Bavarian city of Bamberg in 1460, and very remarkable for the clarity of its Gothic type. This is part of Psalm 114.

Introduction

It is not the best policy to introduce a paper by warning the reader against misunderstanding it. Yet there are three possible areas of misunderstanding in this essay which I should like to guard against. All three of them arise from the fact that it is sometimes necessary to oversimplify a situation in order to deal with it usefully without constantly resorting to "ifs" and "buts"—which tend to complicate the thread of the argument.

In the first place, my picture of the Medieval view of things is probably far from realistic. Not too many people lived in the kind of spiritual atmosphere which I have portrayed in chapter one. Moreover, although I do not wish to give unnecessary offense, I do not at all accept the essentially Roman Catholic theology which underlay it nor the policies which that theology justified. What I do feel to have been an achievement of importance was the preservation, in an otherwise corrupt world, of certain ideals stemming directly from a spiritual view of things that kept constantly before men the fact that they were personally responsible to God, that they were souls with an eternal destiny and not merely animals with superior intelligence.

It is by contrast with our own materialistic culture that Medieval times are looked back upon with some nostalgia. Forgetting the hardships of those days, we envy the spirit of a society strong enough to direct the energies of men, not to the accumulation of personal wealth, but to the erection all over Christendom of monuments to their faith which, in the form of the great cathedrals, gathered all the arts of man in a supreme act of worship. Whatever our judgment of the Roman Catholic Church through the ages, it cannot be denied that this channelling of men's energies away from their own immediately selfish interests and personal needs into a great common undertaking serving a spiritual end and requiring centuries to complete was no mean achievement.

In the second place, the reader may gain the impression that I am opposed to science, to the scientific method, or to the scientific philosophy. Despite appearance to the contrary, this is not my feeling in the matter. Before retirement, I was engaged for many years as head of an Applied Physiology Laboratory with the Canadian government in research dealing with the response of human subjects to stress of various kinds (heat, drugs, work, etc.), using new techniques which had been developed in our laboratories. What I do fear is that the successes of the scientific method in dealing with those aspects of reality which allow precise measurement are misleading us into believing that this is the only method of dealing with reality. The consequence of such a belief is that any part of man's experience which cannot be tested or explored usefully by this method tends to be ignored by the scientists and, as a consequence, denied by the general public.

Now, whereas formerly there was a tendency to deny man's bodily rights, today there is a tendency to deny man's spiritual reality. The spiritual dogmatism which characterized the earlier age is being rapidly replaced by a materialistic dogmatism. In this respect the two ages are much alike. This is why throughout the paper I have contrasted the Medieval and the Modern Synthesis—not because the first was by any means altogether good nor the second by any means altogether evil, but because it is easier to compare opposites, and the more opposite they are made to appear, the more concretely can each situation be examined. And although we tend to be more acutely aware of the evils of our own times and to look more favourably upon the blessings of certain earlier periods in history, I believe it is essentially true that the spirit of man has greater importance than his body and that consequently a society which is more spiritual than material is to be preferred to one which is more material than spiritual. If this is true, we are not altogether wrong in looking back upon Medieval times with some envy.

And finally, a word regarding my question in Chapter 6 as to whether the Christian Church is really called upon to attempt a fresh synthesis.

To me, it seems quite clear that the church's prime responsibility is to bear witness in every way possible to the fact that man, individually, is in need of personal salvation. But I also believe that even in a society which rejects this message, the church is still called upon to bear witness to the fact that man is not an animal but a unique creature of unique significance in this Universe, unique by origin and by destiny and, whether redeemed or unredeemed, uniquely related to its Creator. This uniqueness stems not only from the circumstances surrounding man's creation and fall, but also from the fact that after death he will live again to face a judgment for what he has been in this life. Man is not merely a superior animal, but a child of eternity.

I am convinced that the world needs constant reminding of this fact and that there can be no understanding of "the phenomenon of man" unless it is recognized fully. Nor can the ills of society be properly diagnosed, nor can any proper provision be made for the real fulfilment of human aspirations even at the ordinary social level, unless the true nature of man in this respect is acknowledged.

This dimension of our total understanding of reality cannot be supplied by science. It must be contributed by the Church as a theologically oriented world view and as a by-product of the personal commitment of the individual believer to the spiritual quality of his daily life.

Chapter 1

The Medieval Synthesis

About 1951 I wrote a short paper relating some scientific discovery to Scripture which was published in an evangelical magazine. Inset within the article was a photograph of a young scientist surrounded by all the proper "paraphernalia" of research—retorts, test-tubes, and so forth, dramatically spotlighted from behind to cast shadows on a side wall. Somebody asked me later whether I was the scientist in the picture. I wasn't—though it might have been. The fact is that the laboratory scene was so dimly lit, and so effectively I may say from a photographic point of view, that the identity of the man at work could have been almost anyone. It is doubtful if he could have done any work in such a dismal light! Still . . . it looked good.

Many people unconsciously reveal by the tenor of their remarks that they are deeply impressed by the idealized picture which they carry in their minds of the atmosphere and techniques of scientific research. But if one tries to suggest that research is not quite as single-minded as they imagine, that scientists have a fair share of pettiness in their human relations,[1] and that all too frequently the most dramatic discoveries are made as a result of accident[2] or because the wrong

1. J. Tuzo Wilson wrote, "Scientists have a clearly conceived pecking order, with the most practical scientist at the bottom; and they usually have a poor opinion of research as practiced in other subjects". ("Science Is Everybody's Business," *American Scientist*, vol.52, 1964, p.266A-76A). In *Letters* (edited by Henry James, Atlantic Monthly Press, Boston, 1920, vol. II, p.270), William James makes this remark: "When you refer to what you suppose a certain authority in scientists, I am surprised: for of all insufficient authorities as to the total nature of reality, give me the 'scientist' [...]. Their interests are most incomplete, and their professional conceit and bigotry immense. I know of no narrower sect or club, in spite of their excellent authority and their splendid achievement there." Coming from a man with the reputation of William James, this remark can hardly be considered an expression merely of bias or hostility. In his presidential address to the British Association meeting held in Liverpool, England, Sir Edward Appleton quoted Dr. Hartley ("Observation on Man") as having said, "Nothing can easily exceed the vainglory, self-conceit, arrogance, emulation, and envy that are to be found in eminent professors of the Sciences, Mathematics, Natural Philosophy, and even Divinity itself" (*Nature*, 5 September, 1953, p.426).

2. As excellent examples of fruitful accident, one may note the circumstances surrounding the accidental discovery of radioactivity on stored photographic plates by Roentgen on 8 November, 1895. A. L. Kroeber refers to the fact that "the shock cure for dementia praecox was discovered through a schizophrenic's being given, by a nurse's error, an overdose of insulin injection for the diabetes that he also had" (see *Anthropology*, Harcourt Brace, New York, 1948, p.354). A valuable paper entitled "Speculative Research," dealing with this matter of "accident," was presented by Ritchie Calder in *Discovery*, October, 1960, pp.420-25.

formula was used or because the technician didn't know enough not to attempt the impossible,[3] they seem somehow disappointed.

Yet why should the more realistic picture tend to disappoint one? Why should it really matter whether research is fruitful because genius is at work or because of some accidental discovery? Is it because we find it more satisfying to believe that if something happens which has all the appearances of being purposeful, it was indeed the result of a plan and purpose and not merely the result of accident? This brings me to the first point I would like to make.

We all share, I think, a strong dislike for the idea that significant things happen by chance. Perhaps I should say, we all used to share this dislike—for the fact is that in recent years there has appeared a new kind of philosophical attitude which expresses itself as a downright abhorrence for the idea that there could be any purpose in the universe at all no matter how much evidence there is of deliberate planning. According to this view, the sum total of all events is one enormous accident. We are invited to adopt a picture of things in terms that have been ably summed up as follows by J. W. N. Sullivan:

> The vast extent of the universe both in space and time is, from the human point of view, completely aimless. Those immense lumps of matter in their millions of millions, incessantly pouring out an inconceivably furious energy for millions of millions of years, seem to be completely pointless. For a fleeting moment man has been permitted to stare at this gigantic and meaningless display. Long before the process comes to an end, man will have vanished from the scene, and the rest of the performance will take place in the unthinkable night of the absence of all consciousness.[4]

This was written in 1938, and this view has become even more widely accepted in the intervening years. Three prominent contemporary writers come to mind at once in this regard, namely, Bertrand Russell, George Gaylord Simpson, and Julian Huxley, of whom more later.

But this is nevertheless a phenomenon of recent times. If we go back in history to the period of the Babylonians, Assyrians, and Egyptians, or if we examine the thinking of primitive people of recent times, we cannot even find a word that accords with our concept of "accidents." To them, nothing was or is due to chance. All events, large and small, have been caused deliberately by some agent with a will. Indeed, as Frankfort and others have demonstrated so ably, the "philosophy" of early civilized man led him to look upon himself as a very insignificant and powerless figure playing an uneasy role on a stage dominated by giant personalities who could be bribed or cajoled occasionally but most of the time had

3. All too often what are considered by the "experts" as long-established facts not requiring or justifying further investigation turn out to be only half-truths. Ignorance of such half-truths has sometimes allowed the less expert to proceed with an experiment which has proved entirely fruitful—much to the confusion of the experts. W. I. B. Beveridge, after discussing training for scientific work, nevertheless underscores the part played by misconception in successful discovery (See his *Art of Scientific Investigation*, Heinemann, London, 1950, reviewed in *British Medical Journal*, 27 January, 1951, p.173). And Professor Gluckman has observed that most of the fertile ideas in anthropology "have emanated from armchair students" (*Man*, Royal Anthropological Institute, March, 1952, Correspondence, Item 71).

4. Sullivan, J. W. N., *Limitations of Science*, Pelican Books, London, 1938, p.33.

to be humbly submitted to.[5] The world of the early Middle East and the world of primitive man was a completely personal one and was, therefore, logically filled with evidences of purpose. The world of the scientist today is completely impersonal, and therefore evidence of purpose must be categorically denied.

To deal with an entirely personal world one uses Magic, but to deal with an entirely impersonal world one uses Science. Somewhere between these two there is a religious view of things. It is helpful, perhaps, to distinguish between Magic, Religion, and Science by saying that the relationship between the individual and his world in Magic is a "me-thou" one, in Religion an "I-Thou" one, and in Science a "me-it" one.

Early man and our "primitive contemporaries," as George Murdock has so aptly called them, lived largely in a world dominated by Magic. In such an atmosphere, one was forced constantly to use one's wits, and much uncertainty was attached to life. Cunning and bluff were useful allies, but the resources of the individual were small. Nevertheless, on the whole, the world was an orderly one and a man could come to terms with it just because it *was* orderly. And orderly in this context means that behind it were planners and purposers whose thought processes were not altogether unlike our own. If one behaved in each situation in the proper way, the situation itself would turn out at least acceptable, if not favourably. The fact that this view of the world was often very faulty and seems to us, at this distance, to have been disturbingly filled with uncertainties, should not blind us to the further fact that the average man at least knew how to get along in it.

There is a rather good illustration of this truth from comparatively recent times. This story, I believe, is essentially true. An old Hopi man, who knew all his tribal law thoroughly and understood perfectly how to co-operate with nature, had a son who, having been educated in the native fashion, subsequently went overseas during World War II and later came back with most of this lore discarded—but not quite all of it. When interviewed by an anthologist, the son bravely asserted that he shared none of the superstitious fears of his less worldly-wise father. Indeed, he agreed to be put to the test. Both men were invited to spend one night in a particularly "sacred" place where the spirits of the past, both good and evil, were believed to be very active at certain times.

The old man decided where he would sleep, prepared his bed, went through a little ceremony which created a ring of protection around him against the evil spirits, lay down, and slept like a child. The son, on the other hand, no longer had any confidence in this ritual and could not be bothered to perform it. Yet he could not quite escape the uncertainties of the situation either. After making a valiant effort to quiet the fears which he pretended not to have and which he therefore had no way of dealing with, he finally got up and slipped back into the Hopi village, where he felt secure once again.

The moral of this little story is self-evident, of course; but it is worth underscoring the fact that what may appear to us as a most unsatisfactory view of the world of nature may still have a very reassuring effect upon the man who holds it, *if* he holds it with complete confidence. It is rather like the traveller in strange territory who has a faulty map but is not actually aware that it is so. If his

5. Frankfort, Henri, *et al.*, *Intellectual Adventures of Ancient Man*, University of Chicago Press, 1946, pp.vii and 401.

sense of direction is good so that he never actually has to depend upon the map in a critical situation, the possession of the map, faulty though it is, can provide him with as much peace of mind as a perfectly accurate one. This is an analogy to which we shall return subsequently.

Now all this in one way or another illustrates the fact that the human mind seems normally to be so constituted as to prefer or demand some kind of world view which makes sense out of life, which sets the events of life, one's own and that of others, within a framework that leaves as little room as possible for pure accident to occur. No matter how great a calamity overcomes a man, he may accept it "philosophically," as we say, if he believes that there is some purpose behind it, some possibility of redress—here or hereafter—some benefit to be gained by himself or others as a consequence.

One of the earliest books in the Bible is the story of a man's philosophy. The man was Job—and the story is too familiar to need repeating in detail. But the moral of the story is worth noting, because it was Job's philosophy of history—in this case his own personal history—which made him triumph so wonderfully over what might otherwise have been his total destruction as an individual. He was so sure that there were no accidents, that things didn't just happen by chance, that even the seeming destruction of his very life did not undermine his faith. "Though He slay me, yet will I trust Him," he cried (Job 13:15)—and thereby gave witness to his confidence that there was a plan and a purpose in everything and that the Planner and Purposer was a Person who could be trusted absolutely.

It is customary to argue that the Jewish people were essentially practical and not a bit interested in such an abstract idea as a "philosophy of history." Yet this is what the Old Testament really is, and the extent to which these Scriptures are prepared to attribute to the Divine Planner the apparently smallest and most insignificant events—events involving both the forces of nature and the wills of men—will surprise anyone who has not taken the time to observe how much it actually has to say on the matter.[6]

Although this philosophy of history was not explicit in the way that ours has been defined and elaborated upon in Western culture, it nevertheless became so with Paul in his Epistle to the Romans, and with the writer of the Epistle to the Hebrews, both of whom extended it and thus bridged the gap from Old Testament to New Testament times. Thereafter the early Church Fathers sought to incorporate within this emerging Christian world view much of the philosophical thinking of classical antiquity. Origen's *De Principiis*, about A.D. 230, was one of the more definitive attempts, not merely to provide a comprehensive history from the beginning, but to so structure this world view that it would be intellectually satisfying, thus contributing toward the achievement of a "peace of mind," where the Old Testament had been directed more toward achieving a "peace of heart."

When the city of Rome was being overwhelmed by barbarian hordes under Alaric in A.D. 410 and it seemed to thinking people that civilization was coming to an end, that total chaos would ensue, that all hopes of progress and orderly living were to cease, then Augustine, building upon the writings of his predecessors but illuminating them enormously from his own giant intellect,

6. Custance, A. C., "The Omnipotence of God in the Affairs of Man", Part IV in *Time and Eternity*, vol.VI, The Doorway Papers, Zondervan Publishing Co.

bequeathed to the world between A.D. 414 and 426 his own contribution, *The City of God*.[7] Here he endeavoured to assure his readers that there is still meaning and purpose in it all, that God is still the great Planner, and that though events in the earthly sphere seem so completely without reason or order or hope, in the spiritual realm God remains in sovereign control and world history is moving exactly as He intends it to.

In his thesis Augustine touched upon every aspect of life thoughtfully and created the basic framework for the thinking of generations to come—even to our day. He was concerned with the relationship between man and God, man and nature, man and sin, God and nature, man and society, and each within the framework both of time and of eternity. And in the Dark Ages, which in Europe deepened during the following centuries while the very survival of Christian civilization itself seemed to hang in the balance, there were still those who in seclusion devoted themselves to the study and preservation of this Christian philosophy. In due time this transmitted wisdom, which often combined profound insight with what today seems such manifest absurdity, was taken by Thomas Aquinas and reconstructed into a most elaborate and logically coherent world view which has since come to be known as the Medieval Synthesis and which became the basis of education and the guide to all intellectual endeavour.[8]

As we look back upon this world view, it is evident that while much in it does not satisfy our more critical minds, there was nevertheless plenty of challenge for the sharpest intellect and many intriguing answers to satisfy those who had problems. To most of the common questions which men ask, there were set answers which, though simple, were really quite assuring. For example, a student being told that idol worship was abhorrent to God, asked why, in that case, God did not destroy idols. The teacher replied that this could not be, because some of the objects which men worship played an essential part in the economy of nature—the sun and the moon and the stars, for example. After a moment, the student said, "In that case, why does God not at least destroy those which are not essential?" "Because," replied the teacher, "if God destroyed some of these objects of worship, and not others, it would appear that He was condoning the worship of those which He did not destroy."

Everything was wrapped up in tidy little bundles of reason until nothing was without its proper explanation, its purpose fully "understood". Thus, for example, Hugo St. Victor, chief of the twelfth-century Mystics, said that the spirit was created for God's sake: so that the spirit might be subject to God, the body to the spirit, and the world to the body.[9] Randall has summed up the situation most effectively:

> The world was governed throughout by the omnipotent will and omniscient mind of God, Whose sole interests were centred in man, his trial, his fall, his suffering and his glory. Worm of dust as he was, man was yet the central object in the whole universe. About him revolved the heavens and for him were

7. Augustine, *The City of God*, in the Nicene and Post-Nicene Fathers, Christian Literature Co., Buffalo, New York, First Series, vol.II, 1887.
8. Aquinas, Thomas: a useful text is *Introduction to St. Thomas Aquinas* by Aton Pegis, Modern Library, New York, 1948, 690 pages.
9. Taylor, H. O., "Medieval Mind" in Book II, *Early Middle Ages*, Macmillan, London, 1938, p.91.

> made land and sea and all that dwelt therein. He was the lord of creation, made in the very image of God Himself. For his sake, despite his unworthiness, Almighty God had taken on flesh in Bethlehem and bled upon the Cross that he might be saved from his own folly and pride. And when his destiny was completed, the heavens would be rolled up as a scroll and he would dwell with the Lord forever. Only those who rejected God's freely offered grace and with hardened hearts refused repentance would be cut off from this eternal life. With such a conviction it was inevitable that seekers after the meaning of things should scrutinize every object and event of this, the background of humanity's struggles, to discover its bearing upon the fundamental purpose of things. Everything must possess significance, not in and for itself, but for man's pilgrimage. There must be a reason for every thing, a purpose it served in the divine scheme. That one of God's creatures should exist apart from the course of Providence, that a single stone should fall unknown and unplanned by the maker of Heaven and Earth was an intolerable thought. If no other purpose could be discerned, it was enough that God's creatures existed to make manifest His greatness and lead the soul of man to glorify him [...].
>
> It was not given to mortal reason to decipher the hieroglyph of the universe in detail: but the important fact is that this was the fundamental air of all wisdom and learning, colouring the whole intellectual life and all but excluding any interest in prediction and control, in natural science as we know it [...]. Indeed, a knowledge of natural history for its own sake would have been regarded as almost blasphemous, taking men's thoughts away from its essential meaning for man.[10]

The practical effectiveness of this kind of orderly world view is beautifully illustrated by the story of St. Martin, who took refuge in a cave only to find himself face to face with a poisonous serpent. Whereupon he faced the dangerous creature boldly and said, "If thou hast leave to smite me, I do not say thee nay."[11] What confidence a man may have with such a philosophy as this! And he did live, too. . . .

It appears that much of the content of education had this objective and took this kind of form, leading to the communication of *wisdom* rather than *knowledge*. The sum of Medieval wisdom lies, in the words of St. Francis:

> Suppose that you have enough subtlety and science to know all things, that you are acquainted with all languages, the course of the stars, and all the rest, what have you to be proud of? A single demon in hell knows more than all the men on earth put together. But there is one thing of which the demon is incapable and which is the glory of man [...] to be faithful to God.[12]

10. Randall, John H., *The Making of the Modern Mind*, Houghton Mifflin, New York, 1940, p.34.
11. Gregory's "Dialogues" in J. H. Robinson, *Readings in European History*, Ginn, Boston, 1904, vol.I, p.92.
12. St. Francis: quoted in P. Sabatier, *Life of St. Francis of Assisi*, Scribners, New York, 1894, chap.17.

Moreover, by very reason of the fact that this world view attached equal importance to supernature (with which one cannot experiment in the ordinary sense) as it did to nature (where experiment is proper), the schools inevitably became occupied with argument and—reinforced by the philosophical bias of Aristotle—looked upon experimental verification as both unnecessary and undignified. It might be thought that such a limitation would be stultifying. But this was by no means altogether true. For example, long before this, Augustine had observed with profound insight that time began with Creation.[13] This generative idea formed the basis of much disputation about the nature of time and its relationship to eternity.

Inevitably the question arose as to whether in the other world, after death, there could be such a thing as space if there was no such thing as time. When two angels met in this spaceless world, did they have to cross the intervening distance or were they, so to speak, "already there"? And if so, did angels themselves occupy any space whatever? Or, to put the question in a form more familiar to those who have delighted in ridiculing the topics of conversation of Medieval times, "How many angels could one get on the head of a pin"? Stated facetiously like this, the question seems foolish and hardly worthy of the mental energies of students of university caliber. But this is really an appearance only; I suspect that if Einstein had been asked this question in all seriousness, he might have at once perceived that it really is a profound and important one: quite impractical, of course, but history hardly supports the view that questions are unimportant merely because they have no apparently practical value.

In this Medieval Synthesis, every line of thought and study was integrated with one objective ideally in view, which was to clothe the mind of man with a garment of understanding that would enable him to come humbly but with assurance into the presence of God and worship Him knowingly, recognizing the extent of his responsibilities and accepting his position in the economy of things with proper dignity, and—so they supposed—having also a full understanding of God's thoughts. I say "ideally," because it has to be admitted that this high aim of education was often replaced by the much lower one of maintaining the status quo.

But in this atmosphere there developed educational institutions which approached most nearly the ideal of a true "uni-versity," a student body engaged in a real totality of studies in which every subject was consciously related to all others, and for which theology supplied the guiding principles.[14] It has been said that theology was the "Queen of Sciences". This is not to confuse theology with science, but only to point up the fact that it was the responsibility of theology to maintain the unity of thought by preserving harmony between the disciplines. By this arrangement there can hardly be any doubt that the intellectual life of the Medieval student was far more satisfying and harmonious—though often grossly in error in point of fact—than that of his modern counterpart. In this, at least, we are less well off. Indeed, in his presidential address before the British Association in 1952, Prof. A. V. Hill observed:

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13. Augustine, *The City of God*, book II, chap. 6: "Beyond doubt, the World was not made *in* Time, but *with* Time". See also A. C. Custance, Part I in *Time and Eternity*, vol.VI of The Doorway Papers, Zondervan Publishing Co.

14. Temple, William, *The Church Looks Forward*, Macmillan, London, 1944, p.37.

> Theology was once known as the Queen of the Sciences. If Science as the servant of humanity is to be sure of its direction, the Queen needs to be either re-instated or replaced [...]. The throne is at present vacant.[15]

Now, as we have already observed, the test of truth was not experimental verification but harmonious inclusion within the system. This principle had the effect of giving to it what J. Randall called a "monumental unity".[16] An orderly system of thought appeals to something very deep in human nature and wherever men look for it they tend to find it. When it is not self-evident, then man creates it artificially. As Professor Albert Mead has put it:

> It is the innate propensity of active minds to form species, successively to make distinctions, to point out similarities and then to assemble things that are alike into their kind [...]. This mental trait is not a simple one. It is made up of a strong emotional factor, and an inborn urge to put things in order and, alas, to keep them there; of the intellectual faculty of discernment and discrimination which perceives distinctions and similarities; and of constructive imagination which makes it possible to assemble in the mind things which are widely separated in space and time.[17]

It is this urge which works itself out in many forms of art. Thus we structuralize space and time in sculpture and music, put pictures into frames, drama into acts, poetry into verse, prose into chapters, and history into epochs or cycles. In the Middle Ages all men of quality or position shared in the unity of thought which was the Medieval Synthesis and acknowledged its system of morality. Christendom was united in a way in which it never had been before and was not to be again. Between kings and princes and between nations, there were standards of conduct based upon a system of morality which, while it was often honoured more in the breach than in the keeping, was nevertheless admittedly honoured.[18] Jacques Maritain has summed up the situation in this way:

> No doubt this [...] failed of its highest ambitions. Nevertheless, in how ever precarious a fashion, but one of which nowadays we can be terribly envious, there was at any rate a Christian order, a Christian temporal community where national

15. Hill, A. V., *The Listener*, BBC, 25 February, 1954, p.331.
16. Randall, John H., *The Making of the Modern Mind*, Houghton Mifflin, New York, 1940, p.49.
17. Mead, Albert H., "The Species Complex in Biology and Education" in *Science*, vol. 90, 1939, p.241. See also Leslie Paul, *The Annihilation of Man*, Harcourt Brace, New York, 1945, p.165.
18. Sir Alfred Zimmerman sums up the situation in these words: "Men find it hard today to apply moral standards to politics because they are so often not sure of their own moral standard. Fifty years ago--even twenty years ago [this was first published in 1939]—it could be claimed that Europe and the English-speaking world overseas were Christian—not indeed that life in that area came up to Christian standard, but that the existence of such a standard was at least openly recognized. Homage was paid to it, if only with the lips, and there was shame in openly transgressing it" ("Prospects of Civilization," Oxford Pamphlets on World Affairs, 1939, p.12).

> quarrels were quarrels within one family and did not break the unity of culture: there was a Christian Europe.[19]

And if it should be felt that a Roman Catholic writer would be prone to present a prejudiced view, such an accusation can hardly be brought against H. G. Wells himself, who wrote:

> In the beginning of the seventh century Western Europe was a chaos of social and political fragments, with no common idea or hope [...]. But in the dawn of the eleventh century there is everywhere a common belief a linking idea, to which men could devote themselves and by which they could operate together in a universal enterprise [...]. Here for the first time we discover Europe with an idea and a soul![20]

It is true that there were indeed all kinds of abuses, many of them absolutely appalling. One only has to read Jules Michelet's *Satanism and Witchcraft: A Study in Medieval Superstition* to see the atrocious indignities which the poor suffered at the hands of the rich.[21] The inhumanity of men to fellow men was in some European countries almost beyond belief, though the church took no notice of it apparently. Nevertheless, there was a strange counter current of dedication to the service of God which seems to have underlain every aspect of human life among oppressed and oppressor alike. Thus J. R Hale, in his contribution to the Time-Life series on the *Great Ages of Man*, wrote with complete justification:

> In the Middle Ages the painter, the philosopher, the writer, had used their talents for a single purpose—to praise God and make His purposes plain. But in the Renaissance each branch of intellectual activity became distant from other branches, and each was justified in terms of its means rather than its ends.[22]

In that world there was an extraordinary unity of purpose, by and large, and it was a unity of *spiritual*, or perhaps one should say *religious* zeal, not merely of civic pride. Archbishop Hugo of Rouen, in a letter to Bishop Thierry of Amiens, has left us a record of how the famous cathedral of Chartres was raised. This is what he said:

> The inhabitants of Chartres have combined to aid in the construction of their church by transporting the materials [...]. The faithful of our diocese and of neighbouring regions have formed associations for the same object; they admit no one into their Company unless he has been to confession, has renounced enmities and revenges, and has reconciled himself with his

19. Maritain, Jacques, *True Humanism*, translated by Adamson, Jeffrey Bles, London, 1938, p.141.
20. Wells, H. G., *Outline of History*, Cassells, London (definitive edition), 1923, p.341.
21. Michelet, Jules, *Satanism and Witchcraft: A Study in Medieval Superstition*, translated by A. R. Allinson, Citadel Press, New York, 1962, 332 pages.
22. Hale, J. R., *The Renaissance in Great Ages of Man*, Time-Life, New York, 1965, p.19.

> enemies. This done, they elect a chief under whose direction they conduct their wagons in silence and humility.[23]

That it really *did* have a profound influence upon the hearts and minds of people seems to be reflected—as Sir Kenneth Clark has pointed out in his BBC series of lectures on civilization—in the quite exceptional beauty of features that characterized an extraordinary number of statues of the day which adorned the cathedral facades and interiors. Clark observed:

> I believe that the refinement, the look of selfless detachment and the spirituality of these heads is something entirely new in art. Beside them the gods and heroes of ancient Greece look arrogant, soulless and even slightly brutal. I fancy that the faces which look at us from the past are the surest indication we have of the meaning of an epoch [...]. The faces on the west portal of Chartres are amongst the most sincere and in a true sense, the most aristocratic that Western Europe ever produced.[24]

How strongly this contrasts with the pictures of violence and aggressiveness and sensuality which meet us now at every turn, in the newspapers, magazines, movie marquees, and TV programs. In his excellent study of Medieval processes of thought, Randall points out that there was a kind of universal attitude of mind by this time which coloured everything from the chance event to the cosmic sweep of "Providence," desiring to find meaning and significance everywhere. And so, as he puts it:

> The Middle Ages, in their very eagerness to understand the world about them, saw purposes everywhere, discovered intelligences at work in every event, and found the ultimate reason for the universe in the will of God, which, how ever inscrutable in its details, gave at least the promise of rationality and meaning to things.[25]

Such a philosophy led to some remarkable achievements in the matter of human relations: for example, between rich and poor. Because ideally all men had eternal value, all men had *equal* value and thus special gifts or great wealth were not viewed as evidence of superiority but rather as divinely appointed grounds for the assumption of greater responsibility. Whereas today wealth is not generally viewed in this light but tends rather to be credited to greater personal industry or business acumen than to the will of God, in Medieval times the tacit assumption was made almost universally that privilege and responsibility went together. Of course, there is always a large gap between theory and fact. Yet there

23. Fremantle, Anne, *The Age of Faith* in Great Ages of Man, Time-Life, 1965, p.125.
24. Clark, Kenneth, *Civilisation: A Personal View*, BBC and John Murray, London, 1969, p.56.
25. Randall, John H., *The Making of the Modern Mind*, Houghton Mifflin, New York, 1940, p.28.

is some gain in recognizing an ideal even if we fail to achieve it.[26] In many cases it *was* achieved, and the phrase *noblesse oblige* came to have some real significance.

In many parts of the Old World, this Christian concept is still greatly honoured by rich and poor to such an extent that class distinctions have often persisted harmoniously—to the puzzlement of those in the New World who, equally dedicated to the concept that all men are equal, are not quite so willing to allow that God might wish to distribute wealth unequally for His own good purposes. The Christian belief that all men are equal today tends to make us frown upon class distinctions, because we have failed to round out our Christian philosophy and we allow wealth and privilege to be treated largely as a personal matter. The same Christian belief in Medieval times that viewed all men as equal saw less evil in class distinctions, because wealth and privilege were wedded to responsibility. Again, it must be emphasized that this was only the Christian ideal. The rich often neglected it—but at least they knew they ought not to do so, and this knowledge had a modifying influence wherever the Church reinforced it.

Meanwhile, enough of this world view reached the individual to provide a "map" for him which, faulty though it was, nevertheless did allow him to recognize mentally the spot which marked his own position and about which he could relate himself to the Universe and to God and to his fellowmen in a way which compensated for his unhappy lot, because not only was he not "lost," but he also firmly believed that God had a plan for everything (including himself) and that compensation might be found in the next world.

If an analogy is allowed, we may reflect upon the fact that an unfamiliar pain or discomfort may be a source of much anxiety until we visit the doctor and are told, in a voice which generates confidence, that it is such and such a thing—the term itself being often quite beyond our comprehension. The comfort does not arise from the fact that *we* understand what the trouble is, but rather from the fact that the *doctor* understands what the trouble is. It was the general acceptance of the teaching and the world view of the Medieval Scholars which brought whatever peace of mind they had to the common people and delayed their rebellion against their unhappy lot for so long. The Universe around them had an explanation; it was not without purpose. So long as a man believes this, it is surprising how content he can be in the most frightful conditions. And by contrast, of course, the reverse is also true: once a man loses all faith in the meaningfulness of life and the purposefulness of the Universe, he may be utterly dissatisfied though he has every conceivable physical comfort. Although this Medieval world was "dark," men were happier walking in the dark with a small candle to see by, than walking in the light with no eyes at all.

Thomas Aquinas, though he added polish and sophistication to the Synthesis, did not altogether complete it. In his *Divine Comedy*, Dante added in poetic form the emotional element of which Aquinas was incapable. And in the great Gothic cathedrals the common people played their part in creating a vernacular edition. But as so often happens in history, this monumental creation had no sooner matured than it began to break down. It is an inherent weakness of any such system of thought that the lack of checks which observation and experiment

26. In illustration of his point, there is the story told of Cardinal Lavigene who, when asked, "What would you do if someone slapped your right cheek?" replied, "I know what I ought to do but I do not know what I would do" (reported by Julien Benda, *Betrayal of the Intellectuals*, Beacon Press, Boston, 1955, p.110).

provide causes it inevitably to crystallize into rigidity rather than to grow as a living thing. When the Arabs had penetrated up into Europe, to be stopped finally by Charles Martel in A.D. 732, they had brought with them new ideas which began a ferment of challenge to the old. Where St. Anselm in the eleventh century "believed in order that he might understand," Abelard, following on his heels, began to seek to understand in order that he might believe.[27]

The change taking place was a profound one. Yet in some respects it tended only to encourage the more minute elaboration and more involved justification by rational argument of the world view which had already been firmly embedded. It is the weakness of all such structured systems that when facts no longer support them, the facts are suspected and dogmatism takes the place of truth. Not until the fall of Constantinople in 1453—and with its fall the emigration of the learned Greeks who had there preserved the culture which had been destroyed in the West —did the fatal weaknesses of the Medieval Synthesis become fully apparent. It was the new knowledge which these Greeks carried with them into Europe that finally brought such a challenge to the old intellectual order as to show clearly that it had reached the limits of the mould in which it was cast. That mould was shattered by the new spirit of inquiry, and its destruction left men everywhere toying with the fragments.

27. Anselm quoted by John H. Randall, *The Making of the Modern Mind*, Houghton Mifflin, New York, 1940, p.93.

Chapter 2

The Modern Synthesis

History has been defined as the "drift of culture,"[28] and for the most part the word *drift* is appropriate since it implies a gradual change. It is convenient to divide history into epochs, but such divisions are not always meaningful. The flow of events goes on largely unbroken. Occasionally revolutions or wars mark the end of an age and serve as reference points, but more frequently the change occurs without too many people being aware of it at the time and only observing it concretely in retrospect. The passing of the old World View may not have been as sudden and as revolutionary to those who experienced the events which marked it as it seems to us now, and my description at the close of the last chapter is to this extent artificial. Yet it did come to an end: and the events which marked its breakdown can be examined with profit, because a new Synthesis is now being offered which parallels the Medieval one in many remarkable ways—and has, to my mind, reached a stage which is very close to that assumed by the Medieval Synthesis just before it began to break up. The causes of the collapse of the old World View were many and complex, some being internal and some external to it—but all had the same basic effect, undermining certain concepts fundamental to the integrity of the whole.

As an example of what I mean by internal causes, it may be recalled that man had been held to be central in God's creation. Since he lived on this earth, the earth itself was distinguished in a similar way. It was assumed on theological grounds to be at the centre of the Universe, and common sense experience strongly supported this view, for it was "obvious" that the stars and the sun and moon circled the earth.

Aristotelian philosophy was seen to lend its support to this geocentric picture, and it was accordingly favourably received as being confirming of "the truth" and therefore inherently sound in itself. The test of truth, as always, was not experimental verification, but harmony.

We have already noted that in the eleventh century St. Anselm had believed that he might understand. But following him came Abelard seeking to understand that he might believe. This circumstance reflects a subtle change in the structure of thought which re-positioned some of the older beliefs on a new base. This shift in emphasis from faith to reason had the effect of inverting the argument until it was held with equal assurance that since both reason (philosophy) and sense-experience supported the concept of an earth-centred Universe and since man was on the earth, he must be central to all else and this fact proved his

28. Drift of culture: a phrase coined, I think, by Edward Sapir.

paramount importance. The conclusion was as before, but the premise had been changed.

Having once accepted this idea, it was inevitable that the theological view of man should be endangered the moment the earth's centrality was challenged, though the danger was not immediately apparent.[29]

As an example of what I mean by external causes, one may cite the following. Between A.D. 1200 and 1400, there occurred five events, each of which contributed in a specific way toward the weakening of the old World View and together destroyed it completely. These were: 1) the fall of Constantinople, 2) the development of printing, 3) the perfection of gunpowder, 4) the discovery of the Americas, and 5) the plague called the Black Death.[30]

1) The fall of Constantinople led to the migration back into Europe of educated Greeks who had preserved in Asia Minor the Western culture which had been eclipsed in Europe after the sack of Rome by Alaric in 410. It was virtually an intellectual blood transfusion.
2) The development of printing, using movable type, long known in the Far East, had the tremendous effect of making written texts available to the ordinary reader on a scale never before thought possible. The new learning and new ideas introduced by the Greek immigrants spread far more rapidly than would otherwise have been the case.
3) The perfection of gunpowder, also well-known but in a less effective form in China, had the result of bringing to an end the feudal system, since castles no longer formed the "safe retreats" they had for centuries. Lords and nobles began to find themselves dependent on armies, and this meant raising, hiring, and keeping soldiers; the fact of reciprocal dependency between nobles and common men meant the beginning of the end of serfdom and ultimately led to the rise of a middle class of free wage-earners.
4) To this stimulus was added the discovery of the New World, which not only enlarged man's domain and broke down some of ethnocentrism, but also led to such an increase in trade and in the accumulation of wealth that the benefits of heaven began to pale in contrast with the more assured benefits to be gained on earth.
5) Finally, the Black Death came as such a tragedy, so appalling in its effects upon the lives of so many millions of people—rich and poor, sinner and saint—that faith in the benevolent order of things and God's sovereignty was severely shaken.

All these challenged a system that was too tidy to brook any demand for adjustment or revision, too neat a bundle of questions and answers to perceive

29. This is clear from the fact that when Copernicus finally published his *Book of Revolutions* in 1543, it contained an introduction by Pope Clement VII, commending the work. This fact, underscored by Arthur Koestler in an article entitled, "The Greatest Scandal in Christendom," (*Observer Weekend Review*, London, 2 February, 1964, p.21), shows how unfounded is the common assumption that Galileo dared not at first publish his views openly for fear of ecclesiastical censure. Koestler shows that Galileo's great fear was ridicule by his colleagues, the professors of Bologna, Pisa, Padua, and elsewhere. Galileo admitted this in a letter to Kepler, from which Koestler quotes. The church did not see it initially as a challenge to its own beliefs.

30. *Printing*: a Chinese invention. See Joseph Needham, *Science and Civilization in China,* Cambridge University Press, 1959, vol.IV, sect.32. *Gunpowder*: see also Needham, vol. I, p. 131 and elsewhere. *Black Death*: 1348-50, causing the death of a third of the total population of Europe, according to Wallace K. Ferguson, *A Survey of European Civilization*, Houghton Mifflin, New York, 1943, p. 406.

that they were no longer completely relevant, too cloistered to meet in open conflict with secular philosophies, too closely linked to the privileged classes to suit a bourgeois community, and too unwilling to submit to test by experiment to appeal any longer to the scientific minds which were forming the new intelligentsia. The collapse seems to have been sudden, almost like the instant disappearance of peace when total war is declared.

Theology as a Queen was deposed and her right to arbitrate denied in one area after another. The autonomy which each discipline began to claim for itself was not merely the rejection of the guidance of theology but even of any need to recognize interrelationships with other disciplines developing equally rapidly. The unity of knowledge was lost, and the loss was scarcely even noted. This autonomy expressed itself in the development within each discipline of a language and terminology appropriate to itself alone. While this had the effect of removing correctives which each science had once exercised upon all the others, it did have, however, the effect of greatly accelerating the extension of knowledge and of understanding within each branch of learning. And with greater understanding in a discipline came greater control of its own learning.

Thus came about a situation in which, as the Church with a sense of futility became less and less effective and steadily lost ground as a *spiritual* force, science continually gained ground and authority as a *secular* one. The theologians naturally set about the building of fences by seeking ways and means of limiting the freedom of the scientists. But the latter continued to perform more and more miracles for the common good as the Church performed fewer and fewer, and its defences were futile.

So successful was the Scientific Method in increasing man's dominion over nature that the use of reason alone and the replacement of faith by a growing skepticism became the order of the day. Not unnaturally the Church saw this—or thought it saw this—as the greatest danger to man's spiritual well-being, a well-being which had hitherto depended upon an unquestioning faith. Although the new knowledge led to a great increase in human productivity and the rise of a middle class which in turn favoured the spread of Protestantism, even Protestants looked upon the new rationalistic attitude as being very dangerous to faith. Not only the Council of Trent, which was a Roman Catholic conclave, but even Luther himself speaking for Protestants felt it necessary to protest against the use of reason.

The catechism of the Council of Trent (1545-63) has this statement:

> He who is gifted with the heavenly knowledge of faith is free from an inquisitive curiosity; for when God commands us to believe He does not propose to have us search into His divine judgments, nor to inquire into their reasons and causes, but demands an immutable faith [...]. Faith, therefore, excludes not only all doubt, but even the desire of subjecting its truth to demonstration.

While Luther defined reason as "that silly little fool, that Devil's bride, Dame Reason, God's worst enemy," he added:

> We know that reason is the Devil's harlot, and can do nothing but slander and harm all that God says and does. If, outside of Christ, you wish by your own thoughts to know your relation to God, you will break your neck. Thunder strikes him who examines. It is Satan's wisdom to tell what God is, and by doing so he will draw you into the abyss. Therefore, keep to revelation and do not try to understand.[31]

Calvin, too, viewed the free inquiry of the Humanists as the supreme heresy of thought, so that—as Randall points out—because the Reformers scorned all science, the way was left open for science to assert its claim to complete autonomy.[32] The rift between faith and science widened rapidly, and the emergence of the New Humanism seemed about to provide the common man with an alternative religion much more amenable to the spirit of the times.

It thus came about that from the religious ordering of secular life which had once been the rule, there came to be a secular ordering of life—even of religious life. The purpose of education increasingly became the emancipation of man rather than the worship of God, and the goal of life was the creation of a heaven here on earth much better suited to man's enjoyment because it was entirely of his own design. Kenneth Walker commented:

> When we trace the history of theology and science [...] we find that they slowly diverged from each other and in the course of time became isolated departments of knowledge expressing contradictory views of the universe. As Hardwick has pointed out, the human mind has a faculty of creating prisons for itself, and eventually the scientific spirit incarcerated itself in a materialistic scheme of the universe which completely cut it off not only from religion but from all fruitful speculation concerning man's nature. In like manner the self-sufficient pedantry of the church scholars had the effect of enclosing religion in a rigid casing of thought, which completely isolated it from all the new discoveries being made by the scientists. Insulated from each other's ideas and pitifully satisfied with the sufficiency of their respective beliefs, it was inevitable that in the end scientists and teachers of religion should come into conflict.[33]

Although it is true that, officially, Institutes of Higher Education adopted this apartheid policy, in the sphere of private life there are notable examples of scientists who maintained a more balanced view and did not hesitate to declare their faith while at the same time propounding their scientific views. The Royal Society in its founding membership contained not a few such men. As Coulson pointed out, a certain wholeness of outlook in the matter of science and religion lasted well into the beginnings of modern science. He wrote:

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31. Luther: as quoted by John H. Randall, *The Making of the Modern Mind*, Houghton Mifflin, New York, 1940, p.166.
32. Calvin: as quoted by John H. Randall, *Ibid*.
33. Walker, Kenneth, *Meaning and Purpose*, Pelican Books, London, 1944, p.28.

> Our Royal Society was founded in 1645, and to its growth and importance much of the dissemination of knowledge, without which science cannot live, is due. Among its members were John Wilkins and Seth Ward, both bishops; John Wallis, doctor of divinity and mathematician; Robert Boyle, the chemist who bequeathed the sum of £50 a year to found a lectureship for "proving the Christian religion against notorious infidels," and chiefly recommending his dear sister (his executor) to "the laying of the greatest part of the same (i.e., his personal estate) for the advance or propagation of the Christian religion among infidels"; John Ray, the founder of systematic botany and zoology, whose great book *The Wisdom of God Manifested in the Works of Creation* exercised a profound influence among thinking people and was even used in a shortened form by John Wesley in training his travelling preachers; Christopher Wren, astronomer and architect of St. Paul's Cathedral; as well as the greatest figure of them all, Isaac Newton, who claimed (though we might perhaps disagree with him in this) that his theological studies were at least as important as his strictly scientific ones. It may be true that religious discussions as such were not permitted at meetings of the Society; but in their second charter, the Fellows were commanded to direct their studies "to the glory of God the Creator, and the advantage of the human race." And any doubts regarding the relation between the Society and the Church were to be dispelled by its first historian, Sprat, who wrote:
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> "I do here in the beginning most sincerely declare that if this design (of a Royal Society) should in the least diminish the reverence that is due to the doctrine of Jesus Christ, it were so far from deserving protection that it ought to be abhorred by all the politic and prudent, as well as the devout, part of Christendom."[34]

Coulson rightly observes, "Of course, we know how the separation developed; it was the inevitable result of the atomization of knowledge."

University life gradually ceased to be a totality of studies pursued with a single object and harmoniously integrated into a satisfying World View. Centres of learning in time became what might far better be termed "multi-versities" than universities,[35] the only unifying factor being juxtaposition of faculties and

34. Coulson, C. A ., *Science and Christian Belief*, Oxford University Press, 1955, p.11.

35. Multi-versities: I believe I may be entitled to the claim of being the coiner of this word while at the University of Toronto in 1951. Among those of us who were at that time studying anthropology, it became an accepted term for the first time. I was interested to see it used so many years later by Claude Bissell in his report to the Governors and Senate of the University of Toronto, as reprinted in *Varsity Grad*., Annual Reports, 1964, p.18. And on page 39 of the same report, the situation which the term was designed to cover was summed up by a friend of very long ago, Prof. Roy Daniels of the University of British Columbia, when he said, "We [...] are committed to a great endeavor—the re-establishment of certainty amid doubts, of wholeness in the midst of fragmentation [...]." Kenneth Boulding in the same connection wrote, "There is sting in the remark of a Roman Catholic friend of mine that a State University is a 'City of God' that is all suburbs; our innumerable specialties spread around the intellectual map in formless clusters, with only the most congested trickles of communication between

simultaneity of lectures. What cohesion there was remained not because of any overriding feeling for a need of integration but purely for administrative convenience.[36] Such a blanket statement is, of course, too broad a generalization to be true in every case, for the breakdown of the "ideal" in many of the older universities led to the establishment, especially in the New World, of new universities (Harvard, for example) which had as their original objective the restoration of the old ideal with its central religious emphasis.[37] But the tide of events was already running too swiftly, and one by one even the newer universities, like the older ones, departed from the goals that had inspired their founding.

Smaller denominational and non-denominational universities and colleges sprang up to protest against the complete divorce of the new knowledge and religious faith, but unfortunately these small universities were and have continued to be at a tremendous disadvantage. By their very insistence on the importance of faith they have often had to surrender much of the kind of recognition from the scientific community that is essential to their growth. They suffer from lack of top-flight staff, not having funds for high salaries; exceptionally brilliant students fearing inadequate stimulation are discouraged from enrolling; and funding agencies are apt to withhold grants, suspecting the absence of a sufficiently competent staff or sophisticated facilities for research in

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them, and there seems to be no Centre which can relate one to the other" (*Religious Perspectives of College Teaching: On Economics*, Hazen Foundation, New Haven, 1952, p.22). In *Nature* (7 February, 1953, p.244), reference is made to an institute specially designed to contribute to this integration.

36. Fragmentation for convenience: Conway Zirkle made this observation: "It is hardly feasible to list all the impediments to a proper integration of human knowledge. We have become so accustomed to viewing the universe in splintered bits that many of us really assume that it has a cellular structure and that each cell can be treated conveniently as if it were a pigeonhole. This view is widespread even if it is not held overtly. It is the view that college university administrators seem to favour, for it promises to simplify their always-too-complex problems. Whenever they can, they assign a single pigeonhole to the custody of the corresponding academic department. Thus, by increasing the number of departments, the large colleges and universities may, literally, cover the universe, neatly, completely, and without jurisdictional conflicts. And each savant on the faculty will know just where he stands. Well, the concept at least is orderly!" ("Our Splintered Learning and the Status of Scientists," *Science*, April, 1955, p.517).

37. Concerning the original ideal which led to the formation of universities, John H. Hallowell, Professor of Political Science at Duke University, made this comment: "There is a great deal of talk among college and university teachers today about the importance of integrating our teaching, breaking across arbitrary departmental barriers and promoting interdisciplinary projects. But if we are to relate one subject to another it must be in terms of something which transcends them both. In religion, which is concerned with the whole of a man's life, with the totality of his experience, we have a body of thought and of experience that sheds light on all aspects of human experience and, as a consequence, can integrate subjects, particularly among the humanities and the social sciences, as nothing else can. Indeed, the original universities lay in just such a conviction. And to the extent that universities have lost the faith that originally inspired them, they have progressively lost the unity of purpose that made one out of many. The first college in America, Harvard College, was founded *In Christi Gloriam,* in the conviction that there could be no true knowledge or wisdom without Christ. Those today who are urging the colleges and universities to put religion back into higher education are not urging something upon them that is alien to their nature but are suggesting only that they revive the faith that originally inspired their founding." See *Religious Perspectives of College Teaching: in Political Science*, published by the Hazen Foundation, New Haven, p.33. Surprisingly, recent surveys have shown that colleges which have a theological bias have actually produced a remarkably large proportion of leading American scientists, a statement verified by John R. Sampey, "Training Leaders in Science and Religion" in the section "Comments and Communications" *Science*, vol.114, 1951, p.332. See further, C. A. Coulson, *Science and Christian Belief*, Oxford University Press, 1955, p.11; C. E. A. Turner, "Puritan Origins in Science" in *Transactions of the Victoria Institute*, vol.81, 1949, p.85-105.

depth. There are probably exceptions, but it seems largely to be a losing battle unless there is some compromise of faith.

As universities have become multi-versities, so the Universe itself has ceased to be a Universe in the Medieval sense and has become instead an unimaginably great aggregate of bits and pieces, apparently purposeless in itself, of which our little earth is an inconsequential fragment, and man himself an even more insignificant by-product. This last is the saddest and most disturbing of all the consequences, yet those who accept it seem to do so with a strange kind of enthusiasm.[38] Thus George Gaylord Simpson wrote in his *Meaning of Evolution*:

> Man is the result of a purposeless and materialistic process that did not have him in mind. He was not planned. He is a state of matter, a form of life, a sort of animal, and a species of the order Primates, akin nearly and remotely to all of life and indeed to all that is material.[39]

On another occasion the same author wrote with even more enthusiasm:

> There was no anticipation of man's coming. He responds to no plan and fulfills no supernal purpose. He stands alone in the Universe, a unique product of a long unconscious, impersonal, material process, with unique understandings and potentialities. These he owes to no one but himself, and it is to himself that he is responsible. He is not the creature of uncontrollable and indeterminable forces but his own master.[40]

It is a heroic creed in the light of recent history, yet Simpson is merely working out to its logical conclusion a philosophy which rejects God. When there are no supernatural forces at work, then every appearance of what has hitherto been termed a spiritual life must be reduced to the level of physics and chemistry, perhaps ultimately to electrochemistry alone, and every appearance of transcendental purpose denied. Starting with an accidental by-product of natural forces, everything else must be supposed to have occurred as a result of the inherent properties of matter. This is not new. Democritus of Abdera (470 - 361? B.C.) explained the Universe by a host of fortuitous circumstances, and Anaxagoras of Clazomenae (500 - 428 B.C.) held that a single element must have somehow contained within itself the entire diversity to which it automatically gave birth in time.[41] Bertrand Russell wrote:

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38. E. L. Mascall in his *Importance of Being Human* (Columbia University Press, 1958) underscores the difficulty "which civilized western man in the world of today experiences in convincing himself that he has any special assigned status in the Universe [...] and the sense of instability which this uncertainty produces." He adds, "Many of the psychological disorders which are so common and distressing a feature of our times are, I believe, to be traced to this cause" (p.19).
39. Simpson, George Gaylord, *The Meaning of Evolution*, Yale University Press, 1952, pp.344-45.
40. Simpson: quoted by John Pfeiffer, "Some Comments on Popular Science Books" in *Science*, vol.117, 1953, p.403.
41. As quoted by Jacques Maritain, *Introduction to Philosophy*, Sheed and Ward, New York 1955, pp.52, 54.

> That man is the product of causes which had no pre-vision of the end they were achieving: that his origin, his growth, his hopes and fears, his loves and beliefs, are but the outcome of accidental collocations of atoms: that no fire, no heroism, no intensity of thought and feeling, can preserve an individual life beyond the grave: that all the labours of the ages, all the devotion, all the inspirations, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system, and that the whole temple of man's achievement must inevitably be buried beneath the debris of a universe in ruins—all these things, if not quite beyond dispute, are yet so nearly certain, that no philosophy which rejects them can hope to stand.[42]

This pessimism is prevalent among modern authors. Not long ago Arthur Balfour expressed the same sentiment:

> The energies of our [solar] system will decay, the glory of the sun will be dimmed, and the earth, tideless and inert, will no longer tolerate the race which has for a moment disturbed its solitude. Man will go down into the pit and all his thoughts will perish. The uneasy consciousness, which in this obscure corner has for a brief space broken the contented silence of the universe will be for ever at rest. Matter will know itself no longer. "Imperishable monuments" and "immortal deeds," death itself and love stronger than death, will be as if they had not been. Nor will anything that is, be better or worse for all [that] the labour, genius, devotion, and suffering of man have striven through countless ages to effect.[43]

It would have seemed utterly incredible to the Medieval mind that human beings could really accept and live by such a philosophy. And yet it is so. But there is evidence that just as the older view which had invited such an expansive exercise of faith and demanded little use of reason was ultimately destined to collapse, so now, we may discern that the modern view which depends so largely upon reason and disallows the exercise of faith is also showing signs of its inadequacy. The human spirit cannot long survive a diet of such dry bread. A few years ago, Leslie Paul, with eloquence equal to that of Bertrand Russell, pictured Russell's world in the following way:

> The entire term of humanity is but a minute episode in a scarcely longer history of life on a cooling planet which for the most of its existence knew no life at all. And that planet in the infinite immensity of the universe is a tiny scrap of matter rushing with all other scraps—and from all other scraps—at

42. Russell: as quoted by J. W. N. Sullivan, *Limitations of Science*, Pelican Books, London, 1938, p.175.
43. Balfour: quoted by John Custance, *Wisdom, Madness, and Folly*, Pellegrine and Cudahy, New York, 1952, p.128.

> colossal speed to heaven knows what destination in the curvature of space.
>
> In no one knows what time, though it will be soon enough by astronomical clocks, the lonely planet will cool, all life will die, all mind will cease, and it will all be as if it had never happened. That, to be honest, is the goal to which evolution is travelling, that is the "benevolent" end of the furious living and furious dying [...]. All life is no more than a match struck in the dark and blown out again. The final result [...] is to deprive it completely of meaning.[44]

In his latest book, Simpson has two chapters devoted to an examination of why science has set out so rigidly to exclude the concept of purpose.[45] Basically his argument is that you cannot have purpose without a Purposer, and a Purposer introduces supernature, with which science cannot possibly deal by its own terms of reference. The faith of science, according to Howard Becker, is that the answer to any problem which it so far has been unable to resolve completely is simply "more science".[46] But science has been so successful in dealing with those limited aspects of experience to which it is restricted by its own catechism that the public has been led to assume that what science has ignored could in fact be denied altogether.[47] The scientist in turn, sharing in the spirit of the times, has ultimately come to support this view, so that an opinion has become very widely accepted which attributes to science an omnicompetence which it does not in fact have and did not originally claim. It enjoys competence by dealing only with part of the truth; and denying that there is any other kind of truth it claims *omni*-competence. In the meantime, no one is any longer disturbed when a paleontologist like Simpson speaks with a pompous infallibility on certain philosophical issues which are entirely outside his field. On the contrary, the public is led to believe that what he has to say about the absence of purpose in the Universe and man's position as an accidental by-product of it has the same kind of absolute validity as his announcement about the size of some newly discovered prehistoric reptile. The Medieval Church made equally dogmatic statements which were similarly

44. Paul, Leslie, *The Annihilation of Man*, Harcourt Brace, New York, 1945, p.154.

45. Simpson, George Gaylord, *This View of Life*, Harcourt Brace and World, New York, 1963, chaps. 10 and 11. As a rest cure, I suggest a reading of F. Wood Jones's delightful and thoroughly rewarding *Trends of Life*, Arnold, London, 1953, especially chap. 2.

46. Becker, Howard, University of Wisconsin, in a lecture before the Anthropology Department of the University of Toronto, February 1952, entitled "Science, Culture and Society." Simpson himself puts it this way: "It is a necessary condition and indeed part of the definition of Science in the modern sense that only natural explanations of material phenomena are to be sought or can be considered scientifically tenable" (*The Meaning of Evolution*, Yale University Press, 1952, p.131).

47. Huxley, Aldous, *Science, Liberty and Peace*, Harper, New York, 1946, as reviewed in *Science* by R. T. Cox, who sums up Huxley's views as follows: "Even the fascination of power over the inanimate forces of nature has contributed to the world's trouble, by leading people to mistake for final reality the restricted aspects of experience by the study of which scientists have shown how to attain this power. Where scientists, properly for their own purposes, have ignored a part of experience, general opinion has gone farther and denied its existence altogether" (vol.105, 1947, p.134). Similarly Kenneth Walker observed, "When scientists have announced that they are not concerned with the significance or purpose of things, but only with certain relationships which exist between them, onlookers have often mistakenly assumed the absence of all purpose and meaning" (*Meaning and Purpose*, Pelican Books, London, 1944, p.22).

outside its competence to declare an opinion upon. And in precisely the same way, and for much the same reason, the common man was duly impressed: the tables have now been turned—but the practice is the same, and so is the effect.

Thus having rejoiced in his new liberation from the constricting World View which, while it imposed moral restrictions upon his behaviour and thinking, at least gave meaning to life as a whole, man in time found himself largely free of restrictions—but also in a completely impersonal universe. It was not long before the entire absence of purpose or meaning in history proved intellectually disturbing, and efforts began to be made once again to re-establish meaning on some basis other than a theological one.[48] This is reflected in attempts made to arrange history into cycles, to find in the successive rise and fall of nations and cultures a key which, without introducing God into the picture, would still provide some kind of a "map" that would enable each contemporary culture to see its position in the march of events and to orient its thinking and behaviour accordingly. The works of Vico, Petrie, Sorokin, Spengler and Toynbee are all illustrations of this urge. To the extent that the controlling factor in the movement of history in each of their philosophies is strictly "deterministic" or "spiritual," to that extent various types of people have found them satisfying.[49] In the deterministic view, the controlling factors include such things as economics, climate, geography, genetic endowment, and natural resources.[50] Some have viewed history in cultural terms. Others like Toynbee have tended toward a more spiritual view in that they look upon the decay and collapse of a civilization as being caused by a breakdown in its moral life or a weakening of its spiritual vigour. On the whole, where the view has been predominantly deterministic, it

48. In this connection, Schrodinger made this observation (in 1945): "We have inherited from our forefathers the keen longing for unified, all-embracing knowledge. The very name given the highest institutions of learning reminds us, that from antiquity and throughout many centuries the universal aspect has been the only one to be given full credit. But the spread, both in width and depth, of the multifarious branches of knowledge during the last hundred odd years has confronted us with a queer dilemma. We feel clearly that we are only now beginning to acquire reliable material for welding together the sum total of all that is known into a whole. But, on the other hand, it has become next to impossible for a single mind fully to command more than a small specialized portion of it. "I can see no other escape from this dilemma (lest our true aim be lost forever) than that some of us should venture to embark on a synthesis of facts and theories, albeit with second-hand and incomplete knowledge of some of them--and at the risk of making fools of ourselves" (as quoted by S. H. and S. M. Cohn, "The Role of Cybernetics in Physiology," *Scientific Monthly*, February, 1953, p.85).

49. Giovanni Battista Vico (1668-1744), an Italian philosopher whose chief work was published in France by Michelet in 1827 under the title *Principiis de la Philosophie d'Histoire*.
Sir William Petrie, *Revolutions of History*, Harper, New York, 1911.
Pitirim Sorokin, *Contemporary Sociological Theories*, Harper, New York, 1928.
Oswald Spengler, *Decline of the West*, Allen and Unwin, London, 1926.
Arnold Toynbee, *A Study of History*, 6 vols., Oxford University Press, 1946-57.
See also A. L. Kroeber, "The Superorganic" in *American Anthropologist*, vol.19, 1917, p.162-213; and R. C. Collingwood in two articles in *Antiquity*, September and December, 1927.

50. Under Deterministic views, there are Climatic, Cultural, Biological and Physical, Economic, and Geographic. Climatic: Ellsworth Huntington, *Mainsprings of Civilization*, Wiley, New York, 1945. Cultural: Leslie A. White--see for example "Man's Control Over Civilization" in *Science Monthly*, March, 1948, pp.240ff. Biological and Physical: Julian Huxley, Bertrand Russell, *et al*., Economic: Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Ward, Lock and Co., London, 1776. Contrast, however, C. W. M. Hart, "The Hawthorne Experiments" in *Canadian Journal of Economics and Political Science*, vol. 9, 1943. Geographic: Griffith Taylor, in various volumes, including *Environment and Race*, Oxford University Press, 1927; *Environment and Nations*, Toronto University Press, 1936; *Environment, Race and Migration*, Toronto and Chicago University Presses, 1944; and other works.

has been more acceptable to scientifically minded people; where it has been related rather to values within the culture, it has been more acceptable to men of faith.

At any rate, these endeavours—and some of them have been tremendous works, massive in both scholarship and volume—are symptomatic of the need which man feels for some kind of faith in some kind of meaning and purpose in history. For most of us, a purposeless universe is not merely disquieting in the negative sense, but positively debilitating, undermining our sense of value in things which do not serve personally useful ends, and leading to a very unhealthy state of skepticism about "good" of any kind. Fromm wrote, "Another way of paralysing the ability to think critically is the destruction of any kind of structuralized picture of the world."[51] This kind of negative effect—the absence of an integrated world view—is itself harmful. But the possession of one may or may not be satisfying. Benjamin observed, "Man achieves a satisfying life largely to the extent to which he is able to include the widest range of intellectual experiences with the minimum of conflict between any two."[52] A belief system that is compounded of mutually contradictory elements cannot survive; it must have an inner logical—rather, theological—consistency; it must have the power to create an integrating framework for all else.

Even among intellectuals where skepticism is a kind of habit of mind, there is a growing feeling that somehow the various branches of knowledge need re-integration, not merely because it would be convenient from the educational point of view, but because it is felt that the present situation imposes positive limitations on the practical use to which our accumulated knowledge can be put. These limitations, therefore, relate not merely to the desirability of achieving a true education in the classical sense, but even the more practical object of using the information to make further advances in control or in understanding. It is becoming apparent that a too rigid departmentalization has had the curious effect of making us ignorant, not because we know too little, but because there is too much to be known. The individual is no longer able to adjust to the growth of knowledge sufficiently to integrate it.

While there is no doubt that the lot of the average man has physically improved and culturally his opportunities are now immeasurably greater than they were in the Middle Ages, in the matter of controlling individual behaviour the advance has not been so spectacular. The social sciences appeared to benefit tremendously by the new spirit of free inquiry and indirectly have sought increasingly to make use of the methods and tools which have contributed so greatly to man's control over his environment. At first, there was unbounded optimism that human nature was perfectible by scientific methods. Evolutionary philosophy encouraged this belief, for if man had reached his present high estate as the result of forces which operated in the absence of any deliberate and conscious attempt on man's part to improve himself, how much more might be achieved by effort consciously directed toward an end so desirable. Melvin Rader observed:

> At the dawn of modern science, man was immensely confident that its uses would be beneficent. The great medieval

51. Fromm, Erich, *Escape From Freedom*, Rinehart, New York, 1941, p.251.
52. Benjamin, A. Cornelius, "Science and the Pursuit of Value," *Science Monthly*, October, 1946, p.311.

> seer, Roger Bacon, was fired by a deep enthusiasm for the new world that science would create. It would reveal the past, present, and future, and secure the vast improvement and the indefinite prolongation of life! Similarly such Renaissance thinkers as Giordano Bruno, Leonardo da Vinci, and Thomasso Campanella, harbingers of the modern scientific and technological revolution were intoxicated with its infinite promise. Such optimism found ample expression in the work of Francis Bacon who believed that science would enlarge the bounds of human empire to the effecting of all things possible [...] and in writing the New Atlantis jubilantly imagined the Utopia he believed scientific progress would achieve.[53]

Of course, such a view is greatly encouraged by belief in the inheritance of acquired characteristics, which held that the gains made in each generation would be accumulated so that each individual would stand on the shoulders of his predecessors. As Sir Alfred Zimmern expressed it:

> Up to about fifty years ago, it was the accepted view among biologists that acquired characters—that is to say, physical and mental characteristics which a living organism took on during its own life time—were transmitted from one generation to another together with the original inherited makeup. It was this belief which enabled the early social scientists to have so confident a view about the social progress of mankind. They thought that biology gave them the authority to look forward to a steady process of development in human nature under the influence of a rapidly improving environment.
>
> Improved conditions would lead to an improvement in human nature, and this in its turn would lead to a further improvement in conditions. Thus, by a process akin to that of compound interest, the gains would be increasingly multiplied on both sides until, in the course of a very few generations, the blessings of Western Civilization would be extended over the face of the globe, and man everywhere in the ancient East and in primitive Africa would be ready to live harmoniously under western institutions, and in the words of Tennyson, echoing the popular science of his day, to accept the authority of a single government, "the parliament of man", and "federation of the world".[54]

53. Rader, Melvin, "Technology and Community" in *Scientific Monthly*, June, 1948; pp.502-4. This is a most valuable paper.

54. Zimmern, Sir Alfred, *Prospects of Civilization*, Oxford Pamphlets on World Affairs, 1939, p.22. Zimmern adds, "We know today that these hopes were unwarranted. Acquired characteristics are not inherited—at least not in any form or degree which are relevant for sociologists and political scientists. For all practical purposes, the material of human nature, the stock of instincts and impulses, of qualities and attitudes, with which our statesmen have to contend is the same as that with which not merely Pharaoh and Nebuchadnezzar but the tribal leaders of the Stone Age had to deal. Every baby that is born, insofar as it has not been affected by pre-natal influences, is a Stone Age baby." So also Robert Briffault: "It may be doubted whether the modern civilized individual differs greatly as regards

Tennyson was influenced, like most men of his day, by Herbert Spencer's philosophy which, it should be pointed out, preceded the publication of Darwin's *Origin of Species*, just as Tennyson's *In Memoriam* did—a fact surprising to many who are not aware of it. In his *Social Statics*, Spencer has a chapter entitled, optimistically, "The Evanescence of Evil." In this appears the following passage, which reflects the prevailing sentiments of the day:

> The influence that as advancement has hitherto been the rule, it will be the rule henceforth, may be called a plausible speculation. But when it is shown that this advancement is the working of a universal law; and in virtue of that law it must continue until the state we call perfection is reached, then the advent of such a state is removed out of the region of probability into that of certainty. If anyone demurs to this, let him point of the error [...].
>
> Progress therefore is not an accident but a necessity [...]. As surely as a blacksmith's arm grows large and the skin of a labourer's hand becomes thick [...] as surely as a passion grows by indulgence and diminishes when restrained . . . so surely must the things we call evil and immorality disappear; so surely must man become perfect.[55]

Perhaps one more quotation may be *apropos*, this time from Kenneth Walker, who wrote:

> The nineteenth century was an age of great expansion, of ever widening horizons and of unfounded confidence in the steady progress of humanity. It was believed that under the guidance of Science men were advancing swiftly towards a not too distant millennium.[56]

And finally, a summary statement which shows how progress was to some extent identified not so much with improving human nature as with improving man's lot, in the firm belief that complete mastery of the cosmos would guarantee the improvement of man himself. This mastery was to result from "understanding," and by understanding was meant the reduction of everything to fundamental principles. Thus Andre Schlemmer wrote:

> To the scientist of, say, the end of the nineteenth history, the palace of science was to be an edifice the completion of which was merely a matter of time. The framework had been designed, some of the rooms were ready, some were only waiting to be furnished; on the other hand, some parts of the building were

inherited capacities from his ancestors of the Stone Age: the difference between savagedom and civilization is not organic but cultural" ("Evolution of the Human Species" in *The Making of Man*, edited by V. F. Calverton, Modern Library, New York, 1931, p.763).

55. Herbert Spencer: quoted by G. H. Clark, *A Christian Philosophy of Education*, Eerdmans, Grand Rapids, 1946, p.54.

56. Walker, Kenneth, *Meaning and Purpose*, Pelican Books, London, 1944, p.31.

> just having their foundations laid out but one could already have an idea of what the whole would be. The principles of conservation of energy and of matter were making the substance of the world under study materially solid and reliable, and the laws of physics were relatively simple and coherent. The atomic theory and the laws of thermodynamics gave a good account of what chemistry had recorded.
>
> The discoveries in organic chemistry on the one part, and in biology on the other, made it possible to expect the reduction of the latter science to the terms of the former. Some striking experiments in psychophysiology, joined to the discovery of the localization of a few cerebral activities, gave the hope, soon transformed into belief, that psychology might be a part of physiology.
>
> Evolution gave an account of the passage from elementary to human life, and history was explaining sociology itself by the action of economic and psychological facts. The whole world would soon be explained by a system of sticks and strings.[57]

When Darwin's *Origin of Species* appeared in print in 1858, it was sold out almost in a matter of hours. Darwin himself seems to have been surprised, but his surprise is really only in keeping with a trait in his character which showed up in an odd lack of awareness of how much his own thinking was influenced by other people. It has often been said that ideas are born of the times and that the credited originator merely acts as a vehicle for the idea to find its own expression.[58] Calverton in his introduction to *The Making of Man* observed:

> The very simultaneity with which Darwin and [Alfred Russell] Wallace struck upon the theory of natural selection and the survival of the fittest was magnificent proof of the intense activity of the idea at the time. Every force in the environment, economic and social, conspired to the success of the doctrine.[59]

In the University of Chicago Darwin Centennial Celebrations, a paper was presented by A. L. Kroeber on this very point, and he puts the matter in perspective, saying:

> There is a sort of huge disproportion between Darwin's specific contribution to Science [...] and the overwhelming effect which the establishment of this purely biologic principle [of natural selection] came to have on total science. There was evidently a particular historic concatenation in the world's

57. Schlemmer, Andre, *Crisis in the World of Thought*, Inter-Varsity, London, 1940, pp.15-16.
58. Ihde, Aaron J., "The Inevitability of Scientific Discovery" in *Scientific Monthly*, December, 1948, pp.427-29.
59. Calverton, V. F., *The Making of Man*, Modern Library, New York, 1931, p.2.

> thought which enabled Darwin's discovery to trigger off consequences so great.[60]

Man, it seemed, had at last discovered the unifying principle he sought which—when applied across the board, not merely in zoology—would bring order into man's intellectual life. Tremendous excitement followed, because it seemed to many that a satisfying and rational World View might, after all, be possible without any need for even an "absentee" God, though Darwin himself hesitated to go this far at first. The word *evolution* became a household term, an open sesame to every process, and the key to all understanding. As Susanne Langer has pointed out, there are times when the very coining of a word seems to be all that is required to start vast new trains of thought and to set the mind free to explore in an entirely new way.[61] It is almost like the invention of a research tool such as the telescope or the electron microscope.

Where it had been sufficient in Medieval times in the face of any mystery merely to refer back to God, it now became necessary in the same situation merely to refer to Evolution. Art, language, technology—everything began to be interpreted in this new light and history reconstructed accordingly. The determination to apply this concept universally created an intellectual atmosphere which—just as nature abhors a vacuum—equally abhorred the idea of discontinuities or exceptions. Once the concept had taken hold, it became a consuming passion, in the life sciences in particular but in the physical sciences as well, to construct what Arthur J. Lovejoy has described as "the Great Chain of Being."[62]

The underlying principle here is that from the appearance of the very first atom to the final annihilation of all matter, if such a thing were ever to happen, one ought ideally to be able to establish a series of natural links from event to event which involved no super-nature and no gaps whatever, not even the kind of gaps which would analogously be represented by discrete steps up an incline. This was no stairway, and much less a ladder—but a smooth incline, the stages not being perceptibly separated from one another. Of course, there were limits to this, and these limitations were freely acknowledged. For example, it did not seem likely that after the appearance of the first atom and before the appearance of the second one there would be a series of fractions of an atom in process of formation, though even this is today being proposed.[63] But as far as possible everything was to be joined to everything else with no discontinuities. And it became a common pastime to establish things in series—evolutionary series, that is. The simple always preceded the complex. The process of complexification was a natural one inherent in things themselves. Whenever two nearly related objects were juxtaposed, there was an irresistible temptation to put in the link between them. As Lovejoy says, for example, there was tremendous excitement when the polyp

60. Kroeber, A. L., in his paper entitled "Evolution, History, and Culture" in *Evolution After Darwin: The Evolution of Man*, vol. 2, edited by S. Tax, University of Chicago Press, 1960, p.1.

61. Langer, Susanne, *Philosophy in a New Key*, Mentor Books, New York, 1948, p.18: see especially chap. 5, pp.83-116.

62. Lovejoy, Arthur J., *The Great Chain of Being*, Harvard University Press, 1942.

63. On this see O. R. Frisch in a series of articles in *The Listener*, vol.63, BBC: 21 January, 1960, p.119f., "Exploring the Subatomic World,"; 28 January, 1960, p.l73ff., "The Strange Particles,"; 4 February, l960, p.217ff., "Strangeness and Parity."

hydra were first identified as a link between plant and animal life.[64] And similarly biologists achieved great satisfaction when a link appeared to have been discovered (in archaeopteryx) between birds and reptiles.

The "missing link," which was paramount to the whole system—the link between animals and man—was predicted with such assurance because it was so necessary for the completion of the system that no one was really surprised when it appeared to be found in so-called fossil ape-man: Piltdown, for example. Indeed, that Piltdown Man proved so successful a forgery was only because those who believed in the "Modern Synthesis", as Huxley called it, accepted uncritically almost anything that was concordant with it. It was exactly what had happened in the Medieval one. The intellectual climate of both is the same.

But there have remained certain missing links of a quite critical nature, which tend to be hopefully minimized but yet persist. These are (1) the link between matter and no matter, i.e., the origin of matter itself, (2) the link between dead matter and living matter; (3) the link between man and the other primates; and (4) the link between what is merely consciousness and what is self-consciousness.

Considering these briefly, we have first the origin of matter. Failing all other solutions, it would seem that this problem has been skirted by suggesting, as Hoyle has done, that there "never was no matter,"[65] that matter is eternal, and that the universe is everlastingly regenerating itself. But it seems to me that to say that matter has always been there is merely postponing the question of where *it* came from. We can no more conceive of the infinity of matter than we can of the sudden creation of it *ex nihilo*. Both require an exercise in faith which is scarcely supported by any kind of mental picture of what is involved. One is neither more nor less reasonable than the other.

With respect to the second missing link, the origin of life, it was firmly believed that Pasteur had once for all settled the question as to whether life could appear spontaneously. Since this demonstration had been made by the scientific method, it did not seem that it could be challenged. But it is being challenged now—a circumstance which illustrates what has been appropriately called the "implacable offensive of science". It is challenged by the discovery that in a laboratory environment it is possible artificially to create a situation, such as could have very well existed in the past, which permits the synthesis by natural forces of certain of the building blocks that distinguish living from dead matter.[66] These discoveries have led biologists to believe that life could have arisen purely by accident. It is the nature of things, they say, that anything which *can* happen *will* happen inevitably if one has enough time.

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64. Lovejoy, Arthur O., *The Great Chain of Being*, Harvard University Press, 1942, p.233.

65. Hoyle, F., *Nature of the Universe*, Basil Blackwell, Oxford, 1950.

66. S. L. Miller, working in the laboratory of Harold Urey, in 1955, circulated a mixture of water vapor, methane, ammonia, and hydrogen through an apparatus in which they were exposed to a silent electric discharge. A week later, analysis showed it to contain glycine and aniline in a mixture of other amino acids—i.e., organic compounds previously thought to be produced only from living matter. J. Bronowuki, reviewing a book by Michael A. Arbib entitled, *Brains, Machines and Mathematics* in *Scientific American*, June, 1964, p.133, makes the following observation, "Nothing that has been discovered in the past ten years, or that has resisted discovery, has made us despair of the basic tenet that biological processes have the same mechanism as physical processes. No reputable investigator intends to abandon the search for such concrete mechanisms or to fall back on some mystic vitalism to relieve him of the ardors of the search."

Concerning the third link, it may be said that it has been "found" many times, but further knowledge has invariably lessened the certainty that such finds really are the links sought. Man has not been completely defined yet, and although he is always looked upon as a unique animal in a class by himself, it is not so easy to define wherein his uniqueness lies. There is general agreement that his possession of language and his powers of abstraction are together decisive factors, but how is one to determine whether or not fossils possessed either of these things? Every effort to derive human language by some evolutionary process from the so-called language of animals has failed, and the first people to admit this fact today are the linguists themselves.[67] Nevertheless, the feeling persists that human language is merely an extension, and most people are persuaded that in a rather nebulous way they could conceive of the stages in the process. Thus, even here there is much wishful thinking that the Great Chain can yet be completed. These three links from no-matter to matter, from dead matter to living matter, and from animal to man are therefore optimistically believed to be well on the way to resolution.

And finally, there is the fourth link—which is more disturbing, since it is of such a nature that it is hard to conceive of any experiment which could be designed to resolve it. Superficially, the possession of self-consciousness does not seem to be essentially different from the possession of consciousness, and yet in fact it is: every line of research so far explored has only strengthened the view (1) that man alone possesses it and no other animal, and (2) that to its possession must be attributed all of civilization. Man's every thought and every word is ultimately dependent upon his powers of abstraction and his use of language, both of which are universally considered to be dependent in turn upon the possession of self-consciousness. Indeed, the very existence of science results entirely from this unique faculty. How did it arise? The point is worth examining.

The consciousness of creatures other than man is evidently not a lower form of self-consciousness but something qualitatively different, though perhaps sharing some element of it. Both involve awareness, and therefore both involve the central nervous system. Yet animals with no effective brain (decerebrated) perform many functions,[68] including the raising of young, which would seem to demand consciousness but which, it is reasonably sure, they do not possess in this mutilated condition. Even decerebrate humans show evidences of something which looks exactly like consciousness. Man has no way of knowing what "pure" animal consciousness is; when he thinks about the subject, he becomes conscious of consciousness in his own person and in this process becomes self-conscious. The evidence that animals do not have this self-awareness is extensive and involved: it is one of the few conclusions resulting from research in the behavioural sciences on which, as far as I know, there is virtually unanimous agreement.

So we have to account for a new thing in the natural order. If consciousness is awareness and if awareness is a form of nerve irritability and if the activity

67. For a summary of this evidence, see A. C. Custance, "Who Taught Adam to Speak?" Part 6 in *Genesis and Early Man*, vol. II of The Doorway Papers by Zondervan publishing Co.

68. Decerebrate animals: see H. C. Bazett and W. G. Penfield, "A Study of the Sherrington Decerebrate Animal in the Chronic As Well As the Acute Condition" in *Brain* (Journal of Neurology), vol.45, 1922, p.185-265. Also Sir Charles Sherrington, *Man on his Nature*, Anchor Books, Doubleday, New York, 1955, pp.156-57.

which accompanies awareness can be performed to an astounding degree as a kind of closed-circuit automated reflex, then it *might* be possible to derive consciousness from matter itself as a kind of specialized electrical activity. J. B. S. Watson and the Behaviourist School are really doing just this.

But self-consciousness is a step further for in this instance matter does not merely respond to stimuli, but actually becomes aware of its own inclination to respond, which is a very different thing. "Matter has become conscious of itself," as Mascall has put it.[69] And by so doing, it becomes possible for it deliberately to delay or check its own response. This delay is what makes man a freely acting creature, liberated from the chains which bind action to reaction and characterize all instinctive behaviour. It is the supreme gift which Huxley is at pains to account for, but which he still wishes to call an accidental "acquisition," like sight or hearing or any other of the senses that are supposedly traced naturalistically to some inherent irritability in matter. He has spoken of it as "a glorious paradox"[70] that what is to be regarded as an essentially purposeless mechanism after one thousand million years of blind and automatic operation has finally generated freedom of choice as one of the attributes of our own species and in so doing has, as he expressed it, "superseded itself" as the blind thing that it once was.[71]

The evolutionists do not hesitate to derive sight and hearing from something that was in an earlier stage of evolution "not quite sight or hearing but incipiently so." One step further back, they propose, we find merely a "sensitive area"—photosensitive or pressure sensitive, as the case may be. Going back a step further still, we have only an aggregate of otherwise normal body cells that nevertheless happen to have the potential of becoming in time sensitive in these ways. Further back still, these cells are indistinguishable from all other cells, as indeed they appear to be at one stage in the embryo. The fact is, then, that these people are arguing for an unbroken chain in the process which "tends" of itself to move toward higher organization and capabilities entirely without the introduction of any new element or force. It is hoped to fill out the links not only between species of animals, but between the faculties they possess and the cells which structure these faculties, and even the atoms which constitute these cells.

In short, vision and bearing and all the other senses are merely terminal phases of capacities inherent in matter from the start, requiring only time and the right forces to "let them emerge". Thus arose the power of irritability—and of awareness —and therefore so also of consciousness. It is really not mysterious at all. All mystery is explained away by using the magic word *evolution*. Primitive people have long believed that the power to understand is dependent merely upon a knowledge of how to use the Magic Word!

In a way, it may be said that this movement toward the "reduction" of all phenomena associated with living things began with a manifesto presented to the world by three men: Carl Ludwig (1816 - 1895), who taught most of the great physiologists of the world who were active in the latter part of the nineteenth century; Emil du Boris-reymand (1818 - 1896), the founder of electrophysiology; and Hermann von Helmholtz (1812 - 1894), who needs no introduction.[72] Here in

69. Mascall, E. L., *The Importance of Being Human*, Columbia University Press, 1958, p.35.
70. Huxley, Julian, *Rationalist Annual*, 1946, p.87.
71. See J. Thorpe, "Progress and Purpose in Evolution" in *The Listener*, BBC, 30 July, 1953, p.172.
72. Leake, Chauncey D., "Perspectives of Adaptation: Historical Background" in *Handbook of Physiology*, sect. 4, American Physiological Society, Washington, 1964, pp.5-6.

essence is what they agreed upon: "All the activities of living material, including consciousness, are ultimately to be explained in terms of physics and chemistry." This manifesto was received with varying degrees of interest. It was profoundly influential in Russia as the result of the studies of I. M. Sechenov (1829 - 1905), one of Ludwig's pupils who demonstrated the physical and chemical factors altering the activity of the nervous system.

Later on, this philosophy was to influence profoundly the thinking of Bertrand Russell, who wrote:

> The evidence, though not conclusive, tends to show that everything distinctive of living matter can be reduced to chemistry, and therefore ultimately to physics.
>
> The fundamental laws governing living matter are, in all likelihood, the very same that govern the behaviour of the hydrogen atom, namely, the laws of quantum mechanics [...]. In the chain of events from sense organ to muscle, everything is determined by the laws of macroscopic physics.[73]

It seems that once an idea has been accepted by enough people of importance it becomes self-perpetuating, being thereafter accepted by newcomers to the field not because it has been demonstrated by the scientific method but because of the weight of authority behind it. Now and then some outstanding scientist in the field may raise a question—as J. B. S. Haldane has done in this particular instance—but on the whole the doctrine, once it has hardened, tends only to be hardened still further by each successive generation. The unbelievable can be stated in such a way as to make it sound perfectly reasonable.

In a recent article in the British journal *Nature*, Ponnamperuma arrives at the conclusion that "life itself is only a special though complicated property of matter and that *au fond* there is really no difference between a living organism and lifeless matter."[74] Wood Jones observed that if you poke a corpse you can predict what will happen, but if you poke a live body you can't—and this unpredictability is a basic difference! But given enough information, Huxley might have replied, "This unpredictability will disappear."

This is one of the great goals of all science. Ralph Gerard observed, "Science aims to translate experience into general laws of predictive value."[75] It is true that in lowly forms of animal life prediction is more successful than in the higher forms, and that in the higher forms some prediction is still possible. But in man the method which has allowed prediction to be made elsewhere does not seem to have worked very well. Indeed, as Susanne Langer has observed, the failure of the method of the exact sciences to provide really vivifying leads to research in the social sciences may be evidence that they cannot actually be applied.[76]

73. Russell, Bertrand, *Human Knowledge: Its Scope and Limits*, Allen and Unwin, London, 1961, p.36.
74. Ponnamperuma, C., "Chemical Evolution and the Origin of Life" in *Nature*, vol.201, 1964, p.337.
75. Gerard, Ralph, "The Scope of Science" in *Scientific Monthly*, June, 1947, p.496.
76. Langer, Susanne, *Philosophy in a New Key*, Mentor Books, New York, 1948, p.18. Some thoughts on the social responsibility of scientists will be found in *Science*, vol.109, 1949, p.637. Here M. F. Ashley Montagu, in a note entitled "The Conscience of the Past and the Practice of the Present," records some words by Father Francesco Lana (1631 - 1687), by some named the inventor of the first airship (though too poor actually to build one!): "Other difficulties I see not, which may be objected against this Invention, besides the one which seems to me greater than all the rest, and that is, that it may be thought

In a paper relating science to sociology, Isaiah Bowman, the President of Johns Hopkins University, summed up the contribution of the former to the latter in the following way:

> It is a clever, cynical and hard-bitten world that science is making, one in which the idealistic and the spiritual are bound to have a diminishing place. Viewed against a background of classical education, science has been a disadvantage to our society.
>
> If the most important questions of mankind are those concerning spiritual relations with one another and with God, then science is not to be taken seriously. Through dazzling discovery and successful practical application science gives a sense of power which is both demoralizing and dangerous [...].
>
> Science has taught us analysis, but we have had as yet no large scale and equally successful synthetic constructions that bear on human conduct.[77]

The successes of science have largely resulted by treating nature as a machine. The assumption is then made that because man is part of nature, he too is essentially a machine—and therefore ought to be treated the same. Unfortunately, the method has not proved successful: it has merely led to his disappearance as a person so that it is no longer "man" that is being treated.

Thus it appears that in the case of man we are dealing with something more than merely an aggregate of matter. Thorpe has pointed out that Huxley himself

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that God will never suffer this Invention to take effect because of the many consequences which may disturb the civil government of men. For who sees not, that no City can be secure against attack [...] the same would happen to private Houses, and Ships on the sea [...]. And this they may do [...] with such security that they which cast those things down from a height out of gun-shot. cannot on the other side be offended by those below." To the question, then, why *has* God allowed the invention, an answer is given by D. R. Davis, *Down Peacock Feathers*, Jeffrey Bles, London, 1942, pp.21-26. See also Max Planck, "Meaning and Limitations of Exact Science" in *Science*, vol.110, 1949, p.319ff. A brief but useful article with special reference to Boyle and Newton in this connection will be found in the *Journal of Science and Religion*, vol.I, no.1, Paternoster Press, London, 1947, p.13ff. A striking example of the sense of responsibility of a scientist in earlier days will be found in *Science*, vol.90, 1939, p.180. So also Hugh Dryden wrote "The cold sharp tools of science have not been effective in penetrating the area of human emotions, purposes, and values. 'It is the Nemesis of the struggle for exactitude by the men of science,' remarked the biologist, H. S. Jennings, 'that leads him to present a mutilated, merely fictional account of the world as a true and complete picture.' 'You can no more analyse these imponderables by scientific methods,' said Eddington, 'than you can extract the square root of a sonnet,' ("The Scientist in Contemporary Life" in *Science*, vol.120, 1954, p.1053). See also a review of Bertrand Russell's rationalist philosophy in *Nature*, 25 December, 1954, p.1162.

Conant in his *On Understanding Science* (Mentor Books, New York, 1951, p.25) argues that the methods of science are not necessarily applicable to matters of ordinary life. Maurice B. Visscher, in an article entitled "The Duty to Doubt and the Will to Believe" (*Bulletin of the Atomic Scientists*, December, 1956. p.357) observes, "It has been said recently that when scientists move into philosophic or sociological realms, they 'somehow divest themselves of the scientific method with which they live in the laboratory'." This is only as it should be really. For the detachment which is proper in the laboratory must be replaced by identification in the human situation so that the scientific method is no longer strictly applicable. But they are still popularly credited with the supposed omnicompetence of scientists.

77. Bowman, Isaiah, "Science and Social Pioneering" in *Science*, vol.90, 1939, p.312.

has come a long way from the old view of the animal as merely a machine and has been driven to assent to the possibility that all living substance has what, for the moment, must be called "mind-like" properties.[78] This is perhaps why he took such a favourable attitude toward the work of Teilhard de Chardin, who attributed "mind" to the whole cosmos, to every particle in it, without admitting to a pantheistic view of it.[79] It is a strange thing to see Julian Huxley recommending the work of a theologian, as he did when he wrote the introduction to *The Phenomenon of Man*, but necessity as well as adversity makes strange bedfellows.

It is a long way from pure materialism to the admission that the very first atoms had a kind of mind-like component and "knew" what to do from the beginning, even though the knowing was a very lowly process. But to suggest that they had a kind of self-consciousness is to imply that they not merely knew what to do, but knew they were doing it! It is not simply a matter of admitting they possessed consciousness in some lowly form, but even self-consciousness. If this is not so, then *self*-consciousness is an intruder originating outside the system and not merely a result of the unfolding of the potential of matter itself. But such an intrusion cannot be allowed, and Huxley is thus virtually forced to say that man "is nothing else than evolution become conscious of itself"![80] It is amazing what words will do—and how easily they can gloss over a fatal flaw in an argument

In *The Great Chain of Being*, Arthur O. Lovejoy traces the attempts which have been made in the past to link all forms of life in an unbroken chain by introducing an infinite number of intermediate stages wherever there were apparent discontinuities. These links were demanded between species, of course, and between the non-living and the living. There can be no jumps. The connections must form a smooth slide. The same is required between unconsciousness and consciousness. As Lovejoy points out, "panpsychism" was the view that there is some kind of consciousness, some form of animatedness, some "soul" in *everything*—atoms, stones, plants, animals, man, angels, and God alike. It is a question of degree.

Consciousness is not considered to be an emergent property or function which is very quietly but very abruptly "there" in sentient matter, but must of necessity be assumed to have been existent at a very low level even before it was "manifested" anywhere. This has been termed the "retrotensive" concept, which holds that "whatever is empirically found in or associated with the more complex and highly evolved natural entities must inferentially be read back into the simpler and earlier ones."[81] It has been argued that there are but two views possible: Consciousness is inherent in *all* matter, even in atoms, or it has been introduced from outside.

In answer to Ponnamperuma, Professor Lawden wrote subsequently (also in *Nature*) that he felt the real problem had been skated around and not really faced up to at all. Thus he observed:

> For many years the evidence has been strongly in favour of the view that there is no difference between a living organism

78. Thorpe, J., "Progress and Purpose in Evolution" in *The Listener*, BBC, 30 July, 1953, p.171.
79. Teilhard de Chardin, Pierre, *The Phenomenon of Man*, Collins, London, 1959, 320 pages.
80. Huxley, Julian: in preface of *ibid*., p. 21.
81. Lovejoy, Arthur O., *The Great Chain of Being*, Harper Torchbooks, New York, 1960, p.276.

> and lifeless matter and, in any event, experience in every field of science suggests powerfully that nature is a unity which can be divided into categories for human convenience, but that we must never lose sight of the fact that the boundaries so introduced are man-made and possess no counterparts in reality [...].
>
> Nature seems to satisfy a principle of continuity, so that the marking of dividing lines on her fabric may throw into relief some features of the pattern but it inevitably distorts the reality.
>
> This principle of continuity is exemplified as the smooth gradation of forms from the fundamental particles to ourselves, thus constituting a hierarchy at no level of which can a clear dividing line between the living and dead be distinguished.[82]

Lawden then went on to say that the belief that even human behaviour can be adequately explained by the laws of physics would no longer be challenged by many, yet he expressed some doubts as to whether the consciousness which is his brain—i.e., *self*-consciousness—can really be so accounted for. As he put it:

> I fail to understand how [self] consciousness could ever arise in any matter system how ever complex. A system of particles, each of which possesses the known physical characteristics of electrical charge, spin, etc., might very well be designed to behave like a human being but not to *experience* consciousness as human beings undoubtedly do [...].
>
> We may perhaps hope to explain human behaviour, but *our experience* of this behaviour will remain unaccounted for [emphasis mine].[83]

This question of self-consciousness was the subject of a paper by Seymour S. Kety, entitled "A Biologist Examines the Mind and Behaviour."[84] He first points out that machines can be built or can be designed which will evaluate and discriminate, learn from experience, and even adapt to changing situations, so that it seems possible that an electronic brain could be made which would simulate human behaviour. Yet "there remains one biological phenomenon [...] for which there is no valid physiochemical model and (or so it seems to me) little likelihood of developing one; this is the phenomenon of consciousness." The author uses the word *consciousness*, but the context of the paper as a whole shows that he really has in mind *self*-consciousness. Thus subsequently he quotes A. E. Fessard (*Brain, Mechanisms and Consciousness*, 1954) as having said,

> Momentary distributions of patterns of excitatory or inhibitory state [...] have been proposed [...] as the basis for conscious experience; but what makes a pattern 'conscious' of its own patterning remains an irritating problem.

82. Lawden, D. F., "Chemical Evolution and the Origin of Life" in *Nature*, 25 April, 1964, p.412.
83. *Ibid*.
84. Kety, S. S., "A Biologist Examines the Mind and Behaviour" in *Science*, vol.132, 1960, p.1861, 1863.

Kety then discusses the electro-physico-chemical basis of mental activity and shows that the total energy of the process of thinking can be measured in metabolic terms and expressed as a power requirement equivalent to twenty watts. Experiments are described which show that the "difference between normal consciousness and the depths of coma is only a matter of seven or eight watts." He adds, "Now that we have an energy equivalent for thought I'm not at all sure this proves the physical nature of consciousness."

Much of his own research has apparently been directed toward the determination of the metabolic cost of various types of abnormal mental activity, research which must have provided much reason to encourage the view that consciousness is "nothing but" an electrochemical process.

This leads Kety into a brief discussion of the mechanistic view of behaviour. After quoting Claude Bernard to the effect that "determinism thus becomes the foundation of all scientific progress and criticism," he concludes: "Although I share this faith, I cannot avoid pointing out that it is faith rather than proof which forms the basis of this Olympian generalization."

It is my awareness of my own behaviour that is the new thing crucial to the whole issue. Whence did this self-consciousness arise? The current mechanistic view is quite unable to account for it. I have a mindfulness of my own mind; because I have, I also possess the power to explore the ways in which it could have arisen. But this possession also engenders certain intellectual needs, leading me to search for my relationship to all the other existences around me which seem to lack self-awareness entirely and consequently enjoy a kind of harmony among themselves which I do not share in—yet which I often envy.

Man somehow stands outside the rest of Creation, able to contemplate both it and himself, and able also to ponder the meaning of his own strange unrelatedness to it. The Psalmist, too, asked "What is man?" (Psalm 8:4). But he saw the question as part of a larger one with another dimension to it, the fact that God has taken special notice of him—indeed, in the Incarnation, has "visited" him in His own Person. God the Creator took upon Himself, not the form of animals nor the form of angels, but the form of man, thus creating a bond between Himself and man that is unique in Creation. It was because this fact was fully recognized in the Medieval World View that it still appears to have been so remarkably satisfying for all its faults. It viewed man, not merely as a creature of God and therefore part of the rest of God's creation, but as a creature so uniquely related to Him as to stand apart from all other creatures and with a unique destiny. It was natural to look upon all else, under God, as existing for his special benefit. The purpose of the Universe was related to this God-to-man kinship. The meaning of everything was therefore found by reference to a point outside the system itself, the unique relationship between God and man, both of whom transcend the ordinary limits of time and space by which the rest of nature is bound. The modern World View denies this reference point and being therefore a closed system of cause and effect, cannot even "criticize" itself sufficiently to observe its own logical weakness and philosophical inadequacy.[85]

Man's mind works in such a way that it is pointless to speak of the Universe as having a "purpose" unless it is a purpose which primarily has as its end something that concerns man himself. Some other purpose—say, to lead to a

85. P. W. Bridgman, "Science and Common Sense" in *Scientific Monthly*, July, 1954, p.35.

breed of super-animals other than man—still makes it, for him, an entirely unsatisfactory process.

Even most materialistic investigators admit that there certainly is every appearance of plan and purpose in Nature. Thus Simpson in one of his more recent books agrees that "there are without any doubt directional forces in evolution."[86] And again "there is, or seems to be, an essential order or plan in spite of the great multiplicity. There seems, moreover, to be purpose in this plan."[87] Part of this purpose is observable in the phenomenon of pre-adaptation, by which is meant the appearance of a structure in an antecedent form which serves no purpose at the time but emerges in later forms as a useful organism. Again, to quote Simpson:

> There is little doubt that pre-adaptation does really occur [...]. We shall see that pre-adaptation, with some expansion and modification of its significance, must be accepted [...]. Earlier opinions that random pre-adaptation is an adequate explanation of adaptation were, however, quite unjustified.[88]

Medawar gives as an example the fact that human beings are born with a thicker epidermis on the sole of the foot than elsewhere on the body. This is a pre-adaptation, for, as he points out, it can have served no purpose up to this time since the fetus is strictly treading water.[89] Throughout the history of life in the past, similar phenomena have been noted, the first evidences of a pre-adaptation often appearing a very long time before the organ began to serve a useful purpose—many, many generations later. The fact has so impressed one prominent paleontologist that he finds it impossible to account for it without introducing some "spiritual power which has planned and directed evolution."[90]

Yet at the same time, as we have already noted in several places, Simpson denies categorically that the appearance of man was anything more than an accident. So there is really no meaning to this kind of plan and purpose because the preparatory process itself, by not having man specifically in view, ceases to have any meaning for him beyond that of being academically interesting. If one is persuaded that the stage has been specifically prepared for oneself, then one's being on the stage has a quite different effect upon behaviour than would the knowledge that no such preparations were made but that the stage just happened. In one view, man is fulfilling his destiny, but in the other he is merely taking

86. Simpson, George Gaylord, *This View of Life*, Harcourt, Brace & World, New York, 1963, p.187.
87. *Ibid*., p.191.
88. *Ibid*., p.203.
89. Medawar, Sir Peter B., *The Uniqueness of the Individual*, Basic Books, New York, 1957, p.34.
90. Broom, R.: quoted by G. G. Simpson, *This View of Life*, Harcourt, Brace & World, New York, 1963, p.199. In Simpson's original paper in *Scientific Monthly*, (June, 1947) on "The Problem of Plan and Purpose in Nature," he attributes this statement to Broom but without documentation. In his *Meaning of Evolution*, (Yale, 1952, p.325), he refers to Broom's original article, "Evolution as the Paleontologist Sees It" (*South African Journal of Science*, vol.29, l932, p.54-71), but I cannot find this exact statement in it. Even science itself—not merely evolutionary biology—has come to take the form of a kind of religion. In his Gifford Lecture, published as "The *Relevance of Science, Creation and Cosmogony*" (Harper and Row, New York, 1964), C. F. von Weizsacker concludes that "today's faith in Science plays the role of a dominating religion, differing little in its mythical ('theoretical') components from the universal myths of the past." It even has its "priestly caste, the technologist and expert." See a review by H. L. Nieburg in *Science*, vol.147, 1965, p.1434. And in von Weizacker's book, pages 15, 18, 23, 160.

over—and this quite by accident. By viewing the Universe as a completely Creator-less phenomenon, man finds himself to be of no greater significance than the atoms out of which he is constructed. The answer to the question "What is man?" is not satisfying unless it has reference to the end for which he exists. If this end is merely to contribute to the acceleration of a hitherto blind process, it seems quite unrealistic to believe that such an end will provide a spring for action that requires sacrifice and devotion or calls forth the best in man.

It does not satisfy *my* mind, at any rate, because the super-man which Huxley envisages in the dim and distant future bears little if any relationship to me. This future creature is neither me in my children, nor me in my fellow man. Indeed, it will be a creature vastly superior and really quite unlike me. If it is not, then the "Huxley Plan" will have failed in its objective, which is to direct evolution deliberately into something higher. To provide me with the inspiration that is required to strive for something else than merely my selfish interests, I must have a goal that I can visualize and I must be convinced that the goal is worth sacrificing myself for. The "new revelation" makes no attempt to define the goal; it only seek to assure us that there is one. This is not the stuff out of which convictions are made, and without convictions life is flat and dull indeed!

The displacement of the Medieval Synthesis in which "meaning" was achieved by relating man to God had led to a synthesis which men are no longer related to God nor even to one another, but only to the rest of the animal world at the best, and all other atoms in it at the worst. How is life to have any real significance in such an atmosphere?

In the old days, it is true that men were very tired because they had to work so hard. Today we are merely bored, which is far worse. We are bored because all real drama has gone out of life, so that we find ourselves searching frantically to alleviate our boredom by entering into drama synthetically in books, movies, theatre, television, and even spectator sports. Lewis Mumford has vividly described how in Medieval times, in spite of what appears to us now as the even tenor and eventlessness of each day, man's life was really full of drama. He said:

> Every culture has its characteristic drama. It chooses from the sum total of human possibilities certain acts and interests, certain processes and values and endows them with special significance: provides them with a setting, organizes rites and ceremonies: excludes from the circle of dramatic response a thousand other daily acts which, though they remain part of the "real" world, are not active agents in the drama itself [...].
>
> What was the essential drama of the Medieval Culture? It took place within the Church; it conceived the passage of sinning man through an evil and painful world, from which he might emerge through repentance into heaven, or sink through hardness of heart or confirmed mischief into hell. The earth itself was but a mean stopping place, a wayside tavern of ill fame, on the way to those other worlds. But nothing that concerned this drama was mean: on the contrary the Church, founded through an act of God, brought into the world constant reminders of the grace and beauty that was to come: though art and music might

> tempt men from a higher life, they also indicated its possibility, indeed its immanence. Life was a succession of episodes in man's pilgrimage to heaven: for each great moment the Church had its sacrament or its celebration. Beneath the active drama was the constant chant of prayer: in solitude or in company men communed with God and praised Him.[91]

Even in Shakespeare's time, all the world was still a stage and all the men and women actors, each with his little part to play. Today man has been changed from an actor on a stage into an animal in a laboratory—and the laboratory has no Personal Director. Carl Becker ably summed up the situation when he wrote:

> It has taken eight centuries to replace the conception of existence as a divinely composed and purposeful drama to the conceptions of existence as a blindly running flux of disintegrating energy.[92]

Admitting all its faults, this Medieval Synthesis must have more nearly satisfied man's spirit than our present one does, simply because the individual actors in the drama all had, and were sure they had, some place in the drama. The Modern Synthesis, by contrast, makes the individual virtually of no significance, and the drama in which he is acting out his little piece is essentially indifferent to whether he as an individual succeeds or fails in it. He even finds himself on the stage quite by accident. The common man in Medieval times must often have felt that he was little more than a puppet, but at least he had the assurance that there was a "Puppeteer" who was very much aware of his performance. The common man today often has the feeling of being merely a thing of circumstance, a feeling which is only heightened by the added suspicion that the puppeteer is "mindless chance."

Most of us are sufficiently aware of the wonders which are everywhere to be discovered in Nature to feel that accident is not really adequate to account for them. We may give mental assent to a purely materialistic evolutionary philosophy, but emotionally we find it difficult to believe that the perfection of the eye or the ear or the hand, or the wing of a bird, or the mimicry of a butterfly or insect, or the radar of a bat arose purely by accident. Thus, to quote Medawar again:

> These are intelligible [doubts], but they are founded upon a misconception, namely, that evolution is a perfectionist process. The eye, for example, is beset by chromatic and spherical aberration, and is not correctly centred along its optical axis: Helmholtz, the grand master of physiological optics, said that an optician would be ashamed to make an instrument with such elementary physical faults.[93]

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91. Mumford, Lewis, *The Culture of Cities*, Harcourt Brace, New York, 1938, pp.60-61.
92. Becker, Carl, "The Heavenly City of the 18th Century Philosophers": quoted by C. I. Glickuberg in "Science and the Literary Mind" in *Scientific Monthly*, June, 1950, p.353.
93. Medawar, Sir Peter B., *The Uniqueness of the Individual*, Basic Books, New York, 1957, p.122.

Medawar then proceeds to a study of the imperfections of man, overlooking entirely the possibility that man became a fallen creature, defiled physiologically by generations of unnatural living.[94] As to the faults which may exist in the eye, for example, there are many authorities who would immediately challenge this statement as it stands. The fact is that, as in certain other organs, what may appear as "faults" can often be explained as necessary departures from a purely idealistically perfect form in order to gain certain advantages in operation which would have to be surrendered if the idealized form were to be adopted. In point of fact, perfection must always be defined not in some abstract mechanical terms, but in terms of suitability for function in the actual situation in which the mechanism must work. As an example, there are certain "faults" in the design of the human hand which make it uncommonly difficult to get the fingers warm again if they have once become severely chilled. But to meet this exceptional requirement, certain structural changes would be necessary which would almost certainly rob the fingers of some of their extraordinary powers of manipulation, as in playing a piano concerto. The Designer has to weigh the advantages of each gain and each loss. Sir Charles Bell wrote on the human hand in his famous contribution to the *Bridgewater Treatises*, and because of his reverent attitude, reading his essay can be almost an act of worship.[95] Modern essays on anatomy are apt to be very different, their main object being an excursion into a supposed evolutionary origin, which has quite another effect on the mind of the reader.

These two approaches to the study of an organ such as the hand may both be concerned among other things with the question of design in nature. But there is little doubt as to which of them will contribute most toward a philosophy which has the power of stirring men to action. The motive power in human affairs depends upon the goal which man sees for himself. Lewis Mumford rightly points out that "if society is paralysed today, it is not for lack of means but lack of purpose."[96] Julian Huxley was very well aware of this and for some time busily underscored the idea that while everything in the past has occurred by accident, a creature has now emerged who can consciously direct the future. And this, he

94. *Ibid.*, pp.122-33 (chap. 6). A good illustration of the fact that "fitness" must be defined in terms of "application" is human skin. W. Montagna, an authority, after speaking of the things human skin has to do, says it "has achieved a remarkably effective compromise" (see "The Skin" in *Scientific American*, February, 1965, p.56f.). F. Wood Jones has some pointed words in this connection. He wrote, "All the great naturalists of the pre-Darwinian period had a profound realization of the harmony effected by the various structural developments begot in response to functional demands. Great emphasis was laid upon the fitness of the creature to fulfill its life's role in the surroundings in which it happened to find itself. There was admiration for the development of parts and organs and for the perfections of the adaptation of structure to function.

"But after the advent of Charles Darwin's theory, a profound change of thought concerning all this became apparent in biological literature; and a morbid enthusiasm was displayed in seeking for atavistic, rudimentary and apparently useless structures. Disharmonies were sought for and discovered.

"The harmonies that had so much appealed to the naturalists and anatomists of the 18th century were ignored. The phase of pessimism is well expressed by Eli Metchnikoff (1845 - 1916) in his work, *The Nature of Man*, in which he sought to prove that most living things, when examined critically, could be demonstrated to be made up of a series of misfits and disharmonies, structural, physiological and psychological" (*Trends of Life*, Arnold, London, 1953, p.86).

95. Bell, Sir Charles, "The Hand: Its Mechanism and Vital Endowments as Evincing Design" in *Bridgewater Treatises*, Pickering, London, 1837.

96. Mumford, Lewis, *The Culture of Cities*, Harcourt Brace, New York, 1938, p.229. On the need for an effective motivation, Edmund Sinnott has written with characteristic lucidity in a paper entitled "Ten Million Scientists" in *Science*, vol.111, 1950, p.123ff.

believed, is all that is needed to convert his Modern Synthesis into a proper substitute for the Medieval one. To this end he argued that

> [...] man is enabled and, indeed, forced to view his destiny as the trustee, spearhead, or effective agent of any further evolutionary progress on this planet. He has been thrown up by the cosmic process as an instrument for the further carrying on of that process.[97]

Huxley actually called this "the latest revelation" and appropriately (or otherwise) spoke of it all as part of the new "religion," adding:

> Further, insofar as an effective new belief system must have a religious aspect, it will doubtless need to await for the appearance of a prophet who can cast it into compelling form and shake the world with it.[98]

We have spoken of the manner in which Medieval man because of his philosophy of life had a map upon which he could pinpoint his own position and relate himself to everything around him. With such a map he might *be* lost, for the map might be faulty, but he never suffered from the lost feelings which plague our own generation. Elsewhere, Huxley acknowledged man's need in this sense, for he said in his closing words:

> In the long run, our actions are related to our over-all picture, our map of reality [...]. Even an insect like a bee has to build up a three-dimensional map of the country round its hive to find its way about. It is in relation to the total picture of its surroundings that it steers itself in space.
>
> But man's surroundings are enormously larger, and in them he has to steer himself in time as well as in space. That is why his map must be a four-dimensional one. A three-dimensional one will help him determine his position and chart his direction, but a four-dimensional one will also help him in choosing his destination.[99]

In the volume from which this quotation is taken, Huxley set forth not only the "destiny" which he saw for man, but the means by which it is to be achieved.

97. Huxley, Julian, "New Bottles for New Wine: Ideology and Scientific Knowledge" in *Journal of the Royal Anthropological Institute*, vol.80, parts I and II, 1950, p.20.
98. *Ibid*.
99. Huxley, Julian, *Evolution in Action*, Chatto and Windus, London, 1953, p.153. It seems odd, perhaps, to hear a scientist of Huxley's stamp acknowledging that any kind of religious value has had any kind of significance. He is not alone in this however. Andrew Ivy in a paper on medical research pointed out that there are plenty of goals toward which the energies of men may be *religiously* directed—the conquest of hunger and disease, for example. But science and technology in themselves are not enough. They have little value unless used as tools for the attainment of something worthwhile beyond themselves. As he put it, "We have reached the point in the development of science and civilization where it is clear that they cannot survive without a sound moral philosophy" ("Medical Research: Operation Humanity" in *Scientific Monthly*, February, 1949, pp.120-21).

Evolutionary philosophy is summed up in the answer he gave to these two matters of great importance. As to the destiny, it is merely some higher animal form; as to the means, it is essentially eugenics.[100] It promises man the opportunity of being, in some remote descendant, a superior organism for a fleeting moment, after which he will cease to be. Huxley was persuaded that there can be no higher or more noble goal.[101] How strange that a man with intelligence and such tremendous learning should be so blind as not to see that his beloved theory has already been cast in the form of a religious faith and has indeed shaken the world, leading to a war and to barbarities and to the destruction of life and culture and property on a scale mankind hopes never to witness again. For Hitler was the child of Nietzsche, and Nietzsche was the child of Darwin,[102] and in Darwin this new faith was spelled out in a "scientific" form. But most of us will feel with Henry Margenau that although science has its vogue and its successes are impressive enough in its own field, "yet by itself it is powerless to mold the behaviour of men for good."[103]

In conclusion, we cannot do better than quote the words of E. T. Whittaker of the University of Edinburgh, who wrote:

> At the present time there is a movement in scientific circles aimed at securing for science a greater influence on human affairs and even calling for a re-founding of civilization on a scientific basis. But its advocates do not always understand that, as a necessary condition for the possibility of such a reform, Science must be re-integrated into a unity with philosophy and religion.[104]

But does any religious view of the world accord sufficiently closely with reality that it is capable of providing the basic framework within which such a re-integration could be achieved? The question is, Can Christianity today succeed where Medieval Christianity failed?

100. *Ibid.*, p.152. In the light of our knowledge of what went on in Germany during the last great war, where a "scientific" program for the breeding of a super-race was undertaken, eugenics has come to be viewed with distrust. For who is to define the *eu*-? A rather helpful summary in brief form of the problems involved in this definition will be found in the March, 1965, issue of the *Scientific American*, under Letters to the Editor, pages 8-10. This very useful magazine is readily obtainable in most large libraries. My own teacher in human genetics at the University of Toronto (Dr. Norma Ford Walker) used to remind us that it may be difficult from the point of view of the community as a whole to justify breeding intellectual giants and to discourage the breeding of simpletons. The former can quite easily become an extremely self-seeking or even crooked individual, the latter are apt to be amicable and less dangerous—and indeed, often useful to society in performing simple tasks unacceptable to most of us. Moreover, they help to keep alive in us some of those finer feelings of pity and kindness. On this side of the Atlantic, geneticists are not on the whole very sympathetic toward eugenics, and we publish no eugenics journals in America. Huxley, with his usual bombast, is oversimplifying the problem.
101. *Ibid.*, p.152.
102. Statement made by Will Durant, *The Story of Philosophy*, Simon & Schuster, New York, 1926, p.435.
103. Margenau, Henry, "Ethical Science" in *Scientific Monthly*, November, 1949, p.290.
104. Whittaker, E. T., "Aristotle, Newton and Einstein" in *Science*, vol.98, 1943, p.270.

Chapter 3

History Repeats Itself

The number of parallelisms between the Medieval Synthesis and its modern counterpart are remarkable, not only the spirit in which they have been defended and in the treatment accorded challengers, but also in the basic philosophy which has governed the attitude of the orthodox toward new discoveries. In some instances the role of the leading characters has been reversed, but a comparison between the two world views and the underlying dogmatism which appears in both is most revealing and shows that there is very little difference between the two mentalities which seem otherwise completely opposed.

It is commonly supposed—and I shared this opinion for many years—that the Medieval Synthesis toppled because it opposed Galileo. Arthur Koestler considers that the events leading to and resulting from Galileo's trial formed a kind of turning point in history and "precipitated the divorce of science from faith."[105] This is not the time or place to attempt a sorting out of all the facts of the case in this trial (it has been done in a masterly way—and entirely by reference to original letters, pamphlets and minutes of meetings—by Arthur Koestler), but it is important to note that a tremendous amount of mythology has accumulated around these circumstances. Galileo is pictured as a kind of martyr to the truth and his Inquisitors as evil men dedicated to dogma and determined to silence his plea for a hearing. They are said to have refused to look through his telescope and to have stood firmly in the way of an advance in the science of astronomy.

The facts are somewhat otherwise. Some reviews of Koestler's *Sleepwalkers* have accused him of shallowness and even inaccuracy.[106] Yet any reader who will merely study the numerous excerpts he has presented from original sources would, I think, come to the conclusion that Galileo deserved far worse treatment than he actually got. To quote Koestler once again, "I believe the idea that Galileo's trial was a kind of Greek tragedy, a showdown between 'blind faith' and 'enlightened reason,' to be naively erroneous."[107] Judging by Galileo's correspondence and other records of his opinion of himself, he was fantastically

105. Koestler, Arthur, *The Sleepwalkers: A History of Man's Changing Vision of the Universe*, Hutchinson, London, 1959, p.495.
106. Reviews: for a favorable review of some length, see that by Milton K. Munitz in *Science*, vol.130, 1959, p.326ff.; for one not quite so favourable but very complete, see that by I. Bernard Cohen in *Scientific Monthly*, June, 1959, pp.187ff.
107. Koestler, Arthur, *The Sleepwalkers: A History of Man's Changing Vision of the Universe*, Hutchinson, London, 1959, p.485.

selfish intellectually and almost unbelievably conceited. As an illustration of the former, there is the now well-known fact that he refused to share with his colleagues or with acquaintances such as Kepler any of his own findings or insights; he actually claimed to be the only one who ever would make any new discovery! In writing to an acquaintance he expressed himself as follows:

> You cannot help it, Mr. Sarsi, that it was granted to me alone to discover all the new phenomena in the sky and nothing to anybody else. This is the truth which neither malice nor envy can suppress.[108]

Like many others with such vanity, Galileo was hypersensitive to criticism—and I cannot refrain from including here a revealing incident which is really rather funny. While he was staying at the house of a friend, toward the end of 1612, he heard via "the grapevine" that a certain Dominican father had "attacked" his views in a private conversation. Galileo immediately wrote demanding an explanation. The accused was an old man of seventy years, who wrote back.

> I have never dreamt of getting involved in such matters [...]. I am at a loss to know what grounds there can be for such a suspicion, since this thing had never occurred to me.
>
> It is indeed true that I, not with a desire to argue, but merely to avoid giving the impression of a blockhead when the discussion was started by others, did say a few words just to show that I was alive.[109]

It could hardly be said that the old gentleman was seriously challenging Galileo's views, and Galileo's reaction is clearly that of a small-minded man. This hypersensitivity characterized the whole of Galileo's public life and led him increasingly to become more and more arrogant and less and less reasonable. In due course he made the fatal mistake of insisting that a theory (the epicycles of Copernicus which later proved to be in error) was actually established fact and not merely a working hypothesis. It was this one circumstance which ultimately brought him into headlong collision with the church authorities, who had almost time without number protected him and favoured him and tried to be reasonable with him.

During his clash with the authorities, Galileo constantly perjured himself, and both he and his judges knew it throughout. Whenever he was put on the spot for some manifestly objectionable statements—for example, he had written that all who did not share his views were "mental pygmies," "dumb idiots," and "hardly deserving to be called human beings"—he promptly tried to persuade the court

108. From Galileo's *Il Saggiatore, quoted by E. Zinner in his Enstehung und Ausbreitung der Copernicanischen Lehre,* Erlangen, 1943, p.362.

109. Lorini, Niccolo, Opere XI, p.427, quoted by Stillman Drake in *Discoveries and Opinions of Galileo*, Doubleday, New York, 1957, p.146.

that when he wrote these things he was really only setting forth what the Copernicans thought, not what *he* thought of his opponents![110]

Galileo was constantly appealed to by his judges to admit that he really had written these things as an expression of his own opinion, but he was adamant. When during the final stages of the trial an occasion occurred to quote back to him his own words expressing these very sentiments, out of pity and sympathy and the desire not to ruin an old man his Inquisitors passed up the opportunity, remained silent, and dropped the matter entirely. He was in no way a brave man standing for a great truth. He was not, as Koestler put it, "the stuff of which martyrs are made."[111]

Indeed, it may be said he was a coward above all else, being afraid to express his own Copernican views which, even when he was thirty years old, he declared to a friend that he had held "for many years." He had no occasion to conceal his views, for all the evidence goes to show that Roman Catholics at that time were quite uncommitted in the matter.[112] The Jesuits themselves were more Copernican than Galileo was; it is now well recognized that the reason why Chinese astronomy advanced more rapidly than European astronomy was simply because Jesuit missionaries communicated to them their Copernican views.[113]

The basic issue which brought matters to a head in the end was that Galileo was proclaiming the Copernican system as *fact* rather than a working hypothesis. The Consulter of the Holy Office, Master of Controversial Questions, etc., was a man named Bellarmine, a person of great patience apparently and—surprisingly enough —a true modernist in the sense that he "wanted to be shown". He demanded proof. He said, in effect, "Galileo, you say the earth moves around the sun. I say, obviously the sun moves round the earth. If the earth moved, everything would blow off it. And what is more, we should be able to demonstrate parallax of the fixed stars."[114] All he requested of Galileo at first was that he should present his theories as working hypotheses. In point of fact, Galileo was given every encouragement by the authorities to pursue this course.

But Galileo was so certain that his hypothesis was a fact that he refused the advice and became more obdurate than ever. A torrent of abuse was increasingly heaped upon all those who challenged his opinion; in the end, he even had recourse to a kind of "secret weapon," a knock-down argument that was to settle the issue once for all.[115] Probably sensing that his secret weapon was not quite so weapon-like as it was secret, Galileo refused to produce the evidence for a long time. When he finally faced the enemy with it, it turned out to be an argument based upon the existence of the tides which, in substance, he held could only be explained as being due to the earth's motion as it rolled through space. Of course, he was completely wrong, and judging by the vehemence with which he defended it, it seems likely that he suspected it himself. He had every reason to believe that

110. Koestler, Arthur, *The Sleepwalkers: A History of Man's Changing Vision of the Universe*, Hutchinson, London, 1959, p.485.
111. *Ibid.*, p.493.
112. On this point, see Arthur Koestler's article, "The Greatest Scandal in Christendom", in *The Observer, Weekend Review*, London, 2 February, l964, p.21.
113. Szczesniak, B., "The Penetration of the Copernican Theory into Federal Japan" in *Journal of the Royal Asiatic Society*, 1944, Parts I and II.
114. Koestler, Arthur, *The Sleepwalkers: A History of Man's Changing Vision of the Universe*, Hutchinson, London, 1959, pp.447-46, 460.
115. *Ibid.*, pp.440-42, 493.

the earth did move, but he was quite unwilling to admit that he couldn't prove it, and so his faith became a dogma.

Since the proof never did appear for him, it is not in a way so surprising that in his declining years Galileo may have become a little wary even of his own dogma—and ready to recant. The people before whom he surrendered were far more antagonistic to his dogmatism than they really were to the Copernican system he was trying to support, for there is every indication (as we have already said) that they were quite willing to grant the system in essence.

Perhaps it was for this reason that throughout his trial Galileo was treated with courtesy and with leniency. On at least three occasions before the trial, accusations had been brought against him, and on every occasion he had been entirely exonerated.[116] During the trial it appears that much evidence which might have been introduced against him was quietly laid aside and indeed, in the end, he was not even accused of heresy. When he was retained under sentence, he was lodged in a private apartment with every possible comfort, and his sentence was so formulated as to leave him not only virtually a free man with his honour intact, with provision for his daily needs and the daily needs of his ass, and this in an environment which allowed him to complete his work on dynamics, which many consider to be his really great contribution to science.[117]

Koestler's work on Galileo reflects a new interest in the circumstances surrounding his trial, an interest which has called forth a number of papers pro and con the picture Koestler presents. Strictly speaking, one cannot argue with Koestler insofar as he has based his study and supported it by direct reference to original sources. In his Wilkin's Lecture, G. de Santillana discusses the issues which were involved as he sees them and is a little more favourable to Galileo than Koestler is; but he still supports the latter in his contention that Galileo was not altogether honest with his Inquisitors or with the Pope (Urban VIII), who initially was his friend and not unsympathetic to his views.[118] De Santillana feels that the Pope did not really understand the basis upon which Galileo's discourse was grounded, and that Galileo himself had not given sufficient thought to the broader consequences of what he was presenting as fact. De Santillana believes that both the Pope and Galileo were equally surprised that the issue took the course it did. As a matter of interest, he suggests that the church authorities were more angry than anything because Galileo, having been asked to write up his theories supposing that there would be no conflict in them or that if there was a conflict it would be presented cautiously, found to their horror that they had given official approval to a discourse that was anything but gentle and considerate. De Santillana thinks that Galileo was not altogether aware of his own dogmatism and was not therefore deliberately "twisting the lion's tail"; but after reading the many excerpts from the relevant contemporary documents to be found in Koestler's work, one cannot help but feel that Galileo did know exactly what he was doing.

116. *Ibid.*, pp. 451-55.

117. This was his *Dialogue Concerning Two New Sciences*, which has since been translated by H. Crew and published by Northwestern University Press, 1950. An interesting article on Galileo, with special reference to this work was written by N. S. Hanson under the title "Galileo's Discoveries in Dynamics" and appeared in *Science*, vol.147, 1965, p.471-78.

118. De Santillana, G., "Galileo Today," the Wilkins Lecture (Massachesetts Institute of Technology), 1964, published in *Proceedings of the Royal Society*, Series A, vol.270, 1964, p.447-58.

In the Journal *Science*, a paper by R. E. Gibson[119] sets forth Galileo in his rather more "heroic" image and by contrast paints a less favourable picture of his judges. The article called forth some correspondence during the following months which underscored, among other things, the fact that the proof which Galileo claimed he had was *not* in fact available for at least fifty years and, looked at one way, not for a hundred years. This correspondence also brought out the fact that a rather famous (or infamous) volume by Andrew White, *A History of the Warfare of Science with Theology and Christendom*, was not only an antiquated volume, but also a "highly slanted" one.[120] In view of the fact that this volume has been re-issued, it may be useful to know that scientific opinion does not consider it as the last word in scholarship. White's statements are at times "directly contradicted" by the documents from Galileo's time.

Finally, one of the correspondents, David F. Siemens, properly draws attention to the fact that theologians are not the only people who resist new ideas. He says, "In the light of the vaunted claims of Science to objectivity, honesty, experimental method, and so on [...] a reading or re-reading of Bernard Barber's 'Resistance by Scientists to Scientific Discovery' would be beneficial."[121] It would indeed! Barber's paper may be an eye-opener to many who suppose that scientists are not subject to the evil influences of authoritarianism or plain pigheadedness.[122]

Such, then, is the nature of the "martyrdom" of Galileo—a man who, by modern writers with little sympathy for matters of faith, has been built into an heroic figure, and about whom a great deal of apocryphal literature has accumulated. He did not mutter under his breath, "It moves nevertheless"; he did not drop weights from the Tower of Pisa; he was not "imprisoned"—sacrificing liberty in the cause of science. Indeed, very little of the popular picture can be substantiated from the voluminous firsthand source material about his life and doings.[123] He was challenged, strange as it may seem, not by men who had much faith and very little knowledge, but by men who were, as Professor Burtt put it, empiricists in the strictest sense. Burtt observed:

> It is safe to say that even had there been no religious scruples whatever against the Copernican astronomy, sensible men all over Europe, especially the most empirically minded, would have pronounced it a wild appeal to accept the premature fruits of an uncontrolled imagination, in preference to the solid

119. Gibson, R. E., "Our Heritage from Galileo Galilei" in *Science*, vol.145, 1964, p.1271-76.

120. White, Andrew, *A History of the Warfare of Science with Theology and Christendom*, originally published in 1895 and re-issued by Braziller, New York, 1955, 474 pages.

121. Siemens, David F., in a Letter to the Editor, *Science*, vol.147, 1965, p.8-9.

122. Barber, Bernard, "Resistance of Scientists to Scientific Discovery" in *Science*, vol.134, 1961, p.596ff. Theologians are often chided for their refusal to look at the evidence when it challenges their faith. We are told that they refused to look through Galileo's telescope. Yet the truth is that the Jesuits had better telescopes than he did, and indeed made him a present of one of theirs, to his great joy. The fact is that scientists have been pigheaded themselves—almost unbelievably at times. Thus, when Newton discovered that white was made up of the colours of the rainbow, Robert Hooke—and the Royal Society with him—simply rejected his report and at first flatly refused to look at the evidence (*Scientific Monthly*, February, 1955, p.104).

123. Koestler, Arthur, *The Sleepwalkers: A History of Man's Changing Vision of the Universe*, Hutchinson, London, 1959, pp.353, 429.

> inductions, built up gradually through the ages, of man's confirmed sense experience.
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> In the strong stress on empiricism, so characteristic of present philosophy, it is well to remind ourselves of this fact. Contemporary empiricists, had they lived in the 16th century, would have been the first to scoff out of court the new philosophy of the universe.[124]

This observation is an important one. If I have succeeded in conveying a more nearly accurate picture of what was taking place at this crucial point in history when science and faith, for complex reasons, were almost driven into opposition for the first time because of man's insistence that a working hypothesis was a proven fact, then it will be apparent that history is repeating itself again—only this time with the roles somewhat reversed.

It is difficult for us—knowing what we do about the earth's movement through space, and acquainted as we are with the absolute proofs of the fact—to see that what is now so seemingly self-evident was then *quite contrary* to common sense and to experience. It was obvious that the earth did *not* move. The men who said this were not morons or pinheads or religious cranks, but actually skeptics. It was not that they refused the obvious and preferred the obscure; they merely asked for proof before accepting a view of the solar system which was both contrary to sense experience and challenged a view of the universe which had been built up with great precision and by great minds over a period of centuries, and which in its strictly astronomical aspects had been of great practical value to navigators.[125] One has to bear in mind constantly that not only were the "final" proofs offered by Galileo completely faulty (his theory of the tides), but his insistence upon the epicycles of Copernicus was equally in error. In short, men were being invited to accept a new world picture which placed a greater strain upon their faith than the view which they already held. With our background we tend to look upon this refusal as the result simply of prejudice or ignorance

But now, three hundred years later, in a remarkable way history has begun to repeat itself. The Christian finds his faith challenged once again by another "working hypothesis," the Modern Evolutionary Synthesis—which in spite of its inability to produce the clinching proof makes precisely the same claims to be "fact" that Galileo made for his theory.

It may be that some part of this working hypothesis will one day prove to be factual, as certain elements of Galileo's proved to be. But at present it is still only a working hypothesis, and plenty of time has been afforded since it was first formulated in 1858 to uncover the necessary proofs. Yet these proofs have not yet appeared in decisive form despite many claims to the contrary.

It would seem from modern evolutionary literature that proof is everywhere available. In *This View of Life*, Simpson repeats this so frequently that the text reads almost like a stuck record.[126] It would be disrupting to introduce each quote

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124. Burtt, E. A.. *The Metaphysical Foundations of Modern Physical Science*, London, 1924, p.25.

125. Ptolemy's tables for calculating planetary motions were so reliable and precise that they served with some insignificant corrections as navigational guides to Columbus and Vasco de Gama.

126. Simpson, George Gaylord, *This View of Life*, Harcourt Brace and World, New York, 1963. See p.vii: evolution is one of the few basic facts; pp.10, 193: is a fact, not a theory; p.12: no one has any doubts now about it; p.40: all the facts support it; p.51: only dishonest biologists speak otherwise; p.62: an

at this point, but the tenor of his chant (one might almost say "variations on a theme") is exactly that of Galileo in spirit: evolution is a basic fact, one of the *few* facts, its problems all triumphantly being resolved, unassailable, no one doubting it any longer, disputed only by "dishonest biologists." One is reminded of the queen in Shakespeare's *Hamlet* who observed, "The lady doth protest too much, methinks."

While, like Galileo, modern evolutionary authorities make the same accusations against those who disagree—calling them block-heads, irrational fringe types, or just plain ignorant—and while they uphold their view as entirely rational and quite free of all demands upon faith, yet in certain respects they are behaving "more like the church than the church ever did"!

The new Faith[127] has its cardinals and its archbishops and its colleges; its creeds and its encyclicals; and its prerogative of "appointment" and its powers to silence opponents.[128] And even an analogy to the Ledger exists, though in modernized form. By persuading the better-known publishers that all manuscripts should first be submitted to them for review, they largely discourage or suppress the appearance of any work unfavourable to their own Faith. Moreover, this policy of suppression is reinforced by ensuring that only the Orthodox will secure the best chairs in universities.

The new Faith has its heresies (Lamarckism) and its infallibilities (Natural Selection), and of course, it has its sacred relics—bones, no less! The Holy Grail was never sought with more spiritual zeal than are missing links today, and the most amazing miracles are assented to without the slightest hesitation where the theory demands them (the conversion of scales into feathers, for example).[129] It is the final Truth, and opposition to it partakes almost of the nature of immorality. Indeed, in the university world, to challenge it is to leave oneself open to excommunication.

What seems even remotely possible is at once held true and incontestable if it supports the doctrine. John Randall pointed out that the Medieval Synthesis,

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unassailable fact; p.63: all the problems being solved triumphantly!; p.151: evolution a fact, creation merely a dogma. On page 193 Simpson goes overboard and in fourteen lines sings his paean of praise for the great fact of evolution five times.

127. Faith: That the accepted evolutionary philosophy is very much of a "faith" is strikingly borne out by the words of J. Gray in his review of Julian Huxley's *Evolution in Action* in *Nature*, 6 February, 1954, p.227: "Darwinian orthodoxy demands implicit faith in the efficacy of natural selection operating on chance mutations. Subscribe to this and all doubts and hesitation disappear; question it and be forever lost." The case for orthodoxy can seldom have been stated with greater cogency and enthusiasm than by Dr. Huxley. A few readers, perhaps rather pagan in their outlook, may think it a little strange that, if the case is quite so strong as they are asked to believe, it should be necessary to argue the merits of natural selection with almost "evangelical vigour." The number of words here that have been borrowed from religious terminology is quite remarkable: orthodoxy, implicit faith, efficacy, doubts, being lost, pagan, and finally, evangelical vigour!

128. See, for example, the terminology used by G. A. Kerkut in his *Implications of Evolution*, International Series of Monographs on Pure and Applied Biology, Pergamon, New York, 1960, p.5.

129. Scales into feathers: F. B. Sumner made this observation in *Science*, vol. 93, 1941, p.522: "Nothing but the guiding hand of a designer here, if not the direct intervention of the Creator Himself, [...] only the wave of a magician's wand could have transformed the scales of a reptile forthright into the plumage of a bird." In spite of this, Roger Tory Peterson, the international authority on birds, writing in Time-Life's "Nature Library" (volume on *Birds*, 1963, p.43), was still able to say casually: "It takes no great stretch of imagination to envision a feather as a modified scale basically like that of the reptile—a longish scale loosely attached, whose outer edges frayed and spread out until it evolved into the highly complex structure it is today."

"starting with accepted principles, from them a complete system is to be deduced, a great chain of reason ultimately dependent upon its axioms. The test of truth is not his experimental verification, it is inclusion in such a system."[130] Plato's conception of how to distinguish truth from error is stated in his *Phaedo*: "This is the method I adopted: I first assumed some principle which I judged to be the strongest, and then I affirmed as true whatever seemed to agree with this [...] And that which disagreed I regarded as untrue."[131] That is to say, proof rests not upon scientific demonstration but upon concordance—a circumstance which accounts for the fact that such a forgery as Piltdown Man can go for so long undetected. Piltdown Man had been just what the doctors ordered.

This principle of "concordance" allows one to claim as clearly proven what in fact has not been proven at all but is merely an agreeable idea. Evolutionary literature is full of this kind of "proofs." Stanley D. Beck of the University of Wisconsin in an article directed toward the Christian community wrote with complete confidence:

> To call himself reasonably well educated and informed, a Christian can hardly afford not to believe in evolution. Evolution, including human evolution, is no longer in contention. Evolution has been demonstrated so thoroughly and even produced experimentally—that it has long ceased to be a matter of opinion.
>
> The principle of evolution is now as well established as atomic theory; it is as well documented and verified as any scientific principle known.[132]

It is hard to believe that Beck is speaking seriously, yet the spirit of his observation is common in evolutionary literature. Robert Braidwood tells us:

> It is sure mankind is older than a half million years but no fortunate accident of discovery has yet given us evidence to prove it.[133]

Clearly, in the absence of proof this is merely the assurance of faith—although one might suspect Braidwood of ignorance, for one of his contemporaries of equal renown, Ralph Linton, has written, "Most readers will already be familiar with the principles of evolution and the proofs that it has taken place."[134]

130. Randall, John H., *The Making of the Modern Mind*, Houghton Mifflin, New York, 1940, p.98. V. F. Calverton discusses this point under a slightly different heading which he terms "cultural compulsives," by which he means the guiding climate of opinion of a society at that particular time. He feels that this largely determines what is accepted as true and rejected as false. He says: "It is not what has usually been called the truth of their doctrine which makes theories so powerful, but their adaptability to other interests which they subserve." (*The Making of Man*, Modern Library, New York, 1931, p.27). He had previously expressed the opinion that Darwin's theory was acceptable immediately because "every force in the environment, economic and social, conspired to the success of the doctrine of natural selection and the survival of the fittest" (p.2).

131. Plato: *Phaedo*, as quoted in *Science*, vol.122, 1955, p.1168.

132. Beck, Stanley, "Science and Christian Understandings" in *Dialog 2*, August, 1963, p.316: quoted by Paul Zimmerman, "The Christian and Science," Lutheran Church Missouri Synod, Portland, Oregon, 1964, p.2.

133. Braidwood, Robert, *Prehistoric Men*, Field Museum of Natural History, Chicago, 1948, p.20.

134. Linton, Ralph, *Study of Man*, student's edition, Appleton-Century, New York, 1936, p.8.

This is all very confusing. We are invited by two authorities in the same field—namely, human evolution—first of all to acknowledge freely that we are acquainted with the proofs and then in the same breath to admit that the proof is not yet available. Evidently the word *proof* has very different meanings in different contexts. In one of the Patten Foundation Lectures, Raymond Pearl assured his listeners that "the evidence" that man had "a perfectly natural and normal" evolutionary history is "overwhelming in magnitude and cogency."[135] Yet he hastened to add that the steps by which this occurred are far from certain, there being "nearly as many theories on the point as there are serious students of the problem." He then clinched the matter by saying:

> All of them at present, however, lack that kind of clear and simple proof which brings the sort of universal acceptance that is accorded the law of gravitation for example. Only on one point, and that one a little vague, can there be said to be general agreement. It is that, on the weight of the evidence, it is probable that at some remote period in the past, for which no clear paleontological record has yet been uncovered, man and the other primates branched off from what there-to-fore had been a common ancestral stem.[136]

Talk about "ifs" and "ands" and "buts"! Galileo's special pleading pales into insignificance. One wonders what experimental proof Professor Beck really had in mind. However, the object of introducing these quotations is really not to ridicule a point of view with which I do not agree, but rather to show that Christians should not be considered as standing opposed to established truth, but only unwilling to accept as fact what, in the light of such statements, must surely be considered still only a working hypothesis. As we have seen, on an earlier occasion both Roman Catholics and Protestants felt it necessary to challenge the *unrestricted* use of human reason. History is repeating itself.

Once Pope Pius XII, commenting on certain statements made in a conference on genetics, asked whether evolution should be spoken of as "fact" and if; in the absence of "proof;" it ought not rather to be referred to as a working hypothesis.[137] Theodosius Dobzhansky undertook to reply. After expressing his surprise that *anyone* in this modern age would question the fact of evolution, he hastened to point out that proof existed—proof; that is, that one species could be transmuted into another. One must surely suppose that a scientist with the reputation he has, answering a figure of importance in world affairs and using as the medium of communication a journal like *Science*, would make absolutely sure that his proof was unchallengeable. So what did he offer? He referred to what he calls "the classical example," a completely new plant, *Raphanobrassica*. This reminds me of Galileo's "proof" by his "theory of the tides" . . . .

In the first place, Dobzhansky chose a plant, not an animal. It is quite generally agreed that the principles of change in plants have little bearing on the origin of animal species. In the second place, his "classical example" has an

135. Pearl, Raymond, *Man the Animal*, Principia Press, Bloomington, Maryland, 1946, p.3.
136. *Ibid*.
137. Dobzhansky, Theodosius, "A Comment on the Discussion of Genetics by His Holiness, Pope Pius XII," in *Science*, vol.118, 1953, p.561-63.

uncertain history behind it. Not only is there some question as to whether this cross between a cabbage and a radish really did produce viable offspring (and unless it did, of course, it has no bearing on the problem at all), but the experiments themselves originally reported by Karpechenko in 1924 and 1928 have never, apparently, been repeated successfully.[138]

Furthermore, the end-result can only be described as a "flop," for it assumed a vegetable form in which the roots were useless as a substitute for radishes and the tops as a substitute for cabbages![139] While the last observation is admittedly facetious, since evolution is not concerned with the mere product of delectable food for *Homo sapiens*, yet the whole story is so shaky in its testimony that one can only marvel at the poor judgment of Dobzhansky in even daring to refer to it at all, much less referring to it as a "classical example" of experimental speciation.[140]

It is perhaps not without significance that more recently when addressing himself to the same issue of giving an example of experimental proof; Dobzhansky did not refer again to *Raphanobrassica*. This time, while admitting that speciation is a "critical phase" of the evolutionary process, he offered as proof of its occurrence the example of the salamander *Ensatina Eschscholtzi* found in California, certain populations of which in the south appear to be reproductively isolated from each other, whereas to the north they are connected "by an unbroken series of intermediate populations which are able to exchange genes."

This is not the first time that a single population has spread into two geographically separate areas in such a way that the descendants no longer naturally interbreed. It has been reported of frogs in certain areas. But it is not at all certain how the evidence should be interpreted, because factors other than genetic ones may operate to isolate the two communities. For example, a new environment may shift the breeding seasons of the two branches out of phase, or a change of diet may lead to differences in body odour, making the two communities no longer acceptable to each other as mates. It is not at all certain that if members of either group were transplanted into the other environment, that they would not prove after all within a short time to be still a single interbreeding community. It seems exceedingly unlikely that moving into a new environment could have any permanent effect upon the genes unless, of course, acquired characteristics can be inherited.

So while Simpson argues that those who accept evolution are supporting science whereas those who propose creation are simply expressing dogma,[141] one cannot help but feel that the tremendous emphasis on the "proofs" that evolution has taken place, by so many modern proponents of the new Faith who nevertheless cannot show what they are, is itself a "retreat" from fact to faith, from science to dogma.

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138. Karpechenko's experiments: see on this W. J. Tinkle and W. E. Lammerts, "Biology and Creation" in *Modern Science and Christian Faith*, edited by Russell Mixter, Van Kampen Press, Wheaton, Illinois, 1950, pp.88-89.

139. Reported in *Science News Letter*, 22 December, 1956, p.339, under Biology. The note concludes with the words, "The new plant species was worthless. It combined the prickly inedible leaves of the radish with the miserable root system of the cabbage."

140. Dobzhansky, Theodosius, "Species After Darwin" in *A Century of Darwin*, edited by S. A. Barnett, Heinemann, London, 1958, p.46. There are some doubts whether reproductive isolation is really proof of speciation. See C. E. Goshen's Letter in *Science*, vol.148, 1965, p.892.

141. Simpson, George Gaylord, *This View of Life*, Harcourt, Brace & World, New York, 1945, p.151.

The inverse parallelism which exists here between the two syntheses, to my mind, demonstrates rather clearly that we have not moved very far along the road toward the establishment of complete freedom of thought. Those who are certain that they hold the truth must necessarily believe that those who disagree have no moral right to do so, in which case the devotees of the Modern Synthesis ought to be rather careful how they throw stones at the devotees of its Medieval counterpart. It may seem strange in modern ears that men could once have said with complete self-assurance that the only truths are theological truths and theologians are the only proper preservers thereof. But we do well to realize that a modern writer— Simpson no less—had made this observation:

> All science is philosophical and the only philosophies capable of validation are those of scientists.[142]

One of the papers in the Alphach Symposium, which was inspired by Arthur Koestler and the deliberations of which were published under the title *Beyond Reductionism*, was presented by the European psychiatrist Viktor E. Frankl, a kind of successor to Freud and Jung.[143] Frankl notes that the fragmentation of scientific knowledge resulting from the vast increase in data of recent years has reached the point where scientists in different fields can scarcely any longer speak to one another or unify their world view. Insofar as the accumulation of facts is concerned, there is nothing wrong with the objective itself; but it has made synthesis well-nigh impossible. What chiefly troubles Frankl in this, however, is not so much the loss of a world view that will give meaning to life (which is serious enough in itself) but that the success which specialization has allowed in the manipulation of the facts for practical purposes has in turn led scientists to suppose they have an omnicompetence which they do not really have. As he put it, "What we have to deplore therefore is not so much the fact that *scientists are specializing*, but rather the fact that *specialists are generalizing*. That is to say, indulging in over-generalized statements" [his emphasis]. It is just this human tendency that prompts Simpson to claim, as he did in the above observation, that *scientific* knowledge is the only kind of valid knowledge we have about reality.

It may also seem repugnant that a man should be forced to say he does not believe in something which he does in fact believe, or be declared *persona non grata*. Yet, in essence the same situation exists in many universities today where the evolutionists now stand in the shoes of the Inquisitors. Like many others, I suspect, I can speak from firsthand knowledge: I was refused permission by the Anthropology Department of a Canadian university to proceed with my thesis even after having completed the written Comprehensives "with distinction" (according to the head of the department), essentially because I admitted that I still believed Adam and Eve were real persons. The basis of the judgment was not that I lacked a knowledge of the data, for this was admitted before a group of students by the same department chairman. It was my lack of faith in the orthodox interpretation of the data which put an end to my hopes of obtaining a Ph.D. at the time. I do not complain. The account has long since been squared by

142. *Ibid.*, p.152.
143. Frankl, Viktor E., "Reductionism and Nihilism" in *Beyond Reductionism*, edited by A. Koestler and A.J. Smythies, Hutchinson, London, 1969, pp.396ff.

other means. But what needs to be underscored is that the same people who saw in their own conduct nothing worthy of reproof were on other occasions forthright in their sarcastic treatment of the behaviour of those who refused to allow Galileo to proceed because of *his* unorthodoxy. It is to be feared that not a few institutions of higher learning in certain departments have crystallized their thinking into a dogmatic form which will brook no disagreement, even though they still claim to be the champions of freedom of thought.

We have already referred to Gibson's paper, "Our Heritage from Galileo Galilei," and the correspondence which ensued. Even if some of his assessments in certain respects differ from Arthur Koestler's, there is no doubt about the truth of his concluding observations. Having spoken of the "innate intellectual integrity" of Galileo—which in the light of Koestler's excerpts from relevant historic documents is of very doubtful quantity—Gibson observes:

> This ideal [of integrity] shines through the career of the first great modern scientist. But it is not fashionable now; the present tendency is for the scientific community, now grown powerful, to behave much as the Church did in Galileo's time [...].[144]

Toward the end of his article, after referring to Galileo's determination to cast away the shackles of human authority as a necessary step towards the discovery of truth, Gibson then asks:

> What has become of this ideal whose pricelessness Galileo appreciated so well? It has been and still is widely accepted in theory, but as Einstein remarks, "we are by no means so far removed from [...] [the] situation [prevailing in Galileo's time] even today as many of us would like to flatter ourselves." Human authority still dominates a large part of our intellectual life.[145]

This authoritarian spirit has shown itself most obviously in those departments which deal with the life sciences, a field of inquiry in which by the very nature of the case absolute proof is often most difficult and the temptation to substitute theory in place of fact is therefore most acute. Perhaps the dogmatism of the life sciences is matched (or even possibly exceeded?) only by the dogmatism of the social sciences. Prof. H. J. Eysenck of the Institute of Psychiatry in London said, when trying to gain an objective hearing for some unpopular ideas he has on the question of race and intelligence: "The mantle of the Inquisition sits uneasily upon the shoulders of the scientific establishment."[146] Yet there it does indeed now sit!

In conclusion, the Medieval Synthesis has been condemned by moderns both because it was a system based on faith and structured around a central idea incapable of proof by the scientific method, and because its custodians refused to accept as a fact what at the time was only a working hypothesis, the implications of which were hostile to it. In this respect the Modern Synthesis is not essentially different. It too is a venture of faith which so far appears incapable of

144. Gibson, R. E., "Our Heritage from Galileo Galilei," *Science*, vol.145, 1964, p.1275.
145. *Ibid.*, pp. 1275-76.
146. Eysenck, H. J., Letter to the Editor, *New Scientist*, 29 May 1969, p. 490.

experimental proof; and the authorities who propose it are adopting precisely the same dogmatic attitude toward anyone who challenges them.

Nevertheless, there is one profound difference between the two situations. The Medieval Synthesis somehow succeeded in ennobling all kinds of human activity, even to some extent war. The Modern Synthesis has virtually removed the word *noble* from the English language. It has allowed the justification of the most selfish and barbaric forms of human behaviour, between individuals and between nations, on the grounds of expediency because, despite all protestations to the contrary, it is a philosophy formulated on the principle that the fittest ought to survive without first having defined by what standard fitness is to be judged.

I predict that the Modern Synthesis will suffer the same fate as its Medieval counterpart, and for much the same reasons—but not until a more satisfying synthesis has been formulated to take its place.[147]

147. It is good to bear in mind the wise observation of James B. Conant, who wrote: "We may put it down as one of the principles learned from the history of science that a theory is only overthrown by a better theory, never by contradictory facts." (*On Understanding Science*, Yale University Press, 1947, p.36).

Chapter 4

The Fragmentation of Thought and Life

At the close of chapter 1 we had reached the final fragmentation of the Medieval Synthesis. The immediate effect was a new spirit of freedom of inquiry, a new sense of liberation from the confining restraints of theology, bringing to each discipline a fresh vitality.[148] One by one the older disciplines began an independent development, formulating their own principles of inquiry, their own terminology, their own modes of evaluating the evidence, and their own standards by which to judge the truth. In the very nature of the case, the fragmentation process confirmed itself until it became a kind of policy leading to the belief that a fuller understanding in any realm of inquiry would naturally result by isolating it. Isolation, not synthesis, was believed to be the secret of getting at the truth. D. Ewen Cameron likened this approach to the behaviour of a dog with a bone which, in order to extract from it all the meat it contained, isolates it from the rest of the body and drags it off into a corner by itself; there to worry it with every means at his disposal.[149]

This concept was in time extended to include the further idea that if; having once isolated something, one could magnify the object sufficiently, then as Radl put it, "one could get nearer to reality."[150] The principle is that the less one has to look at, the more one can see. And this principle of "divide and conquer" paid extraordinary dividends, for the fact is that one of the most immediate effects was the achievement of far greater *control* over the forces of nature than had ever been thought possible before.

However, this success had the unfortunate effect of leading to a certain amount of confusion, first in the public mind but later among intellectuals also,

148. Nicholas Berdyaev wrote in his *Fate of Man in the Modern World* (Morehouse, New York, 1935, p.48): "At the time of the Renaissance the freedom of human thought was proclaimed, but the dialectic of that emancipatory process led to the transformation of freedom of thought into 'free-thought'. This is a new dogma quite different from freedom of thought. Free-thought has proved to be a compression or even a denial of man's spiritual life. And true freedom of thought, not free-thought, will but confirm the truth of Christianity. The emancipation did not set free the whole man, it simply liberated thought itself, as a sphere quite apart from human existence: it was the declaration of autonomy for thought, not for man himself. This autonomy was proclaimed in all spheres of social and cultural life, and everywhere it brought about the dissociation of these various phases of life from the integral man. The autonomy of economic life, for instance, created the fatal figure of the 'economic man' who is really no man at all. The crisis and decline of the freedom of thought is in direct causal relation with the fact that it is not so much man's thought which is set free, as that thought has been set free from man, has become autonomous. But this autonomy is something quite different from freedom."

149. Cameron, D. Ewen, "The Current Transition in the Conception of Science" in *Science,* vol.107, 1948, p.556.

150. Radl: Quoted by Ralph Gerard, "The Scope of Science" in *Scientific Monthly*, June, 1947, p.499.

which resulted from the tendency to equate—quite mistakenly—control with understanding. The assumption was made—though it is manifestly contrary to common experience—that the tremendous increase in control thus achieved could only have resulted from a great advance in true understanding.

Yet a moment's consideration will show that control and understanding are not at all the same. Most of us are able to control many things of which we have little or no real understanding. Understanding is often—indeed, usually—quite unnecessary in the normal course of events. We may drive a car with an automatic gearshift or use a telephone or turn the radio from one station to another without the slightest understanding of how they actually work. One might answer to this that although we ourselves, the users, control these things without much understanding of how they work, nevertheless the designers must have understood how they worked in order to construct them. But this again proves to be a fallacy. We do not really understand something merely because we have found a way of describing what goes on. Le Comte du Nouy says, "Any electrician thinks he understands how an electric battery works but the best physicists do not share his opinion."[151] We do not understand the meaning of a reaction merely because we understand the sequence of events which underlies it. This sequence enables prediction and thus allows possible control, but it does not provide any understanding of the real causes. Indeed, Bankoff has said:[152]

> Science today makes no claim to explain in the terms of absolute causes. The claim of modern science is that it describes. At the back of its mind is always the reservation "as if" [...].

Now, "as if" is explanation by an analogy. Although it appears very persuasive, it really achieves nothing beyond the description of one set of phenomena in terms of another set of phenomena—and these are often little or no better understood. The advantage of this method of explanation is that relationships become evident which were not formerly so. This often has the effect of providing an apparent explanation. Yet Einstein was perfectly correct when he said that in reality we are merely drawing one incomprehensible out of another.[153]

The fact of the matter is that although this process extends our powers of control over the forces of nature, we are not really any nearer to understanding them precisely. It is difficult to realize that prediction is quite possible without understanding. If one may be allowed to misquote or re-apply an observation made by Eddington which I think is particularly apt, it could be said that complete understanding of anything is a kind of idol before which the scientist tortures himself daily.[154] Our explanation, even in physics (surely the most exact of sciences), still partakes more of the nature of plausibility than comprehension.

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151. Du Nouy, Le Comte, *Human Destiny*, Signet Books, New York, 1949, p.26. See also the article by R. C. Osthoff entitled "Batteries" in *International Science and Technology*, November, 1964, in which he remarks (p.49) "Battery chemistry is far more complex than most people imagine [....]. We don't know, for example, precisely what equations to write for all the reactions in an ordinary dry cell and we aren't certain that the equations we customarily write for the lead-acid storage battery are really the right ones." Yet these batteries work!

152. Bankoff, George, *The Boom of the Atom*, Faber and Faber, London, 1946, p.25.

153. Einstein: quoted by Sir Alfred Ewing in *Science*, vol.89, 1939, p.29.

154. Eddington, Sir Arthur S., *Nature of the Physical World*, Cambridge University Press, 1930, p.337.

There is, in fact, a widespread measure of agreement today that our ability to control and thus to achieve power has progressed so rapidly, and proved so successful an adventure, that the purer objective of seeking disinterestedly for what might be called "intellectually satisfying comprehension" has been suffering more and more by default. Science, in fact, is being degraded in the minds of many people into mere technology.

There is much satisfaction in being able to control—and much dissatisfaction in not being able to. Witness the frustration when a car refuses to start or the annoyance when electronic equipment fails to function properly during an experiment in the laboratory, as it all too frequently does! But this kind of satisfaction is no substitute for the kind of satisfaction that comes from understanding, and it is the failure to distinguish between these two kinds of satisfaction that has somehow rendered science so powerless to effect the "good life" because they serve quite different purposes.

Even Marx was keen enough to observe this fact.[155] "The pure light of Science," he said, "seems unable to shine but on the dark background of ignorance. All our inventions and progress seem to result in endowing material forces with intellectual life, and in stultifying human life into a material force." What we need is not the kind of understanding which allows us to control the forces of nature, but rather that which enables us to interpret them and explore their meaning for man in the light of his true end. Of course, we can never understand *anything* completely. Our understanding is always limited. Since everything in the universe is related to everything else in the universe, we can only understand everything about any single thing by understanding everything about every single thing. Daniel Lamont observed:

> Science, because of its essential method, cannot probe the secret of even one object. If we knew a single object through and through, we should know the entire Universe through and through.[156]

Only God knows the Universe through and through—so we need His help to achieve even sufficient understanding to make sense out of the sum total of our experience. We have indeed increased our control, and to this extent science has contributed to man's dominion over the earth; but it has not brought with it any deep and abiding satisfaction. There are even many who believe now that we never can achieve a satisfying world view. The reason for this denial is, on the face of it, obviously sound: no man can ever hope to encompass a sufficient grasp

155. Karl Marx: quoted by Melvin Rader, "Technology and Community: the Mandates of Survival" in *Scientific Monthly*, June, 1948, p.502. Echoing the views of Karl Marx (though not consciously), the English novelist George Gissing, in 1898 in his Roycroft Papers, expressed his own feelings as follows: "I hate and fear 'science' because of my conviction that, for a long time to come if not forever, it will be the remorseless enemy of mankind. I see it destroying all simplicity and gentleness of life, all the beauty of the world; I see it darkening men's mind and hardening their hearts; I see it bringing a time of vast conflicts, which will pale into insignificance 'the thousand wars of old,' and, as likely as not, will whelm all the laborious advances of mankind in blood-drenched chaos" (quoted by Eugene Ayres, "Social Attitude Toward Invention" in *American Scientist*, vol. 43, October, 1955, p.536).

156. Lamont, Daniel, *Christ and the World of Thought*, 1935, p.154: quoted by F. I. Andersen, "The Modern Conception of the Universe in Relation to the Conception of God" in *Transactions of the Victorian Institute*, vol.82, 1950, p.83.

of known facts to achieve an integration of it because, as Fred Walker said, "We have become 'ignorant' in new way, not because we know too little, but because there is too much to be known."[157] It may be true. Yet the necessity of achieving integration once again is very widely recognized today.

Alfred North Whitehead wrote some years ago:

> Each science confines itself to a fragment of the evidence and weaves its theories in terms of notions suggested by that fragment. Such a procedure is necessary by reason of the limitations of human ability. But its dangers should always be kept in mind. For example, the increasing departmentalization of universities during the last hundred years, how ever necessary for administrative purposes, tends to trivialize the mentality of the teaching profession.[158]

The consequence is that we find ourselves trapped by a method of inquiry which demands an ever-increasing specialization, a steady narrowing-down of the legitimate field of interest for each individual. The process has become almost a disease, and it has so affected the relationship between the disciplines that university training has been forced to concentrate on teaching men how to perform some particular function competently rather than how to develop a satisfying philosophy of life. This has had detrimental effects on society itself because it inevitably leads to the eclipse of "ends" by "means." As Erich Fromm pointed out, educated man, though he has learned to deal with some of the pieces most effectively, can no longer see meaning in the whole.[159] It is not merely the intellectuals who have been troubled by this fragmentation: the disease has reached into every department of man's life. It is the same disease which led Newton to insist that his philosophy about the meaning of the universe as a whole must be rigidly excluded from his laboratory. It was not that Newton was the first to insist upon this bifurcation between faith and science, but the very brilliance of his thinking did give tremendous weight to his conviction that it was improper to seek any common ground between them. Scientists as a whole have tended ever since to accept this form of intellectual apartheid, although some of Newton's contemporaries (Leibnitz, for example) disagreed with him strongly.[160]

But the first step toward apartheid had been taken long before this. It began when a clear distinction was first made between the kind of knowledge which can be achieved by reason and experiment, and the kind of knowledge which requires revelation to complete it—in short, between science and theology. Undoubtedly this distinction had been recognized before Galileo's time, but it came to a head with his trial. Nature and supernature were henceforth to be categorized, and each became the preserve of a distinct community, the two communities soon forming themselves into opposing camps.

There had been a time when discontinuities between the natural and the supernatural in man's daily round were not even recognized. Men had not

157. Walker, F., "Blueprint for Knowledge" in *Scientific Monthly*, February, 1951, pp.90f.
158. Whitehead, Alfred North, *Nature and Life*, University of Chicago Press, 1934: quoted in *Science*, vol.132, 1956, p.1066.
159. Fromm, Erich, *Escape From Freedom*, Farrar and Rinehart, New York, 1941, p.251.
160. Whittaker, E. T., "Aristotle, Newton and Einstein," *Scienc*e, vol.98, 1943, p.270.

distinguished between matter and spirit. This means, not that they confused them, but rather that they equated them. Nothing happened in the physical realm without in some way a counterpart action taking place in the spiritual realm. Nothing that happened was really supernatural at all. In Medieval times nothing is surprising. Faith had no difficulty believing about the bishop who walked over the sea to Ireland and met an Irish bishop walking in the opposite direction, greeted him without surprise, and stooping down, plucked a flower and asked him to carry it back to England as a token of his constant remembrance. Yet no one had the slightest doubt that if he fell into the water he would sink. Water was both able and unable to sustain a human body—it sustained our Lord, and even Peter for a little while. It was not felt necessary to try to square these experiences. Some things were known and some were believed, and both were absolutely true. In the daily round, cause and effect were recognized clearly where it would be fatal to ignore them, yet none doubted that they could be suspended at a moment's notice. The unseen world was in many respects more real and more powerful than the seen. There was not the least incongruity in Francis d'Assisi preaching to the birds or in Ambrose addressing the serpent and reminding it that God was over all: for everything was joined to everything in a spiritual bond. Matter was merely a manifestation of spirit, and nature of supernature.

But if one can pinpoint such a tremendous change in attitude as having a beginning in some particular event, one might say that with Galileo's trial began the fragmentation which first of all put matter and spirit into two compartments and then into opposing camps and finally into a new equation in which the latter was an accidental by-product of the former and therefore had no real existence in its own right. Faith ceased to have substance.

The merging of the material and spiritual world had the effect of giving a peculiar dignity to labour. There were a few tasks which seemed to have escaped this baptism, but they were surprisingly few. In our dedication to cleanliness we might suppose that tasks which dirtied a man might somehow be thought of as soiling his soul. But it was not so. Even chimney sweeps felt there was a peculiar dignity in their trade. In a way the whole attitude is summed up in Luther's words:

> Who sweeps a room as unto the Lord
> Makes that—and the action—fine.

Millet's famous painting *The Angelus* has captured the spirit which somehow made menial tasks far less menial than we now commonly think them to be. The feeling which a man had toward the labour of his hands was something quite different from the attitude of, say, the factory worker when he tallies up his day's production of pieces. There was identity. The man left part of himself within the product of his hands and because he did, he felt toward it, was proud of it, was dissatisfied with imperfection, could in fact commune with God about it, and perhaps see God as a Workman also. There was a time when a man went to the woods and prepared for himself from raw material the various pieces which were then carefully shaped and pegged together, and fitted with a wheel which he completed with great pride, and behold, a wheelbarrow . . . a complete work of art which brought with it a genuine sense of satisfaction and indeed, hard work

though it was, of re-creation. Labour had a wholeness about it, just as the farmer experienced the complete process of preparing the soil, sowing the seed, and harvesting it. But the enormous technical strides which ultimately resulted from the complete autonomy of science led to the dehumanization of labour and of industry.

Today few men have the satisfaction of completing anything. They merely contribute bits and pieces to some end-product which not infrequently they never actually see. Joad put it this way: "The industrialized individual is condemned by the conditions of his existence to perform with never varying efficiency operations of never varying monotony which conduce to no end but the continued performance of similar operations in the future."[161] The re-creative effect of manual labour has been surrendered by this process of fragmentation, and whereas men once returned home physically tired but not altogether dissatisfied with the day's work, they now return home tired because completely bored. The man who made the wheelbarrow was scarcely aware of the passage of time. It flowed unbroken and unnoticed. The man who makes the pieces finds the day to be composed of precise increments of time, the passing of which he is acutely aware. Impatience to get on with the job is replaced by impatience to get away from it. For most men there is nothing sacred about work any more, nor is there honour in a task well done (only the possibility of promotion), nor does the doing of it have any significance beyond the fact that it fulfills the requirements of a contract with an employer. Even Christians, it is sad to confess, refer their daily work to the Lord only in emergencies.

Herskovits has stated the case with keen insight:

> No discussion of the motivation that underlies the drive to work may omit the satisfaction that comes when a craftsman can point to an object and say, with pride, "I made it." Herein lies one of the most difficult problems of an industrial society [...] where specialization of labour has been carried so far that this identification with the finished product is not possible. It is only under such circumstances that labour becomes distasteful, and where release from work is envisaged as the requisite to desirable living.
>
> We become aware with astonishment that the concept "vacation" is unique to our society [...]. We tend to overlook the fact that a vacation is no release from the expenditure of effort, but it rather affords an opportunity to expend energy without outside intervention. This, and this alone, is what makes it desirable.[162]

The sense of identity has been lost—identity of the man with his work. But also the feeling that the individual has any "uniqueness" about him which makes his work, fragmentary though it is, have at least some importance. The famous Hawthorne experiment demonstrated in a remarkable way what a difference it makes to the spirit in which man works when he feels that he is an individual and

161. Joad, C.E.M., *Decadence: A Philosophical Inquiry*, Philosophical Library, New York, 1949, p.390.
162. Herskovits, Melville, *Man and His Works*, Knopf, New York, 1950, p.274.

his work has special significance.[163] This experiment destroyed the illusion that man's satisfaction as a workman is directly proportional to the economic returns. People tend to express their failure to find satisfaction in their work by complaining of other things—long hours, low wages, poor conditions, and bad employee-employer relationships. It is amazing what conditions a man will put up with if he is really fulfilling himself in his work [...] which in a way explains why Medieval man accepted so many ills with so little complaint.

The older words—Integrity, Honesty, Dedication—are replaced by the one terrible word, Boredom. Moreover, the pride which a man once took because he was able to enter wholly into and complete his tasks, identified him to some extent with his employer; and although class distinctions were strongly marked and fully acknowledged on both sides, yet there was a certain community of spirit in the relationship. That spirit has virtually disappeared, and the disease of fragmentation has borne its fruits here also.

Although almost everyone is happy when the day's work is done, the sense of "relief" often arises from the fact that there is other work to do. Complete idleness is far from satisfying.[164] Peter Murdock has pointed out that societies which live in utopias tend also to live in a state of chronic warfare.[165] The alternative to having a life of work which is drudgery is not a life without work, but a life with work which is stimulating. We speak of certain types of work as being rewarding. Such forms of employment allow for dedication and with dedication the formation of convictions—about the worthwhileness of goals, wrongs to be righted, things to improve, conditions to be changed, causes to be supported. Man is at his best as sponsor of something, and unless he does sponsor something he becomes apathetic or cynical. To be convinced about nothing is the saddest state in which a man can be, and it is a characteristic of our own times. The fact is that no strong emotional feelings about anything can survive inaction. One must be doing something—and in one form or another this means work with a sense of dedication.[166] But one cannot be dedicated to work which has the appearance of being futile. And thus it has come about in our society that for most men, the work they do brings no stimulation and neither leads to nor requires conviction about anything.

The man who has no convictions is the man who is bored, and boredom inevitably seeks its own release vicariously. Because boredom brings fatigue, physical as well as mental, bored people look for stimulation as spectators rather than participants. In Roman days bread was not enough; the circus was equally

163. Hawthorne experiments: reported by C. W. M. Hart in the *Canadian Journal of Economics and Political Science*, vol.9, 1943, 14 pages.

164. Leisure: J.V. Langmead Casserley, in his *Fate of Modern Culture*, 1941, wrote: "Men who are able to exercise skill and initiative in doing work which aims at achieving purposes which they see to be valid, do not attribute so much importance to their leisure. The majority love their leisure because their work has become a burden and a chore, period. But can leisure ever replace in human life the part played hitherto by purposeful and interesting labour?" (p.62).

165. Murdock, G. Peter, *Our Primitive Contemporaries*, Macmillan, New York, 1951. With reference, for example, to the Samoans who live in a kind of tropical paradise, he points out that they nevertheless are "in a chronic state of war" (p.63). By contrast, war is virtually unknown among the Australian aborigines, whose habitat is at the other extreme.

166. Sinnott, Edmund, "Ten Million Scientists" in *Science*, vol.111, 1950, p.123ff., has some excellent thoughts on this matter of the need for convictions as a stimulus to life.

important. As men's appetites became jaded, the stimuli had to be increasingly more acute until skill and daring had to be replaced by cruelty and violence.

It is a commentary on human nature that the original Greek word *agone*, which meant "game," came in time to mean something quite different and appears in English in the form *agony*. It is hardly necessary to point out how cruelty and violence increasingly form an essential part of modern entertainment. Games become rougher, and sports cease to have any element of sport. Movies and TV programmes strive by such emphases to hold their audiences. And recognizing that some changes in the programme must be made from time to time, they produce the bewildering effect of impinging upon the consciousness of the viewer with violent emotional shifts, from tragedy to comedy to tragedy, in such a way as to render an integrated emotional experience of any programme difficult indeed. It is common to find an announcer telling of the death by starvation of thousands of people in some part of the East in a tone intended to convey the importance of the news, and then to proceed at once in a tone of even greater earnestness to extol the merits of some toothpaste or cleanser. What this does to the announcer's own mind and sense of judgment we cannot easily tell, but for the viewer it serves to disintegrate entirely any orderly emotional response which is appropriately related to the events in view. Such shifts may leave a child in tears of sympathy and tears of laughter within too short a span of time. It is, in fact, the fragmentation of the emotional constitution.[167]

Melvin Rader has aptly summed up the present situation and the penalties we pay:

> No phase of technology has been more disruptive of primary group life than the development of mobility and communication as a result of modern inventions. People dart about by means of trains, ships, buses, trolleys, automobiles, and airplanes in a manner that would have been incredible fifty years ago.
>
> Likewise a startling revolution in communication has been produced by the rotary press, linotype, telegraph, telephone, phonograph, camera, radio, moving pictures, and television and by the multiplication of museums, libraries, postal facilities, educational institutions, and publicity and propaganda agencies [...].
>
> The effect of both mobility and communication is to weaken or dissolve the old neighbourhood unity [...]. In the metropolitan environment, where mobility and communication are most highly developed, the main direction of human attention has shifted to unstable contacts, remote influences, and dispersed currents of thought.[168]

And Rader concludes:

167. Influence of radio: on this, see Jeoffrey Gorer, *The Americans: A Study in National Character*, Cresset Press, London, 1948, especially pp.113-14.

168. Rader, Melvin, "Technology and Community: the Mandates of Survival" in *Scientific Monthly*, June, 1948, p.503.

> The cumulative effect of these factors is a disorientation more radical than the world has known for many centuries.
>
> When the mind is subjected to rapid shifts in time, space, rank, and expectation, impressions are multiplied beyond the individual's power of synthesis.
>
> Faced by this disjunctive multiplicity of experience, many minds have floundered in their effort to achieve life organization.[169]

Even the power of comprehension is fragmented. Rapid transport shifts the individual with respect to his environment, and the phone and the film shift the environment with respect to the individual; and every personal contact, by phone, on the television screen, on the bus, on the plane, wherever people meet people, tends to be fragmentary in nature. The very mobility of working people contributes to this social fragmentation by constant shifts of job and changes of address so that it is a rare event for children to spend more than a few years in any one district. They never really learn to know the postman and the baker and the butcher—or even their next door neighbour. Certain essential "roots" are thus entirely lacking.

Within the home itself; the same process is at work. There are many means by which the individual can live his own life and think his own thoughts by listening to his own personal radio or reading his own books in his own room, but one essential of all earlier societies is being surrendered—namely, the hearth. It is not an accident that hearth and home have from time immemorial been linked together. We are commonly told, and rightly I think, that a home without a family altar cannot cohere: I believe this is perfectly true in the realm of the spirit. But there is also a realm of the *social*, and here I suspect that a home without a family hearth will suffer the same lack of coherence.

The open fire in earlier times served as a focal point. Furniture was so disposed that people shared this focus and in doing so were drawn together socially. An open fire is one of the few things left which one can sit in front of and do nothing without being restless due to a feeling that it is a waste of time. The hearth not only draws people together, but draws them "out." In the very movement of the flame there is something which both rivets the attention and paradoxically sets the attention free. For all its undeniable advantages in other ways, central heating has this negative effect, that it permits the members of a household to sit with their backs to each other literally and metaphorically. We cannot, of course, turn the clocks back, but it is nevertheless a sad consequence of this modern convenience that home life from the social point of view has been encouraged to fragment. And central heating is all part of the achievement of autonomous technology. The advance is undoubtedly looked at from the point of view of physical comfort; the penalty has yet to be fully assessed, and the assessment will be made in terms of the effect upon the human spirit rather than upon the human body.

And so the process of fragmentation proceeds apace, splitting not merely people in a community, and people within a single household, but even people within themselves. To some extent it would appear that most civilized individuals

169. *Ibid.*, p.504

are schizophrenic. The social scientists and the psychologists, in their eagerness to adopt the analytical methods of the exact sciences, have taken man apart, and in their hands, the individual has logically ceased to exist.

It has been said that with Descartes, psychology lost its soul and found its mind; with the English empiricists, it lost its mind and found its consciousness; with the behaviourists, it lost its consciousness and found its reflexes.[170] The end-result, quoting Taylor, is that "man was changed from being a person who responds to a thing which reacts."[171] In the New Testament man was a "living soul"; by Descartes's time he had become a "thinking machine"; now he is merely a reacting thing. It is not true, of course, and the very stating of this otherwise logical conclusion is sufficient to render it entirely unacceptable as a view of what man is. This in itself is an indication that the fragmentation process can be carried only so far and then it becomes self-evidently inadequate—inadequate both as a key to understanding and as a guiding principle for the building of a satisfying philosophy of life for most people.

After giving a summary review of the progress of the scientific method from Medieval times to the present, and after showing that it had reduced man merely to an aggregate of atoms, Leslie Paul wrote:

> It was logical to assume, after this capture of man's material body, that his mind was but an instrument of his survival, a special limb evolved to help out the others. And this mental limb, investigated by psychologists, disclosed obedience equally with his body to inherent laws governing all its actions. The triumph of science was complete and the annihilation of man in the sense that he existed in Medieval times was accomplished.
>
> That is the profoundest of the consequences of these centuries.[172]

Many recent writers are urging a return to a fresh approach, what might be called a Comtian as opposed to a Hobbes-ian approach.[173] But to a large extent the influence of the scientific philosophy applied to human affairs has already borne fruit throughout Christendom in devastating ways by creating divisions and personal animosities resulting from these divisions which were quite unknown in Christendom in Medieval times.

We may indeed argue that very few of us would wish to return to that older world of cold and disease and discomfort. This is not surprising in view of the warmth we are accustomed to and the health we enjoy with comparative freedom from the awful plagues and epidemics of those days, as well as our comfortable

170. This statement originated, I believe, with Dr. R.-H. Shevenell, School of Graduate Studies, University of Ottawa, Canada.

171. Taylor, John, *Man in the Midst*, Highway Press, London, 1955, p.41.

172. Paul, Leslie, *The Annihilation of Man*, Harcourt, Brace, New York, 1945, p.148.

173. By way of explanation, it should be said that according to Hobbes, society is to be explained in terms of the individual, whereas Comte held that the individual is to be understood in terms of the society. These two viewpoints reflect the attitude of Socrates, who said "Know thyself," over against Plato, whose view was that "to know thyself" one must "know history." Or equally, the first holds that the whole is to be explained in terms of the parts; the second, that the individual is to be understood in terms of the whole. The present feeling is that we must return to the view that only in the light of the whole, only in the light of society, shall we gain a real understanding of the nature of the individual.

methods of travel and communication. And compared with the dismal furnishings of the vast majority of people in northern climates in those days, most of us live in palaces. But this is to compare their physical discomfort with our modern conveniences, and to overlook what may have been psychological compensations which our modern conveniences seem to have taken away from us. As Nietzsche said, "He who has the *why* of life can bear with almost any *how*." People were often physically exhausted in those days, but then they found some pleasure in rest and sleep. Today we are tired because we are bored and sleep has almost gone from us, leaving us with no escape from our boredom or our tiredness.

I do not think we *do* want to go back. But we have really only exchanged one kind of burden for another, and I am not sure that our forebears' burden was any less bearable than ours is; indeed, theirs may have been *more* bearable, because they did not recognize how physically burdened they were. They had nothing by which to judge. We do have, and we do not like what we are beginning to recognize as the penalties of our way of life. In his now famous book *Chance and Necessity*, famous perhaps largely because of its lucid pessimism and inescapable logic, Jacques Monod robs man of any comforting bond he may ever have had in his sense of being part of a tremendous drama with other-worldly overtones, and leaves us only with "an anxious quest in a frozen universe of solitude."[174] Primitive people and the founders of Middle East civilizations alike shared the view that nature was "contact-able" because all its forces were personal as man is personal. One could get on in the universe by coming to appropriate terms with nature, as one does with people. So they made bridges which carried them over the rough spots in life by personalizing the forces of nature in the universe, and by deifying some of them in order to establish diplomatic contacts more conveniently—especially with those forces which were hostile.[175]

Today we have felt the same need to make a bridge, because modern man has also sensed his alienation from the rest of nature, that same nature which he has abused and exploited. But he finds himself unable to view it as being animated like himself; because he has been trapped by his own worship of mechanism. So now he is forced to make *himself* a mechanism and therefore as impersonal as he has made the universe about him. A bridge of relationships is thus built, but it is an entirely unsatisfactory bridge for all but a few strange souls who find the worship of human technology satisfactory. Rene Dubos has summed up the contrast rather well:

> Phrases such as the classical age, the age of faith, the age of reason, or the romantic age may not correspond to historical realities, but they convey nevertheless mankind's nostalgic longing for certain qualities of life that most people, rightly or wrongly, associate with the past. In contrast, we prosaically designate our own times the atomic age, space age, age of automation, antibiotic age—in other words, the age of one or another technology.[176]

174. Monod, Jacques: quoted by Theodosius Dobzhansky in *Science*, vol.175, 1972, p.50.
175. Frankfort, H., and Frankfort, H. A., *The Intellectual Adventure of Ancient Man*, University of Chicago Press, 1946.
176. Dubos, Rene, *So Human an Animal*, Scribners, New York, 1968, p.13.

It is a curious thing that the *expansion* of knowledge has resulted from a *contradiction* of interest. The pinpointing of some minute aspect of the whole fabric has so enlarged the total fabric itself as to make it incomprehensible in its wholeness. Since the pieces have meaning only in relation to the whole, they too lose all meaning. When we dissect the individual, isolate aspects of his behaviour, and attempt to assess the man himself by concentrating on his parts, we lose the individual. We truly isolate ourselves, and if anything in the world is most likely to destroy interpersonal relationships, it is isolation and fragmentation. We take our clocks apart and are somehow surprised that they no longer tell the time! As Robert S. Morison put it, "Science encounters more and more difficulty in providing a satisfying coherent and unified picture of the world."[177]

In *The Betrayal of the Intellectuals*, Julien Benda underscores how intense national emotions have arisen between peoples who in former times lived without personal animosities even when their countries were officially at war.[178] He points out that when men went to war in ancient times, more often than not it was a matter involving only the kings and nobles and mercenaries of the two opposing forces who had any strong feelings. The common people often saw their cities change hands with almost complete indifference. The situation was not disrupting, and even in the nineteenth century the conquered accepted marriage ties with the conquerors without any sense of impropriety or feelings of lasting hostility.[179] The non-combatant had no personal involvement and treated the enemy civilian no differently from his own neighbour.[180] There was one situation, however, in which this was not strictly true and it is an instructive one.

During the Crusades Christians looked upon Moslems as creatures less human than themselves: and the feeling was mutual. But when wars occurred between Christian nations, the "humanity" of the enemy was never in question. These were family squabbles, and though they were as bitter as such squabbles can be, there existed genuine restraining ties which—if it can be said without being misinterpreted—baptized the processes of war and kept violence within well-recognized bounds. The breakdown of this unifying philosophy has had the effect of rendering war infinitely more terrible because it is so merciless. The enemy is now *always* "less human" than oneself.

Moreover, it is no longer a case of soldiers fighting soldiers but, as a strange fulfilment of a prediction made in the New Testament, it is now "nation against nation" (Matthew 24:6, 7). The appalling truth in modern war is that civilians are increasingly more involved than soldiers are. It has recently been pointed out that whereas in World War I the proportion of civilian to military deaths was about five percent compared with 95 percent, in World War II the proportion had

177. Morison, Robert S., "Science and Social Attitudes" in *Science*, vol.165, 1969, p.152.

178. Benda, Julien, *The Betrayal of the Intellectuals*, Beacon Press, Boston, 1955.

179. *Ibid.*, notes A and B, pp.166-67.

180. On this point, D. R. Davis has some reflections: "In pre-democratic Europe, it was not peoples, but kings and dynasties that went to war with what soldiers they could hire. The people, i.e., the peasant, the craftsman, the merchant, the scholar, etc., continued the even tenor of their way mostly undisturbed. One consequence of this was that war was conducted with a certain chivalry and professional decency. At the Battle of Fontenoy, in the War of the Austrian Succession, when the English Guards came into contact at last with the French Guards, an English officer stepped out of the ranks and, bowing towards the French, said: 'French Guards, will you please fire first' [...]. When the battle was over, the question who was victor, who was vanquished, having been satisfactorily settled, they all shook hands" (*Down Peacock's Feathers*, Jeffrey Bles, London, 1947, pp.90-91).

become 48 percent civilians to 52 percent military. During the Korean War the percentage of civilians killed relative to fighting men was 84 percent to 16 percent.[181] A man can no longer find even this much nobility in fighting—that he has donned his uniform "in order to protect his family." He is safer in the army.

It is a question of the civilian population not only suffering more heavily the consequences of war, but in large measure being actually involved in the provocation of it. As Benda points out, the "wounded pride" of a whole people may force their own leaders to go to war even when they would not otherwise have done so.[182]

So there has arisen a new spirit abroad which divides nations, which makes for a kind of giant national selfishness justified on the philosophical grounds that national survival has greater importance than the prosperity of the community of nations as a whole. The same fragmentation has occurred between classes, and by classes Benda means not merely poor people against wealthy people, but any group of people who share a common selfish interest against any other group of people who share a conflicting interest. It means labour against management, one skill against another skill, union against union, as well as class against class in the old sense.

Starting with divided personalities and proceeding upward through divided homes to divided communities and divided classes, we end up with nation against nation. And the fundamental cause of it appears to be that there is no single guiding principle governing the object of all men's daily lives. Living has become an end in itself rather than a means to something higher; as a consequence, competition for the means to survive—whether of the individual or the class or the nation—has become the guiding principle. Within that arena which saw many injustices, yet which was unified as Christendom, we have seen the gradual emergence, as Benda puts it, of a "closely woven fabric of hatred from one end of Europe to the other."[183]

The saddest thing of all is that in the absence of some understood goal for life, the tremendous striving for means always proves to be a tragic exercise in futility, so that the most idealistic conceptions of thoughtful men directed toward the maintenance of peace lack the one essential requirement: namely, the *object* of peace. Never before did man have in his hands so much power, and never before was man so powerless. Never before were means so abundant, and ends so entirely lacking. The hope of the future lies in a re-discovery of man's true end.

181. These figures are taken from an article by Max Born, "What Is Left to Hope For" in the *Bulletin of Atomic Scientists*, April, 1964, p.4.
182. Benda, Julian, *The Betrayal of the Intellectuals*, Beacon Press, Boston, 1955, p. 13, footnote 1.
183. *Ibid.*, p. 2.

Chapter 5

The Chief End of Man—and the Means

There is a vital distinction between the kind of truth which is apprehended by believing and the kind of truth which is arrived at by rational processes of thought. There is an emotional involvement in the first, but the second requires little beyond mental assent. The first is often, perhaps usually, the basis of conviction and therefore of action; the second is more frequently the basis for the restraint of action.

A man may be absolutely certain that something is a fact and yet react with a characteristically "so what" attitude. On the other hand, the man who *believes* something to be absolutely true, though he cannot otherwise prove it to be so, seldom assumes complete indifference toward it. To a certain extent a man *is* what he believes, not what he knows. Knowledge gained by belief involves the will and provides the spring for action. Knowledge gained purely by reason can also be internalized to such an extent that neutrality is no longer possible, and it then becomes like the knowledge of faith since it is no longer merely "known" but "believed." The end-result is the same. Yet this still does not alter the fact that we hold two kinds of knowledge—believed knowledge and assented-to knowledge. I am convinced that these two kinds of knowing, though they may be held in the mind with equal certitude, are in entirely different categories. Indeed, they tend often to be in conflict, not because the one is more true than the other or because the one is true and the other false, but because the effect which each has upon the will is so different.

Moreover, rational knowledge is essentially dependent upon recognition of what is "conceivable." We do not really grasp rationally what we cannot even conceive to be possible. But a Christian may have real knowledge of certain things by faith which are otherwise quite inconceivable. That something material was created out of nothing material (Hebrews 11:1) is inconceivable—yet we know it to be a truth. This is where Revelation is absolutely essential, and this is why, without it, there are real limitations to what a man may know. The man who is not a Christian is never completely sure of that which he cannot conceive, whereas a Christian can be—for example, the omnipresence of the same Lord in every part of the world.

This difference in mental set is fundamental and underscores the fact that a Christian not merely believes something because he understands it, but understands it because he believes it. One kind of confidence is born of understanding, and the other kind of confidence gives birth to understanding. George F. Thomas has rightly observed that the religious perspective of the

Christian does not contribute new facts but does contribute an interpretation of the facts which deepens our understanding of their ultimate significance.[184]

Now, by the use of logical argument based upon commonly accepted assumptions, speculation may lead to strong opinions about things otherwise unprovable. But these speculations have real limitations, because they lack the factual basis to turn them into certainties. I believe it can be said that these limitations are most serious in their consequences when they chiefly concern the matter of man's "ends," both his origin and his destiny. It would be a matter of keen, though academic, interest to know how the Universe originated and what its fate will be. But it is a matter of paramount importance for man to know with certainty his true origin and his true destiny. Origin and destiny are closely related: the one "end" relates to the other. Indeed, where purpose is involved, the destiny determines the origin. In evolution, where purpose is excluded, the origin determines the destiny. The question then arises, What is the chief end of man? And here, for the Christian, divine Revelation is decisive.

I am well aware that the chief end of man has been defined by godly and scholarly men in the Westminster Confession as being, "To glorify God and to enjoy Him forever." The concept is both beautiful in itself and beautifully formulated. And yet, for myself, I believe Scripture provides us with an even simpler and more profound definition. It is a definition so simple as to be easily dismissed for its very brevity: The chief end of man is "To please God." It was for this that man is and was created (Revelation 4:11), and everything else is subservient to this end.

The Lord Himself completely fulfilled this role as Man (Matthew 3:17; 17:5), but it seems certain that the vast majority of us please God only now and then. Once or twice in my own life I have had the feeling that the Lord was smiling. Once or twice: no more. Probably this is true of most of us. But I believe that this is the one end for which man is made and that everything else that we may be or do or strive toward is a means to this end. All our service, all our worship, all our sorrow for sin, every sacrifice, every aspiration—all must subserve the same end . . . even obedience to His known will, which it is quite possible to perform without pleasing Him.

It seems so easy when we first become Christians, especially if we are still young, to say with complete earnestness, "I wish only to do the Lord's will"—and having said it, to feel a wonderful sense of personal satisfaction in the approval of those around us who share our desires. Yet even here the motive may be confused. There is really only one standard by which our lives will ultimately be judged and that is whether we were pleasing to God. One is driven to the conclusion that it must be what we *are* and not what we *do* that really counts with the Lord. Thus, loving the Lord or enjoying the Lord or obeying the Lord or even accepting the Lord's salvation in the first place—all these are means serving the chief end, which is to please Him. It was entirely of His own pleasure that we have been adopted into the blameless family of God (Ephesians 1:5).

I might say that the writing of these papers is what I believe the Lord has called me to do, and it might appear that I should have fulfilled my mission in life when the last word of the final paper has been set down. If to complete this mission, I should become increasingly impatient of interruptions, neglectful of

184. Thomas, George F., *Religious Perspectives in College Teaching: Education*, Hazen Foundation, New Haven, 1951, p.13.

common household duties, indifferent to the needs of those around me, and unwilling to assume any of my responsibilities as a citizen, then the completion of this life's work might have some significance as an end in itself; *but* if this life work is merely a means appointed of the Lord in order that I myself might in the doing of it become pleasing to Him, one would have to assess it as a failure. Thus, while there is a sense in which each of us may have a goal in this life which we may come to look upon as that which all else must be made to serve, it is not *really* the true end. All our doings —casual tasks or life work—must be a means, never ultimately the end. In everything we do, the object must always be simply to please God. So, for the true assessment of a man's life, one must clearly distinguish between the means and the end. If his life work is viewed as end in itself, we may look upon it as a success. But if we look upon it as a means to a higher end, our evaluation of it might not be the same at all. What a man has done may be highly successful, but what the "doing" did to the man himself may be a very different thing.

It makes all the difference to our evaluation of the worth of a life whether we think in terms of ends or means. At the present time in all areas of life, what had once been recognized as merely means to one well-defined end are being made ends in themselves. We seek wealth for its own sake, leisure for its own sake, and even peace for its own sake.[185] We are all touched by the disease in one way or another. The various means by which men formerly hoped to achieve certain goals have themselves been substituted as the goals to be achieved. When we ask people why education is important, it is usual to be told, "In order to get a better job." Why a better job? In order to earn more money. To what end? For security and leisure in retirement. This is the "end." But it is not an end at all, it is merely a means; ironically we recognize the fact when we speak of a man retiring with affluence as being a "man of means."

Of course, one may properly speak of goals along the way, each of which becomes an end to be achieved. But they are merely stages, points marked ahead giving a sense of fulfilment when passed. Yet all these stages must be contributory —not really ends in the absolute sense. They do allow us to set our sights within reach at each stage of development, but they can never be substituted for the true objective. But, following the ways of the world, we are often tempted to confuse means with ends and to look upon the journey itself as though it were the destination.

In secular life the point has been reached where the hallmark of success is to have obtained first-class passage on a train, the destination of which is no longer a matter of concern. To distort a well-known adage, It is better to travel well than to arrive at the right destination. And as a matter of fact, it is an occasion of considerable annoyance to most people to ask them what the destination is: and by destination I'm not thinking of eternal destination in this case, but simply the

185. 1n a paper entitled "On the Social and Moral Implications of Science," Joseph Schneider observed: "A weakness in the scientific approach to problems of social order from the first has been the faith that man's innate good sense will prevent the misuse of power over nature. The winning of power over nature has tended just for that reason to become an end in itself [...]. People have forgotten the reasons for the acquisition of material riches. Acquisition has become an end, not a means to better living. The conclusion to which we are brought is that the winning of power over nature has not effected the good life. So the tools of science are powerless to decide the good life." (*Scientific Monthly*, November, 1945, p.358).

fundamental purpose of all the striving. The annoyance rises in part from the fact that it is far easier to succeed in defining the means, and acquiring them, than it is the end for which they are being acquired. It is easier because we are not quite sure what the end should be, so we postpone its definition until we have accumulated enough means to provide us with leisure and security—we hope—to sort out the more important question. Thus we live almost a life before we give much thought to why we are living at all. And when the time comes to think about it, it is almost always too late.

Lewis Mumford writes eloquently and rather as a prophet of doom about the fate of our Western civilization, with its city-centred mass culture dedicated to the accumulation of means and our ever-increasing gross national productivity. "If society is paralysed today, it is not for lack of means but for lack of purpose."[186] And in a kind of summing up to his massive *Story of Civilization*, Will Durant observes: "Since we have admitted no substantial change in man's nature during historic times, all technological advances will have to be written off as merely new means of achieving old ends."[187]

We shall explore this point further, but for the present I wish only to draw attention to the fact that natural wisdom (reason) is an exercise of the intellect applied much more appropriately and much more successfully to the question of means than faith is. And conversely, the exercise of faith is much more important in the matter of goals or ends. To the question, What is man's end? the answer must involve an exercise of faith. To the question, By what means shall he arrive there? the answer still involves faith to some extent, but reason has much greater importance.

Now, the proper goal for man is closely linked with his origin. It is tied to the question of what he is, and what he is is inevitably involved in the question of how he came to be, his origin. Thus the nature of his origin has very much to do with the nature of his proper goal in life. And in this question of origins, faith plays a very important role. This is equally true whether one believes in the creation or evolution of man, because absolute proof is impossible either way: both concepts are matters of faith.

The Christian is very frequently chided for his naive faith in the record of Genesis which, it is held, sets forth the origin of man in such detailed form that one cannot be expected to believe it because it is all too concrete. If we had been given a very generalized statement with as little detail as possible, it might have been acceptable. In answer to this criticism, it is important to bear in mind that the record of Scripture which deals with man's origin assumes the detailed form it does simply because it is revelation. If reason could have supplied the details, revelation would not have been necessary. Thus, to understand man's "end," faith has to be exercised both in the revelation concerning his origin and in the revelation concerning his destiny. Both are beyond reason. When we ignore or deny this fact, we easily confuse the issues of life by appointing to man an inappropriate end, an end which might be proper were he merely a superior animal but is not proper to a special creation of God. Thus we end up by converting the means by which the appropriate goals might have been achieved into goals themselves—mere survival, for example.

186. Mumford, Lewis, *The Culture of Cities*, Harcourt, Brace, New York, 1938, p.299.
187. Durant, Will, *The Lessons of History*, Simon and Schuster, New York, 1968, p. 95.

It is so easy, even for a Christian, to forget that to achieve holiness of life, to serve mankind in love, to sacrifice a promising career and go to the mission field—all these are merely means to an end, not ends in themselves. They must be done "to please God," or they are merely to please ourselves. Motives can be terribly confused—even among the children of God—and this includes all kinds of sacrifice which may be made apparently out of a pure heart. It is sadly true, as Ruskin said, that all too often the rarest gifts of purest love are no self-sacrifice at all but only self-indulgence. Even the desire to be Christ-like in character may be quite wrong if it becomes an end in itself. Not a few have sought to be saintly for dubious reasons. This, too, must be a means; and the end to please God. It is so simple and yet so profoundly difficult.

The true end of man is lost sight of when his true origin is denied. This is why life has for so many become pointless. No "means" can be successfully substituted for ends—neither wealth, nor health, nor any of the other commonly desired things of life. Not even godliness. Men constantly try to make the substitution, but always with the same result—disillusionment. This is why even the most godly of men may say, "I have cleansed my heart in vain, and washed my hands in innocence" (Psalm 73:13).

All this may appear as an intrusion into the flow of thought of the paper as a whole. However, my object is to underscore the fact that the quality of man's life is determined by what he sees to be the proper goal for himself. And as with the man, so with the society as a whole. So long as a sufficient number of people of influence in Medieval society saw the purpose of life to be a spiritual schooling ultimately directed toward the high aim of making a man pleasing to God, then there was a possibility that means would be recognized as means and not be made ends in themselves. The quality of life was ultimately spiritual; though men were as sinful then as today, there was a greater possibility for the recognition and preservation of transcendental values in ordinary behaviour. Common courtesy and chivalry were both expressions of this recognition. While the true end of man was thus kept in view, the exercise of faith was naturally encouraged.

Today chivalry and common courtesy are rare: faith is out of fashion, and the high aim of making the things of this world serve the purposes of the next has been replaced by making the things of this world ends in themselves. The achievement of means has become the goal. It follows naturally enough that faith tended to be eclipsed by reason.

In two areas of life particularly, this transposition has had acute repercussions. Education has lost its way, and material wealth has brought about a peculiar kind of poverty. At a conference of the Scottish Institute of Adult Education held in Dumblain, Sir Eric Ashby observed:

> Adult education is in a dilemma of ends and means. There is, of course, a vague end in view. Although education for leisure and personal satisfaction is now declared to be the purpose of adult education, it is a very shadowy purpose [...].[188]

188. Ashby, Sir Eric, "Technological Humanism" in *Nature*, 10 March, 1956, p.443.

Ashby then proceeded to show how, formerly, when the ends were clear, the means were on the whole inadequate for the ends. Now that the means have become more adequate, the ends have become clouded. He concluded:

> These changes have two consequences. There is a new pre-occupation with resources; people worry about food, new forms of energy, new materials; and there is a frenetic concern for security [...]. Society spends most of its time thinking about means and not ends.[189]

More recently, Aldous Huxley is quoted as having said:

> In our institutes of higher learning as much is spent on the natural sciences as on the sciences of man. All our efforts are directed, as usual, to producing improved means to unimproved ends. Meanwhile intensive specialization tends to reduce each branch of science to a condition almost approaching meaninglessness.
>
> There are many men of science who are actually proud of this state of things. Specialized meaninglessness has come to be regarded, in certain circles, as a kind of Hallmark of true science.[190]

We have, then, a preoccupation today with means instead of ends and, as an inevitable consequence, the eclipse of faith by the crowning of reason. Those who have faith have also been deceived at times by the advances made in perfecting means and by the resulting material improvement in the life of the common man. It all contrasts so markedly with the failure of the Church to improve the lot of the common man in the Age of Faith that we suppose faith does not have the kind of importance that reason does. Faith becomes a place of refuge only in times of emergency, and in our modern world the man of faith has become a kind of second-rate citizen. The more faith he has, the less likely he is to have means—a fact which once led, and still leads, many people to assume that there is some kind of virtue in poverty.

It is probably not altogether untrue that the man of strong faith does neglect reason and pays the price of having done so by being to some extent a failure in the things of the world. He falls back upon an artificial kind of emphasis on his "poverty" as a proof of his "great faith." In so doing, he almost inevitably begins to convert his faith into a means, a way of getting along, a navigational aid that is not really different in kind from the philosophy which the unbeliever holds—except that it is far less successful. So faith comes to be a substitute for reason, and it is apt to be employed where it is quite improper to employ it, namely, in the matter of means. And this, I believe, is a cardinal error.

To summarize, therefore, what we have been setting forth in this short chapter: it may be said that both the individual and society as a whole must make

189. *Ibid.*

190. Aldous Huxley: quoted by John Walsh in a note: "Aldous Huxley: the late Author felt Scientists tend to search for Truth, Ignore Consequences," *Science*, vol.142, 1963, p.1446.

the proper use in the appropriate places of both faith and reason. An order of society which lives exclusively by faith or exclusively by reason will ultimately fail to fulfill the total needs of its members and will collapse. There is an essential place in the life of man for the exercise of faith where reason will not serve and an essential place for reason where faith will not do. Essentially, reason applies in the matter of means and faith in the matter of ends. Only the Synthesis which pays strict heed to this fundamental truth can ever prove lastingly satisfactory.

Chapter 6

Towards a Christian World View

One day at the dinner table, we were entertaining a number of friends from distant parts of Canada and the United States. Not one of them was a child of God, nor even a member of any church. They were professional people, one of them an engineer, another a professor in a Canadian university. I felt that we *must* at least try to carry the conversation toward the things of the Lord. They all accepted that we were professing Christians, having known us for many years. But they had no interest really in anything spiritual—only in matters of intellect.

After a while I asked the simple question, "What do you think is the purpose of being alive?" Amazingly, the question stumped them all, entirely. They had no answer; indeed, it seemed almost certain that not one of them had ever stopped to ask the question. They were, in short, all travelling First Class and enjoying the trip, but they had no idea whatever of where they were going. For them, it was literally true that to travel was more fun than to arrive.

Each of my friends became animatedly engaged in the general discussion which followed. But it was really only an academic exercise, an exercise of the mind, a discussion of what ought to be the goal in life rather than what was their goal personally. I think it embarrassed them before each other to speak personally beyond saying they wanted to accumulate means in order to do things. The idea that one might view life as a process of character building in preparation for another world that was to be more abiding and more real and more rewarding than this present world never once occurred to any of them. Nor, I am sorry to have to confess, did they end up by asking me what my goal was—as I had hoped they would! This was not disrespect: it simply never occurred to them to do so. I genuinely believe that very very few people are ever really interested in others unless they are the Lord's children. It looks like it in some professional people whose duty it is to be so, and who are trained to express their interest without being offensive to people's sense of privacy. But even with such people it is still largely a professional interest. It seems to me that only the Christian will persevere in prayer for other individuals as individuals. This is a kind of crucial test of real interest.

As I see it, we are called upon to keep alive in society the great truth that man is not merely a super-animal, but a child of eternity with a destiny that makes this life a corridor of training and development, that is a means and not an end in itself. We ourselves must try so to live that we shall *increasingly* please God, for only then do we fulfill the goal for which we were and are created. Every experience ought to contribute to *this* end. This is the perfecting of the saints.

But what of our impact, our "message" to the world about us, to those whose lives intermesh personally with our own? I believe we ought to seek constantly to remind men that they are indeed special creatures of God's particular concern, in need of forgiveness and cleansing and re-creating in order that they may be once more in fellowship with Him who sustains them and in whose hand their lives really are—even though they are seldom aware of it.

And we ought to bear witness, too, to the fact that this is God's world—God's universe, in fact—created *for* man's sake, as Hugo St. Victor put it. "The spirit was made for God, the body for the spirit, and the world for the body: the world that it might be brought into subjection to the body, the body that it might be brought into subjection to the spirit, and the spirit that it might be brought into subjection to God." It is all of a piece. The world was made for man, and man for God. Indeed, I believe—as I have sought to show in two other papers[191]—that the Universe itself was designed for man. Man is indeed the measure of all things, but not man as an isolate—man in fellowship with God.

Such an overall World View carries us back to the idea of the Medieval Synthesis which was a construct of faith and reason in harmony. But it was destroyed when reason, based on other premises, became inexorably opposed to faith. It is time to show that the modern premises—the philosophy of scientific rationalism, of biological reductionism, and of mechanistic determinism—are half-truths of the most dangerous kind. They have neither ennobled society nor provided a rewarding world view for younger men and women; nor do they help or comfort those who are approaching the end of life's journey or already are walking in the valley of the shadow of death.

We have, then, two fundamental questions which engage man's attention: the chief end toward which he should be striving, and the means by which he will achieve that end. In the matter of ends, faith is more important than reason: in the matter of means, reason is more important than faith. So we find ourselves called upon, in the living of a fully rounded life, at certain times to exercise faith at the expense of reason and at others reason at the expense of faith. Faith and reason are not opposed; they merely apply in different situations. When we say they are not opposed, we ought really to say they *should* not be opposed—for all too frequently they are. When this occurs, it generally means that one of the alternatives is being exercised inappropriately, often because means and ends have been confused.

Scripture does not oppose faith and reason. It recognizes clearly the value of both and the proper place of each, frequently linking them together yet never confusing them. It is by no means true that God attaches all importance to the exercise of faith and little or none to the use of the mind. Consider, for example, the background of those three men who, in the economy of God, were chiefly responsible for the communication of the written revelation of God which we have in the Bible: Moses, Ezra, and Paul.

It is hardly necessary to say that Moses was well-educated. At the time of his coming of age, Egypt was close to the peak of her cultural greatness and her princes and nobles must have received the finest education that was then available in the world. Moses himself was a protégé of Hatshepsut, a princess of

191. Custance, A. C., "The Universe: Designed for Man?", Part I in *Science and Faith*, vol. 8 and "A Christian World View: The Framework of History," Part V in *Noah's Three Sons*, vol. 1 of The Doorway Papers, Zondervan Publishing Co.

the ruling house. Such was the man chosen by God, not merely to lead the children of Israel out of bondage, but to hand over to them that part of Scripture which was fundamental to everything that followed, its first five books. Before Moses did so, he underwent an experience which has importance for us today because it shows that God is more concerned with the mind itself than with its content.

As soon as he had graduated and felt himself qualified as a leader, Moses offered his services to God and to his people at some risk to his own prospects, only to find they were rejected. For a very long time in the wilderness where he had fled in his confusion, he un-learned much of what he had been taught in Egypt. One wonders why in the providence of God he had been given the opportunity to learn at all. The answer to this is, I think, that what God wanted was a mind that was highly trained rather than a brain that was filled with worldly wisdom. What God sought was a tool that He could use, an intellectual weapon through which to communicate His will to mankind. It took forty years to reduce a man who had probably held a high command, and was certainly learned in the true sense, to a state of humility and instructability in the things of God.[192] Moses was thereafter known for his meekness, but it would have been a mistake to have supposed that his humility was evidence of mental incapacity.

At the other end of Scripture, we have Paul, no less learned in the wisdom of the world and who, like Moses, was a born leader. There are many indications that Paul was of university calibre just as Moses had been, though there is some question whether he was actually a graduate of a university.[193]

As with Moses, so God dealt with Paul, sending him into the desert by himself—not for forty years this time but only for three, since times were changed. Here God moulded for His own purposes a highly trained mind to be the vehicle for the completion of the revelation begun with Moses. In both cases what God sought was a keen mind.

In between these two mental giants there stands a third figure: Ezra. Ezra was educated in the Babylonian seat of learning, and in due time he was appointed the task of closing the canon of the Old Testament, overseeing the re-writing of it in the Aramaic script, instituting the Great Synagogue as a body of men who would both preserve it and help in its elucidation, and establishing the order of worship which in due course formed the pattern of worship for the Christian Church.

These three men, each educated in the best traditions of their age in recognized centres of learning, were God's chosen vessels through whom He shared His thoughts with mankind. They were all men of great faith undoubtedly, but it is apparent that they were also men of learning and administrative capacity.

Because of the times in which Paul lived he was, unlike Moses and Ezra as far as we know, forced to give more thought to the question of how far the Fall of Man had affected not only his behaviour but also his thinking processes. Paul had the experience in Athens of recognizing something which had taken place during the interval from Malachi to the birth of our Lord. In this interval of about four

192. According to Josephus, Moses commanded the Egyptian expedition which captured Mero, the capital of Nubia (see *Antiquities of the Jews*, Whiston's translation, Milner, London, undated, book II, chap.X, p.57).

193. On the matter of Paul's education, see chapter 2 of J. Gresham Machen's *Origin of Paul's Religion*, Macmillan, New York, 1925. On the other hand, see the remarks by F. W. Farrar in his *Life and Work of St. Paul*, Cassell, Petter and Galpin, London, undated, vol.I, p.38.

hundred years since the closing of the canon of the Old Testament, God had remained silent. I do not mean by this that He had not spoken to individuals, but only that nothing had been added to the Scriptures. During this same interval there had appeared in Greece a succession of men who may well have been the greatest thinkers the world has ever known. These men were true natural philosophers—that is to say, they sought wisdom and understanding, apart from revelation, as an end in itself without the slightest desire to make it serve any practical aim. They thought about life, about human nature, about values, and about God. The sum total of their deliberations provided them with very few certainties about life and none about God Himself. When Paul went to Athens and saw the altar with its inscription, "To the Unknown God," then it appears to have struck him with tremendous force that the four hundred years of silence were God's method of showing that the natural mind is severely limited in its apprehension of spiritual truth. It was only, as Paul put it, "after that in the wisdom of God man by philosophy knew not God, then God sent forth His Son" (I Corinthians 1:21) to complete the revelation of Himself. Only then . . . .

The natural mind has in some way been infected by sin, and it is no longer capable of arriving unaided at the whole truth. Man requires not merely a regeneration of his fallen spirit, but a renewing of his mind (Romans 12:2), a renewal which quite literally brings a transformation in his thinking. This is a common experience, this transformation, for the educated man who becomes a Christian. It is rather as though one stood somewhat off-centre in a wheel, the spokes of which are the lines of thought which engage a man's mind and which he feels ought to unite somewhere but somehow fail to do so. The process of regeneration both supplies a whole new set of motivations for the spirit of man and also lifts him, as it were, and sets him at the centre of the wheel so that quite suddenly a whole lot of hitherto unrelated thoughts begin to form into a meaningful pattern. Not only does the Universe begin to make sense and life begin to assume meaning, but the will of God becomes clear in a new way. It is thus by the transformation resulting from the renewing of the mind that it becomes possible for a man to prove what is the good and perfect and acceptable will of God.

Christian faith has the unique effect of integrating life's experiences because it puts man in touch with the ultimate Disposer of all events. A. Cornelius Benjamin, speaking of man's need for this kind of integration and speaking as a scientist and not as a Christian, nevertheless wisely observed:

> It must be remembered that man's experiences constitute an organic whole which should not itself be torn apart by the act of intellectual abstraction in terms of which we try to understand it.
>
> What is to be emphasized is that each of the value pursuits, uniquely characterized by the goal it seeks, nevertheless exhibits elaborate and complicated relationships to all other values and corresponding experiences.
>
> Man achieves a satisfying life largely to the extent to which he is able to include the widest range of such experiences with the minimum of conflict between any two [...].

> Life is dissatisfying to the extent to which it is lacking in integration, how ever wide its sweep may be.[194]

In writing to the Ephesians (4:23), Paul speaks of being renewed in the spirit of the mind. I think here he is referring not so much to the mere processes of thinking in a strictly objective sense, but to the bias of the mind which in many respects is far more important. Yet Paul does not neglect the fact that there is a content to the mind as well as a bent, and this content is influenced by the exercise of faith. If we accept divine revelation we may "know" many things which are not known by the man who rejects it. In Colossians 3:10 I believe Paul has this in view when he speaks of the new man which is renewed in knowledge. Writing to Timothy, Paul reminds him that God has not given us a spirit of fear but of power and of love and of a sound mind (2 Timothy 1:7). These three form a combination of great importance; any two of them without the third can lead to a disaster. Love and power without a sound mind is very likely to lead to passion. Power and a sound mind without love is very likely to lead to corruption. And love and a sound mind without power leads to futility.

What Scripture is telling us in all of this, I think, is not that man's mind unredeemed is useless, but rather that it has severe limitations. These limitations become particularly apparent when a man attempts to deal with his origin and his destiny, neither of which he can know with any certainty except by revelation, each determining the other. By use of reason alone, he can only surmise what his origin was—the evidence being inconclusive, because it is quite conceivable that the form of the first truly human being was not unlike that of his animal contemporaries though he himself was constitutionally something completely different. There can be no certainty that what looked like man was man. As for the future, apart from revelation we have even less upon which to base a judgment.

In his search to find a meaning for life, man is inevitably handicapped by this uncertainty as to what his own proper destiny is. Ultimately, he ends up by seeking the answer outside himself, outside the time-frame which hems him in. With few exceptions, and these only in very recent times (I have in mind Simpson and Huxley, for example) this quest for meaning has turned men's thoughts to God as the Controller and Ordainer of human destiny. Then it becomes of paramount importance for a man to know what God is like, for upon this hinges whether man may have hope or only uncertainty at the end. It was Job's plea in the face of personal catastrophe that he might be brought face to face with Him in whose hands his destiny lay (Job 23:3, 4). Yet in this most important of all quests, the natural mind has shown itself most inadequate. Only so far does man's reason lead him—and never quite far enough. The wise men of the East were led by their natural understanding to seek the Lord (Matthew 2:2). But they were only able to get *near;* they were not able to find the Lord without help. For the last lap of their journey they had to inquire of the way from someone who already knew.

To know the Lord, man's mind has to undergo a transformation. Edwin Bevan, Toynbee's friend, said to him on one occasion, "Man's vision of God is like a dog's vision of his master. The dog by habit and association comes to know his master in a limited manner. But to know him fully the dog would have to forsake his canine nature for a human nature." The implications of this observation are

194. Benjamin, A. Cornelius, "Science and the Pursuit of Value,"' in *Scientific Monthly*, October, 1946, p.311.

tremendous. Human nature can know God only in a limited way. Handicapped by sin, this knowledge is incomplete and uncertain. Man needs something of the divine nature before he can know God—and this acquisition is brought about by a re-birth which constitutes him a son of God.

The distinction is one of great importance. Christians frequently suppose that a non-Christian cannot know God. But this is clearly not the case. Scripture tells us that Cornelius had answers to prayer before he was a Christian and, indeed, that his alms were accepted also (Acts 10:4). In the Old Testament there are a number of occasions upon which the heathen openly acknowledged God as sovereign and were rewarded for their faith—Nebuchadnezzar, for example (Daniel 4:34-37). It is quite possible to believe in God without believing in Jesus Christ, as He Himself said by implication (John 14:1). But in this same passage Jesus went on to point out that while it was possible for any man to come to God as unto One who is the Judge of all men, only through Him could any man come to God as *Father* (John 14:6). And only by sharing God's nature as a child of His can man come to know God as one person knows another. The natural mind is not able to achieve this kind of knowledge (I Corinthians 2:11). All this is first a matter of faith, and only after it is experienced does it partake of the nature of knowledge and become reasonable in its own right. Looking back upon the experience, one can to some extent rationalize it all, but without the faith which makes the transaction between God and man possible, it does not appear rational to others who have not experienced it, and no amount of logic will lead to the knowledge of this kind of truth. It is a case where to know the truth one must start with it: it cannot be reasoned out.

Faith, therefore, becomes a key to a new kind of knowledge (Luke 11:52). The key is not some particular form of religious conformity such as the scribes and Pharisees were trying to make it in the passage referred to. It is simply that kind of faith which is properly called "saving" faith.

We know from Scripture that man was created for God's pleasure (Isaiah 43:21; Revelation 4:11) and that this pleasure was to be the result of a special relationship which is appropriately set forth as that of a child to his father. But man's disobedience destroyed that personal relationship, and with it the intended fellowship also. It is our sins that separate us from God (Isaiah 59:1, 2; Habakkuk 1:13). The Lord Jesus Christ took upon Himself the blame and responsibility for our sins, paying the penalty in His own Person by becoming man and sacrificing Himself, the innocent for the guilty. "Saving faith" is a faith that wholly accepts this sacrifice and rests upon it as entirely sufficient to restore both the relationship and the fellowship which has been forfeited. On this ground, a man's position may be changed from that of one whose whole life is under judgment and who cannot therefore be pleasing to God, to one whose failures are forgiven and whose attitude toward sin has been fundamentally changed, and in whom God can once more be well pleased. Thenceforth all experience is providentially directed toward increasing the pleasure which God takes in that individual; and part of God's pleasure is to reconstitute the thinking processes of the individual so that he can gain a new understanding of the meaning of God's creation and acquire a new sense of purpose. Not only do his motives become gradually purified, but his powers of comprehension acquire a new dimension. Without this saving faith, it is "impossible to please God" (Hebrews 11:6).

This new way of looking at things does not take the form of a loosely related series of articles of belief; each of which may be held as a separate proposition. Rather, it is a system of beliefs having an organic unity in which no one element can logically be sustained in isolation.[195] The word *logically* is important, for the system as a whole is logically defensible once certain premises have been granted. It is these premises which demand the exercise of faith, but so do all premises, including those which underlie the philosophy of science.

This is a point which needs careful consideration. In any system of thought, one must always start somewhere, and the validity of the starting point must always be accepted on faith. The scientist says, "I believe that there is but one kind of reality, the physical order of things, the nature of which will ultimately be understood only by the scientific method." The Christian says, "I believe that there are two kinds of reality, a physical one which is that acknowledged by the scientist, and a spiritual one which cannot be understood without the revelation of Scripture." It is pointless to set these two, the one against the other: each side must allow the other's point of view. The premises of the scientist are the unprovable basic assumptions of a mind unenlightened by revelation; the premises of the Christian are the unprovable basic assumptions of a mind enlightened by revelation. What both hold are basic unprovable assumptions. The premises cannot be argued logically because, if they *are* premises, they cannot be rational in the strict sense. If they were rational, they would have to be conclusions, i.e., "reasonable because"—and the basis of these conclusions must then be sought further back. This process must be extended backward until a simple statement is reached which can be traced no further but is held as a matter of faith.

The basic premise of science is as we have stated it above, though it is not always expressed in these precise terms. And the basic premise for the Christian is essentially as we have stated it, though it, too, is not always so set forth. They can be enormously elaborated, of course, and there is a tendency on both sides to do just this, each trying to demonstrate by this elaboration that their own basic premise is rational and the opponent's irrational. It is a useless game: one cannot defend a basic article of faith by an appeal to logic. It simply cannot be done. If it were possible, the article of faith would cease to be an article of faith and become merely one more piece of derived knowledge. What is "rational" is rational because the steps leading up to it and upon which it is based are themselves demonstrable by the same reasoning process. If a premise rests on something, it is *not* a premise but a conclusion. Yet all systems of thought begin with an assumption. In any argument, an "assumption" may merely be a fresh starting point within the system, somewhere along the line, chosen only for convenience in dealing with what follows without bothering with what went before. But *always* there is some basic premise, some root idea, some fundamental assumption,

195. Jacques Maritain, in his *Introduction to Philosophy* (Sheed and Ward, New York. 1955, p.101), speaks of the Christian system of thought in its totality as pre-eminent among all other systems of thought because "in itself it realized a maximum of consistency in a maximum of complexity." And he adds: "Neglect of the least of its principles involves the most unexpected consequences, distorting our understanding of reality in innumerable directions." On the same point, James Orr wrote some years ago (*God's Image in Man*, Eerdmans, Grand Rapids, 1948, p.7): "The Christian system is an organism, every part of which is sensitive to change in any other." And subsequently: "I do not think it can be sufficiently emphasized that Christian truth forms an organism—has a unity and coherence which cannot be arbitrarily disturbed in any of its parts without the whole undergoing injury" (p.260).

something which stands at the very beginning which must be "allowed" in order to proceed. This is held by both scientist and Christian as an "article of faith." It is of the greatest importance to keep this fact in mind when dealing with either the Christian World View or the scientific one. The two views are absolutely alike in this one aspect of their structure.

Thereafter, granted the one basic assumption, all that is built upon it *must* be rational. No part of the superstructure may be merely presented as an article of faith. The whole fabric of thought must be built logically, systematically, indeed almost inevitably. If a false conclusion is drawn at any point, the system will be weakened, though it may still embody a final truth because, being what we are, we sometimes manage to compensate for one error by introducing another, for one irrationality by another irrationality.[196] So a man quite incompetent in the use of logic can nevertheless arrive at the truth. Many do. And because of the absence of logic, they end up with a truth that is held almost entirely by *faith*. This is all too often the position of the less-educated believer whose conviction is indeed Truth and yet who finds himself quite unable to defend his conviction before a logical opponent. Such a one inevitably comes to suspect reason. He knows he is right, but he cannot defend his position except by affirming his faith.

It may appear that I am labouring a point overmuch, but I suspect the low opinion of Christian theology which is held by those with scientific training is because the Christian World View is presented in a confused way. The confusion lies in this, that those of us who hold this view with conviction try to present the basic premises as though they were rational, and have been so lazy in working out the superstructure with the strictest attention to logical construction that it will not really stand up to critical analysis. When these inconsistencies are pointed out, we tend to be unprepared and retreat by saying, "Well, this is what I believe." In a way, we ought never to have to use the word *believe* any more than the scientist

196. A beautiful illustration of this is to be found in Kepler's case. Koestler wrote (in *The Sleepwalkers*, Hutchinson, London, 1959, p.33): "At the turn of the sixteenth century, one Johannes Kepler became enamored with the Pythagorean dream, and on this foundation of fantasy, by methods of reasoning equally unsound, built the solid edifice of modern astronomy. It is one of the most astonishing episodes in the history of thought, and an antidote to the pious belief that the Progress in Science is governed by logic." Subsequently, speaking of Kepler's calculation of the true nature of orbital movement: "Now at the very beginning of the hair-raising computations in chapter sixteen, Kepler absent-mindedly put three erroneous figures for three vital longitudes of Mars, and happily went on from there, never noticing his error. The French historian of astronomy, Delambre, later repeated the whole computation, but surprisingly, his correct results differ very little from Kepler's faulty ones. The reason is that toward the end of the chapter Kepler committed several mistakes in simple arithmetic— errors in division which would bring bad marks to any schoolboy—and these errors happen very nearly to cancel out his earlier mistakes. We shall see, in a moment, that, at the most crucial point of the process of discovering his Second Law, Kepler again committed mathematical sins which mutually cancelled out, and 'as if by miracle' (in his own words), led to the correct result." A few pages later (p.328) Koestler completes this fantastic story as follows: "The last step which had got him out of the labyrinth had once again been a faulty step. For it is not permissible to equate an area with the sum of an infinite number of neighbouring lines, as Kepler did. Moreover, he knew this well, and explained at length why it was not permissible. He added that he had also committed a second error, by assuming the orbit to be circular. And he concluded: 'But these two errors—it is like a miracle— cancel out in the most precise manner, as I shall prove further down.' [...]. The correct result is even more miraculous than Kepler realized, for his explanation of the reasons why his errors cancel out was once again mistaken, and he got, in fact, so hopelessly confused that the argument is practically impossible to follow—as he himself admitted. And yet, by three incorrect steps and their even more incorrect defense, Kepler stumbled on the correct law. It is perhaps the most amazing sleepwalking performance in the history of science [...]."

does. We ought to say, "This I know." Such knowledge would be perfectly defensible if the system itself were coherent. The only occasion to fall back upon faith should be in the presentation of the basic premises. Yet I do not claim for one moment to have so stated these Christian premises in a completely satisfactory way.

Stated the way I have presented it, the requirement seems clear enough. We exercise faith and admit it only when we introduce premises; and we avoid expressions of faith thereafter. However, it does not require too much thought to see that, having stated as part of our premise that we believe in the necessity of revelation, the revelation contained in Scripture, we must at the same time recognize that faith will be exercised also in the interpretation of this revelation. For example, two Christian men may agree that God introduced animal life by some act of creation—both holding this an act of faith and presenting it therefore as a premise. But stated thus, it is not sufficiently well defined as an article of faith upon which to build a logical superstructure. For the question still arises as to whether God introduced every kind of animal by a separate act of creation or whether He merely created a few archetypes. What this really means is that the Christian premise is not something simple but quite involved, and it will not therefore be nearly as easy to present it adequately as it is for the scientist to present his premise, which can almost be stated in a single sentence. This is where we need a confluence of minds who not only have the same basic faith, but have training in a very wide range of disciplines. Such associations exist, but none of them have yet seriously undertaken the task of providing the Christian community with an adequate statement of faith with which to confront the scientific community. It is no simple task because we have not yet succeeded in agreeing upon the meaning of the text of the early part of Genesis—where most of our premises are rooted.

The situation might be thought to be hopeless. But it is not so. Each one of us, because of our very nature, feels it important to have some kind of working hypothesis about the beginning of things which to a more or less degree we are able to square with what we understand the revelation to mean. We are then in a position, if we will, to explore the logical consequences of this working hypothesis. If we do this honestly, we may find that it leads to conclusions which are clearly at fault. If these conclusions are arrived at by logical extension of our own private understanding of the premises, then we must assume either that our logic is not sound or that our private premise is not completely valid. Discussion with others might help to sort this out, and many conferences revolving around the question of the relationship between science and Christian faith are intended to do just this. But unfortunately, as a rule, resolution is sought not by the means of "logical extension" but by the much less effective means of "checking for scientific accuracy". This, I believe, is a fundamental weakness of all such joint efforts and will never carry us much farther than we now are toward a resolution of the problem, except possibly by reducing our faith and thus the tension between it and reason.

The Medieval Synthesis was an attempt to do just this, to extend by the use of the strictest logic the knowledge we have through revelation and to erect it into an elaborate and comprehensive superstructure that is logically defensible. It failed because certain unprovable things which were held as part of it were

actually illogical extensions. The geocentricity of the Universe and therefore the immobility of the earth were two of these. It was logical that the earth was immobile if it was indeed at the centre. But whether this was a true conclusion depended not upon whether it was logical but rather whether the premise was a true one or not. This underscores the fact that a conclusion may be a perfectly logical one but untrue—if the premise is false. Medieval scholars argued for the centrality of the earth on the basis of common-sense experience and then found support for this view from certain passages of Scripture which others, at the same time, were warning might not after all be that supportive.[197] They might be poetry. If a conference could have been called under ideal circumstances to study the pros and cons of the supposed support which was being drawn from Scripture, it might have become apparent that the biblical references, being indeed poetic, could not be forced into a kind of scientific strait-jacket. The question might also have arisen as to whether this might not equally be true of the early chapters of Genesis. But if this ideal conference included Hebrew scholars, they would readily have the answer by pointing out that while the Psalms are written in the original Hebrew as poetry, these portions of Genesis are not. Who knows what the course of theological history might have been if a measure of agreement could have been reached by free discussion of this critical point? It seems quite conceivable that the trial of Galileo might never have occurred.

It therefore appears to me of great importance that we should distinguish between the things which we hold entirely by faith and the rational conclusions which we draw from our beliefs, making no apology for our faith and making no mistake about our logic thereafter. I am sure that once the basic premises have been set forth acceptably, it should then be possible to use the scientist's own kind of argument to sustain all the rest. And we should have the courage to attempt such a presentation of the Christian World View. Such then, is what I believe to be the place of reason in Christian.

We have therefore considered the place of reason in the Christian faith, and we have now to consider the other side of the coin, the place of revelation in the scientific view of reality.

This question would have seemed completely meaningless a few years ago when scientific thinking was held to be ideally a kind of machine-like, objective, un-emotional, logical process carried on by an uncluttered mind as a sort of automated activity guaranteed to be infallible and to provide us with the ultimate truth. Today there is a rather more humble assessment of the "scientific mind." We realize today that scientists, like Christians, make basic assumptions which are acts of faith—are, in fact, unprovable. And we also realize that scientists themselves are human beings. As such, they have their little biases and foibles and prejudices and blind spots and areas of gross ignorance where faith is called in to supply the deficiency of knowledge.

But laying aside the frailty of human nature and allowing for a moment that on the whole the scientific edifice or World View has provided itself a sufficient

197. According to G. de Santillana (*The Crime of Galileo*, University of Chicago Press, 1955, p,27f.), Cardinal Conti had written to Galileo on July 7, 1612, observing that the daily rotation of the earth proposed by Copernicus did not seem to agree with Scripture unless it was assumed that certain passages must not be taken literally: but such an interpretation was permissible "only in the case of the greatest necessity."

number of internal checks to make its logical consistency impressive, there is still one essential weakness in it—one critical flaw—which it is necessary to observe carefully.

We believe that there are two aspects of reality: those which are strictly physical, and those which are non-physical—the material and the spiritual. Together they constitute the whole of reality. Obviously it is quite possible by a life of contemplation to concentrate on the spiritual world and to reduce involvement in the physical world almost (though not quite) to zero. In a negative way, the Indian mystic may do this.

On the other hand, it is equally possible to concentrate on the material world and virtually to ignore the spiritual. The materialist does this with varying degrees of "success." Experience shows that the physical aspects of reality can, for many practical purposes, be dealt with without concern for the spiritual; this has had the effect—as we have already noted—of leading the general public to suppose that what the scientists have merely ignored is in fact to be denied altogether. As Kenneth Walker put it, "The scientists' report that the Universe worked like a machine led to the misconception that the Universe actually was a machine and only a machine."[198]

The reason why this incomplete view of reality can be adopted with impunity in certain situations is worth examining. In the scientific world view, any errors which may result from the assumption that the only reality is the material one tend to be systematically camouflaged. This is because the man who sets himself to deal only with the "precisely measurable" elements of reality naturally structures his experiments so that they require only physical reactions for their success. If he happens inadvertently to make demands upon nature which are beyond the capabilities of its purely physical reality, his experiments automatically fail and therefore he abandons them. Without realizing that he has biassed his experiment, he is apt to be confirmed by their failure in his belief that there is no other form of reality. However, his failure is not due to the absence of a spiritual reality but because the experimental procedure has been designed to work only within a physical framework. And conversely, of course, when his experiments are successful, he is naturally confirmed in his materialistic belief, since his method does not bear fruit if employed to test spiritual reality.

Charles B. Wooster put this particularly well in a Letter to the Editor of *Science* in which he challenged certain assumptions made by the strict "determinists." He wrote:

> Wherever science has been successful, determinism has been found. Does not this irresistibly bolster the argument? Not irresistibly, and *perhaps not at all* if scientific method involves a deterministic bias [emphasis his]. When a scientist is given a set of data his first step is to seek some trace of order, some evidence of interrelation among the individual items. When he thinks he has found it, he constructs a hypothesis, which he then tests by examining the concurrence (or lack of it) between the deductive consequences of his hypothesis and appropriate empirical observations. What does he do if he fails to find any order in the

198. Walker, Kenneth, *Meaning and Purpose*, Pelican Books, London, 1944, pp.98ff.

> data? He may seek more extensive data or more precise data. But if he continues to fail to find any order? I submit: he ultimately abandons this exasperating project and seeks a more promising one. Ergo, the scientist concentrates his efforts in the areas where causal relations appear. He *prospects for determinism and that is what he finds* [emphasis mine].[199]

Now, this is the problem in part. But the determinist also has research tools designed to respond meaningfully only within the framework of mechanism. Moreover, he is not really dealing with data (i.e., *givens*) at all, but with capta (things *taken*). Nature gives no data. It gives everything there is—itself as a whole phenomenon. We select out what our mental bias enables us to recognize as separable and so we bias our working materials from the start. On these biassed so-called givens we turn our design-biassed research tools. What then can we expect to find, except on very rare occasions, but "mechanism"!

Rene Dubos observed: "The methods used by the investigator determine and limit the kind of observations he can make. If scientists elect to study man only by physicochemical methods, they will naturally discover only the physicochemical determinants of his life and find that his body is a machinery of atoms."[200] And he then observed with insight: "The mechanical definition of human life misses the point because what is human in man is precisely what is not mechanical."

Though repetition is burdensome, the point needs emphasizing by stating it in as many ways as possible. The scientific method has been designed specifically to give answers in the physical order of things and has proved therein highly successful. If it is applied in the spiritual realm, where it is entirely inappropriate, the result is not merely bound to be negative but also bound to reinforce the belief that there is no spiritual reality. The very success of the scientific method in its own bailiwick contributes to the misunderstanding.

But what does this success really prove? Only this: that one segment of the whole of reality can be artificially isolated for a certain type of analysis, and if this is treated *by methods appropriate to the isolated segment*, it can be handled with great success. And this is precisely all that it proves. As Charles T. Tart, Professor of Psychology at the University of California, put it, when data which make no sense according to the accepted view at the time are brought to our attention, the usual result is not a re-evaluation of the accepted view but a rejection or misperception of the data.[201] There is no possible bridge-building the way things are in the present climate of scientific determinism—although it is clear that younger men are turning from science partly because of its uncompromising devotion to materialism, and this is causing some less inflexible scientific bodies to give second thoughts to their established ways. Even the recent change of attitude toward Velikovsky's catastrophic views is a straw in the wind.[202]

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199. Wooster, Charles B., under the title "Determinism: Bias and Complementarity" in *Science*, vol.146, 1964, p.471.

200. Dubos, Rene, *So Human an Animal*, Scribners, New York, 1968, p.l32.

201. Tart, Charles T., "States of Consciousness and State-Specific Sciences" in *Science*, vol.176, 1972, p.1204.

202. The whole 1973 series of special issues of *Pensee* devoted to a consideration of Velikovsky's ideas reflects this altered climate of opinion (published quarterly by the Student Academic Freedom Forum, Portland, Oregon).

When occasionally something is observed that seems contrary to this scientific philosophy (a cancer in its final stages suddenly cured by faith, for example)[203] in order to preserve the view that there is only one kind of reality, science is forced to ignore the evidence or to deny it or to demand a kind of "proof" which can never be provided.[204] It can never be provided because science demands that the proof be the kind of proof which can only be obtained within a purely physical system and by an experimental method which has been specifically designed for dealing with that aspect of reality. This kind of experiment does not apply to a frame of reference which takes into account the whole of reality by including the supernatural also.

Miracles occur—but they cannot be proved to have occurred by this method, for such a proof as is here demanded involves "repetition at will." The scientist will say, "Let me see you do it again. . . ." And this would not be a proof of "miracle" at all, but only a demonstration of the existence of some new law of nature not previously recognized. The form of proof demanded is not appropriate to the miraculous event, since such an event by definition is exceptional and not repeatable at will.

I believe that miracles are occasions upon which God suspends or supersedes or accelerates or in some way modifies the natural order so that an event occurs which is entirely exceptional. A miracle then, according to this view, would be an indication that God is interfering in the natural order by an act of will because it pleases Him to do so. To make miracles merely the operation of a higher law is, in effect, to say that God is imprisoned by laws—even if the laws were originally of His own making. I do not believe that God is bound in any way whatsoever, by any laws which He has appointed. . . . Phenomena and experiences which are not accountable in strictly physical terms (I would include self-consciousness here) are not so much outside of or contradictory to the natural order but involve another dimension. The Kantian argument has relevance here. It states that

203. Although I do not have the original reference, the circumstance is referred to by Sir Charles Marston in his book *The Bible Comes Alive*, Eyre and Spottiswoode, London, 1937, p.3.

204. R. E. D. Clark has rightly observed that when the scientist, to justify his unbelief, demands proof, he is very seldom influenced by the proof when it is produced. He merely demands further proof of a higher order, and thus the gap is never bridged (*Science and Religion*, vol.1, no.5,1948, p.200). In *Science* (vol.123, 1956, p.9f) are some articles on extrasensory perception entitled "Science and the Supernatural." In the first, S. G. Soal of England, remarks (p.10): "Price [a critic] evidently thinks that extrasensory perception should be established once for all by an absolutely fraud proof, cast-iron experiment. The late F. C. S. Schiller, the Oxford philosopher, used to argue that such a hope was illusory. Even if such an experiment were feasible, we should find that as the years passed and the experiment faded into history, fresh doubts would begin to be raised about the reliability of the experimenters or the possibilities of collusion." This clearly reveals the part which the will places in all belief systems. It is analogous to Clark's remark that the evolutionists demand evidence of creative design, but when shown it, merely raise the standard of the evidence they require or the kind of proof they will accept. And this goes on indefinitely, so that the bridge is never crossed. This demonstrates that such forms of unbelief are not really rational at all, though they are always claimed as such. The point is well illustrated from the number of occasions upon which scientists have publicly announced that if such-and-such a thing could be shown, they would at once abandon their old view and adopt the new one. Yet, when these conditions were fulfilled, they did not do what they promised. For specific illustrations of this form of evasion, see the following: Merson Davies, *The Bible and Modern Science*, Pickering and Inglis, London, undated, p.201; Alexander Goldenweiser, *Anthropology*, Crofts, New York, 1945, p.505; Walter Kidd, "Plan and Purpose in Nature", *Transactions of the Victoria Institute*, vol.31, 1897-98, p,216; E. L. Grant Watson, "Facts at Variance with the Theory of Organic Evolution" in *Transactions of the Victoria Institute*, vol.70, 1938, p.4; and Herbert Wendt, *I Looked for Adam*, Weidenfeld and Nicolson, London, 1955, p.117.

whenever we find an apparent contradiction to be a fact, this can be taken as evidence for the existence of a hitherto unsuspected dimension of the problem. For example, if two mutually exclusive objects have the same co-ordinates (x, y), this is evidence that they must be displaced in a third dimension (z).[205]

So long as science refuses to recognize the possibility of a third dimension to the problem, refuses to use appropriate methods of experiment, or denies that such experiments can lead to useful conclusions, just so long will its partial view of reality be erroneously accepted as the only view of reality. We do well to remember, as Ewen Cameron observed, that "the laws of nature are now considered simply to represent our ways of conceptualizing data."[206] Laws do not—for all their success in application—necessarily encompass the whole of reality. If we may be allowed to continue the analogy, I think it would be useful to say that it is in the realm of this third dimension that the limitations of the natural mind are most evident. And because God recognizes these limitations He has provided us with revelation. This revelation does not give us all the information we would like, but it supplies us with certain pieces of knowledge, certain facets of truth, which are otherwise entirely beyond our reach but are absolutely essential to our understanding of our own destiny.

Man has a spiritual life which cannot be explained merely as a kind of epiphenomenon or extension of his physical life. Psychology tends to deny this, to constrict itself by limiting its field until it becomes merely an extension of neurophysiology. So long as this view of the spiritual side of man is held, it is natural not to look any further than the natural order for the explanation of human behaviour. But revelation makes it clear both from the circumstances of man's origin and his subsequent history that his behaviour, his needs, and his aspirations cannot be accounted for merely by reference to neurology or physiology. Scientific "ignorance" of the truth in this matter has rendered it, for all its successes elsewhere, quite unable either to provide society with a value system that will lead to the achievement of the "good life" or, which amounts almost to the same thing, a satisfying world view. Having denied or ignored God's revelation of man's origin, science has been unable to define his destiny effectively and therefore is unable to supply "meaning." Because of its refusal to exercise a broader faith in the matter of its premises, the scientific method has critically handicapped itself in the service of man. It is here that the acceptance of divine revelation would be appropriate to the scientific view of reality.

A few years ago, a very great scientist, Max Planck, in a paper entitled, "Meaning and Limits of Exact Science," virtually acknowledged what has been stated above. He wrote:

> If we take a closer look and scrutinize the edifice of exact science more intently, we must very soon become aware of the fact that it has a dangerously weak point—namely, its very foundation. Its foundation is not braced, not reinforced properly in every direction, so as to enable it to withstand external strain and stresses. In other words, exact science is not built on any

205. This is quoted by "D. M. M." in his review of Karl Heim's *Christian Faith and Natural Science* (SCM Press, London, 1953) in *Christian Graduate*, September, 1953, p.121.

206. Cameron, D. Ewen, "The Current Transition in the Conception of Science" in *Science*, vol.107, 1948, p.555.

> principle of such universal validity, and at the same time of such portentous meaning, as to be fit to support the edifice properly.
>
> To be sure, exact science relies everywhere on exact measurements and figures, and is therefore fully entitled to bear its proud name, for the laws of logic and mathematics must undoubtedly be regarded as reliable. But even the keenest logic cannot produce a single fruitful result in the absence of a premise of unerring accuracy.
>
> No phrase has ever engendered more misunderstanding and confusion in the world of scholars than the expression "Science without presuppositions". It was coined originally by Theodor Mommsen and meant that scientific analysis and research must steer clear of every preconceived opinion. But it could not mean, nor was it intended to mean, that scientific research needs no presuppositions at all. Scientific thought must link itself to something, and the big question is, Where?[207]

Many people, before and since Max Planck, have questioned whether scientific knowledge is capable of providing complete answers, the chief point of criticism almost always reverting to the matter of values. It is assumed that we need greater control over nature and more and more sophisticated power sources —but why do we need these things? To what ultimate end? In the English journal *Endeavour*, E. F. Caldin raised this question shortly after the war. He said:

> Science, then, is not an adequate description of nature; it is a portrait made by an observer with a particular point of view and a definite limitation of his vision. From natural science we cannot learn what material nature is for, how and why it exists at all, and why it has any laws [...]. Science by itself throws no light on its own value, nor on values in general. It is not a royal road to knowledge of every kind.[208]

More recently still, in the American journal, *Science*, Prof. Hugh S. Taylor underscored these limitations even more specifically. He observed:

> We need to insist on an increased appreciation by our students of science of points of view other than that of the inductive sciences [...].
>
> What I think the scholastic philosophers are trying to tell the scientists is that science, in spite of all its manifold contributions to the health, welfare and development of human life, does not and can not provide us with a philosophy, a way of life.[209]

I think Taylor's meaning is clear enough: he is not really saying that there is no such thing as a scientific philosophy, but only that a scientific philosophy is not really a satisfactory philosophy to live by. The unsatisfactory element in it results

207. Planck, Max, in *Science*, vol.110, 1949, p.319.
208. Caldin, E. F "Value and Science" in *Endeavour*, October, 1946, p.161.
209. Taylor, Hugh S. "One Scientist's Attitude to Thomistic Philosophy" in *Science*, vol.117, 1953, p.198.

from its failure to set forth clearly an appropriate goal for man to live and strive for. And this failure in turn results from an inadequate view of what man is because of a false view of man's origin. Even Julian Huxley admits the present inadequacy of scientific philosophy when he says,

> Some system of belief is necessary. Every human individual and every human society is faced with three overshadowing questions. What am I, or What is Man? What is the world in which I find myself, or What is the environment which man inhabits? and, What is my relation to that world, or What is man's destiny?
>
> Men can not direct the courses of their lives until they have taken up an attitude to life: they can only do that by giving some sort of answer to these three great questions: and their belief system embodies that answer.[210]

What Huxley is underscoring is that knowledge by itself provides no spring for action unless value judgments are made on the basis of this knowledge. In his biography of George E. Coghill, Judson Herrick points out that "scientific facts are not worth what it costs to discover them unless they can be so interpreted as to lead to value judgments as guides to more satisfying purposeful action."[211]

Clearly what man needs is guidance. For this he needs knowledge which evidently the scientific method cannot provide. But Christianity can provide it. Prof. Cornelius Jaarsma, in a monograph published in the United States, expressed this very effectively when he wrote:

> Faith is not the asylum of ignorance to which are assigned the things we believe but do not understand. Nor is faith the sphere of religion and reason or understanding the sphere of knowledge. Neither is faith based on reason in the sense that we believe a thing true or false because we understand it. The Christian faith is the source of knowledge which is basic to the true understanding of all things experienced.[212]

Jaarsma's final sentence here is most important, for although it seems paradoxical, faith is in very fact a source of knowledge—not just any faith, but Christian faith, the faith which is rooted and grounded in Scripture.

210. Huxley, Julian, "New Bottles for New Wine: Ideology and Scientific Knowledge" in *Journal of the Royal Anthropological Institute*, vol.80, parts I and II, 1950, p.16. Huxley is admitting the inadequacy of humanism in its present forms. In reviewing Bertrand Russell's *Human Society in Ethics and Politics*, T. S. Simey underscores the fact that "rationalism as a creed" is equally inadequate. He speaks of young people in universities who are attempting to make major decisions about what they will do with their lives and observes, "Rationalism is a dead creed for them, despite current attempts to accept emotion as well as reason as a significant influence in our lives. It has not yet been replaced in the Western world by anything that stands the tests of criticism and experience, and the younger generation of thinkers must be regarded as facing the intimidating task of discovering a new philosophy and a new faith, or re-discovering an old one." (*Nature*, 25 December, 1954, p.1162).

211. Herrick C. Judson, *George Elliot Caghill: Naturalist and Philosopher*, University of Chicago Press, Chicago, 1949, epilogue.

212. Jaarsma, Cornelius, "Christian Theism and the Empirical Sciences," issued as a monograph by *American Scientific Affiliation*, August, 1947, p.7.

One of the most distressing qualities of life today is the lack of—one ought perhaps even to say, fear of—convictions. The scientist who has convictions, or at least the scientist who expresses them, is likely to be suspect. Convictions indicate bias, and we have been taught that bias is a naughty word. The absence of convictions robs life of colour and makes men generally cynical about the matter of dedication. Edmund W. Sinnott, in a paper published in the journal, *Science*, examined this modern trend and felt that it was severely detrimental to human well-being and that to a large extent responsibility for it must be attributed to the basic philosophy of the scientific method. He said:

> One of the serious problems of our day arises from the fact that certain high qualities in human life, much treasured in the past, are slowly breaking down, and that to replace their values men are turning to substitutes which are often fraught with peril. The ancient virtues of tolerance and open-mindedness, for example, tend easily to degenerate into a tepid neutrality: and to restore the spiritual motive power thus lost as convictions evaporate, we are tempted to revert to dogmatism and authority [...].
>
> Today when easy going tolerance is so often the ideal attitude and security is commonly reckoned the highest blessing, we may well forget man's tremendous capacity for dedication, his eagerness to nourish convictions, his persistent quest for certainty. The significance brought into his life by a cause and a creed often seems to him compensation enough for the loss of freedom [...].
>
> Man at heart is an adventurer. He craves something to stir his pulse and lift him out of routine. But to gain it he too often resorts to harmful expedients, to the hysterical stimulation of speed or alcohol or hectic restless living. He gets his thrills second hand by watching games or movies or the TV screen. Whipped up enthusiasm is no sound substitute for the rich stimulation life can know if its highest possibilities are fulfilled.[213]

It appears that we are all constantly reminding ourselves that for man "ends" are of paramount importance, that they are indeed more important than "means." At one time, universities concerned themselves largely with man's ends; since it is in this quest above all that man requires wisdom, education in centres of higher learning was primarily concerned with wisdom. Study was directed to this end, while technology was left entirely to "trade schools". Great importance was attached to philosophy as a natural source and theology as the divine source of wisdom. The study of history was important because of the moral lessons it could teach. Classical literature was studied because it contained the cumulative wisdom of the past. But with the shift of emphasis from ends to means, university life changed gradually, and the content of study became factual. Data occupied more and more space in the curriculum and ideas less. Today the arts seem to be fighting a losing battle in the larger universities which lean more heavily for their

213. Sinnott, Edmund, "Ten Million Scientists," *Science*, vol.111, 1950, p.123.

reputation upon applied sciences, in the pursuit of which funds are more readily available and enrollments are larger. Today, as has been reported all too frequently, all too sadly, we see an increasing number of Ph.D.s (doctors of *philosophy*) whose knowledge of philosophy in spite of the degree is abysmal, and who can hardly put together an English sentence without errors in spelling or grammar. Those who are to be tomorrow's leaders not only lack a satisfying philosophy of life but do not even have the means to construct one.

The basic materials for such a "construct" have been lost. Sir Walter Moberly wrote:

> Mores, ways of life, the recognition of binding obligations, are bound up with some accepted view of the nature of man and of the world, though this may take the form less of a doctrine of the mind than of a picture dominating the imagination. But it is just this common picture of framework that has now so largely disappeared [...].
>
> Over a large part of Europe and Asia binding convictions are lacking and there is confusion, bewilderment, and discord. The whole complex of traditional belief, habit, and sentiment, on which convictions are founded, has collapsed. All over the world indeed the cake of custom is broken, the old gods are dethroned and none have taken their place.[214]

This is a not unnatural consequence of a habit of mind fostered largely by the scientific community which, in its determination to be objective, has shied away from any involvement in the treatment of values. The scientific method is directed toward the attainment of exact knowledge by a method which theoretically excludes any information that has not been derived by the same technique. This has rendered it what might be called a "closed system of understanding". But as soon as any system closes itself in this way, it deprives itself of the power of self-analysis and therefore of self-criticism.

The possibility that the scientific world view is in reality quite incomplete is denied by those who hold it firmly. They do not deny it because they are necessarily pigheaded and do not want to admit such a possibility, but because they *cannot* admit it. One soon discovers this in conversation. The closed system of reasoning, in which their minds are imprisoned by training and in which the experimental evidence which carries weight with them confirms for them at every turn, makes any admission of inadequacy quite impossible. It is simply inconceivable.

Until the inadequacy is demonstrated by some other means than logical argument—a crisis in their lives, for example—such an admission would be tantamount to intellectual suicide. While present deficiencies are admitted, it is held that they will be repaired in due time by more "science" and not by any appeal outside of it.

Of course, what is really at fault is the basic premise, not the constructs which have virtually built themselves upon it. The deterministic view of things is so inevitable the moment it is decided that the scientific method is the only valid

214. Moberly, Sir Walter, *The Crisis of the University*, SCM Press, London, 1949, p.16.

way to explore reality, that any alternative hypothesis which is incapable of experimental verification by this particular method never can be admitted. Once the first step is taken wholeheartedly, the rest is inevitable. Man, as a human being in the biblical sense of having a significance beyond time and space, is annihilated—to be replaced by man the animal, highly complex but still essentially animal, having animal aspirations.

Thus a whole dimension to life is lost. Having no way to deal with it, it is first of all ignored and then denied. The dimension which is lost is the most fundamental one of all, the spiritual one, the very dimension which is the basis of the only goal for man worthy of his potentialities.

Mechanistic determinism is a harsh reality, we are told, an inescapable conclusion from the scientific evidence. But what if the scientific evidence is only part of the evidence? Paul said, "If in this life only we have hope, we are of all men most miserable" (I Corinthians 15:19). Indeed we are! No wonder the great promises of science are incapable by themselves of providing society with a philosophy of hope, but tend only to breed a sense of pointlessness and futility. It is becoming increasingly apparent that the basic need which we all have at certain periods of our lives for a worthwhile goal is not being served by the scientific world view. Young people find it an excuse for selfish indifference rather than a challenge to a nobler life and are disappointed that even enlightened selfishness fails to bring satisfaction. Older people find in it justification for the abandonment of their once-high ideals rather than an encouragement to renew them, and in self-justification they look cynically upon those who have retained them. The efforts which have been made by Julian Huxley and George Gaylord Simpson to provide a kind of ersatz destiny based on eugenics is not realistic. And since the two world wars, humanism no longer carries much conviction either.

From what source, then, shall this need be supplied? To my mind, Christianity—I think one ought rather to say, Christian theology—can alone supply this need. But it will not be the theology of Medieval times, which for its basic assumptions rested with equal weight upon Scripture and Tradition. It must be a theology which bases its premises entirely within Scripture. These premises should be carefully formulated and then presented without apology and with no appeal to reason. And then, when this is done, the logical consequences should be worked out with the strictest attention to rational argument and with the fullest possible use being made of all the factual knowledge that is relevant to the exploration and elaboration of these logical consequences. I believe if this were done with complete honesty, the Christian faith would achieve a respectful hearing where, at the present time, it is merely politely ignored; and theology would once more provide a set of guiding principles which could enormously simplify and make more effective our educational processes by restoring a proper goal.

I do not believe that this is the most important objective of the Christian Church, but I do believe it has a responsibility here which has been seriously neglected. Besides its prime concern for the personal salvation of the individual, the Church must also bear a clear witness before the world to the fact that man is not just a superior kind of animal, but that he has a unique relationship to God, involving not only a unique origin—of which Genesis provides the details—but setting before him a unique destiny of which the rest of Scripture has given a

sufficient account. This witness must be given before all men, not merely those who are Christians; these things apply to all men.

No synthesis which is not firmly based upon these great truths can possibly provide for man a satisfying world view by which he may order his daily life and fulfill his role in society.

I believe that even in a society which rejects the gospel, the Church is still called upon to bear witness to the fact that man is not an animal, that man is a unique creature of unique significance in this Universe, unique in origin, of unique design, and of unique destiny, and, *whether redeemed or unredeemed*, related in a special way to the Creator. This uniqueness stems not only from the circumstances surrounding man's creation and fall, but also from the fact that after death he will live again to face judgment for what he has been in this life.

Man is not a superior animal, but a child of eternity. I am persuaded that the world needs constant reminding of this fact, and that there can be no understanding of "the phenomenon of man" unless his special origin and destiny are recognized fully. The ills of society cannot be properly diagnosed, nor can any proper provision be made for the real fulfilment of human aspiration, even at the ordinary social level, unless the true nature of man as a fallen but redeemable creature is acknowledged.

PART IV

THE FITNESS of LIVING THINGS
and the
SIGNIFICANCE of DAUERMODIFICATIONS

[Doorway Paper #61, first issued 1971]

Chapter 1

How Is Fitness Acquired?

Those who live nearest to nature never cease to wonder at the *fitness* of living things. Until man intrudes, nature seems replete with evidences of wise design. Every creature is equipped with all the structures, all the skills, and all the instincts necessary for its own continuance as part of the web of life. Man alone appears to be an alien and a disturber.

The concept of nature as "red in tooth and claw," which Tennyson introduced in his poem *In Memoriam* some ten years before Darwin published his *Origin of Species*, is increasingly being viewed today as a travesty of the natural order. Probably the only reason it has survived so long is that those who contributed most to reinforce it by their writings, including Darwin himself, derived too much of their knowledge of animal behaviour by observing them in captivity. In the wild there is inevitably some shedding of blood, but we now know that cruelty *per se* is almost entirely absent. Death is avoided by all living things, and they do not seem to live in fear of death, except where man intrudes.

Structurally animals are extraordinarily sensitively fitted for the kind of lives they live. To the Christian this is evidence of wise design, but to the unbeliever it seems to demand some other explanation. In many cases where the element of fitness is truly extraordinary, it becomes extremely difficult to see how it could come about purely by chance.

One of the earlier students of nature who sought to account for this fitness without any direct appeal to supernatural intervention was Jean Baptiste Lamarck (1744 - 1829). In his *Philosophie zoologique*, published in 1809, he reasoned that any animal could adjust itself structurally to improve its fit with the environment and pass on the advantageous adjustment to its descendants. By a process akin to compound interest, each generation improved upon the fitness of the previous one and thus all living creatures constantly enhanced their chances of survival—not by a process of elimination of the unfit, but by improving their own fitness. This natural ability was resident within the constitution of all living things. It was not a conscious goal-seeking which might be confused with some form of teleology, but simply part of the stuff of living. The important thing was that every gain was inherited. "Lamarckianism" came to be defined simply as "the inheritance of acquired characteristics," and the acquired characteristics were modifications of structure resulting to the benefit of the organism from the direct influence of the environment.

In Darwin's time, Lamarckianism was very widely accepted by those who by disposition sought an explanation of fitness without appeal to supernatural agency. Curiously, Darwin did not himself feel happy about it. He sought for and found what he considered a better explanation in the multiple concepts of Natural Selection, the Struggle to Survive, and the Survival of the Fittest. In Darwin's view, Lamarckianism was unrealistic, mystical, and not adequately borne out by the facts. He saw the elimination of the unfit as a much more likely and verifiable principle of improvement of a species. He did not reject the inheritance of acquired characteristics, but he questioned whether characteristics were ever acquired by the mechanism Lamarck envisioned.

In the course of time, however, Darwin himself gradually shifted his position in this respect, and it is interesting to observe the change in his thinking as reflected in his own written observations. In 1861 he wrote:

> My greatest trouble is not being able to weigh the direct effects of the long continued action of changed conditions of life without any selection, against the action of selection on mere accidental (so to speak) variability. I oscillate much on this head, but generally return to my belief that the direct action of the conditions of life has not been great. At least this direct action can have played an extremely small part in producing all the numberless and beautiful adaptations in every living creature.[1]

But one year later, on 24 November 1862, Darwin wrote to Sir Joseph D. Hooker:

> I hardly know why I am a little sorry, but my present work is leading me to believe rather more in the direct action of physical conditions. I presume I regret it because it lessens the glory of Natural Selection and is so confoundedly doubtful.[2]

Darwin reflected upon the matter and became convinced enough that ten years later, when he published the sixth edition of his *Origin of Species* he observed:

> Species have been modified [...] chiefly through natural selection of numerous, successive, slight, favourable variations, aided in an important manner by the inherited effects of use and disuse of parts; and in an unimportant manner [...] by the direct action of external conditions [...]. It appears that I underrated the frequency of these latter forms of variation as leading to permanent modifications of structure independently of natural selection.[3]

1. Charles Darwin: *Life and Letters*, edited by Francis Darwin, Murray, London, 1888, vol. II, p.369, in a letter to T. Davidson dated 30 April.
2. *Ibid*., p.390.
3. Darwin, Charles, *The Origin of Species by means of Natural Selection*, Murray, London, 6th edition, 1872, chap.15, p.421.

In the first edition of his Origin of Species (1859, chap.6, p.256), Darwin had said that natural selection is "in some cases" aided by the use and disuse of parts and "slightly affected" by the direct influence of the environment. In the sixth edition (1872, p.167) the words "in some cases" had become "in many cases," and "slightly affected" had become simply "affected." Four years later, in 1876, Darwin wrote in a letter to Moritz Wagner:

> In my opinion the greatest error which I have committed has been not allowing sufficient weight to the direct action of the environment, i.e., food, climate, etc., independently of natural selection [...]. When I wrote the *Origin* and for some years afterwards I could find little good evidence of the direct action of the environment; now there is a large body of evidence.[4]

Finally, in 1877, in a letter to Melchior Neumayer dated 9 March, he wrote concerning an example of direct influence of the environment reported by his correspondent. "It is by far the best case which I have ever met with showing the direct influence of life on the organism."[5]

But his common-sense logic and the evidence he accumulated in support of natural selection were persuasive enough that they prepared the way for the final overthrow of Lamarckianism—an overthrow completed by the experiments of Auguste Weismann (1843-1914).

It had long been recognized that modification of a parent body by artificial means had no effect upon the offspring. Circumcision, for example, had been practised for thousands of years without leading to a race of congenitally circumcised male children. The operation still had to be performed in every generation. Still there was a possibility that the modification was not effectively passed on because only the *father* of the next generation was involved, and not the mother. If some comparable gross modification of the mother had been repeated over the same period of time, the results might have been different. However, it had been customary in China for many centuries to bind the feet of female infants in the upper classes of society. Small feet were considered beautiful. Yet here again there was no evidence that the modification was becoming inheritable. Clearly, modifying the male *or* the female in such ways, even after centuries of repetition, did not affect the germinal stream in any way, since no influence upon subsequent generations had ever been observed.

In an attempt to determine whether inheritance of such modifications or acquired characters would occur if *both* sexes were modified in the same way, Weismann cut off the tails of experimental mice of both sexes, male and female, for many generations: he still found that such a modification did not become inheritable. Thus Julian Huxley remarked upon the apparent immunity of living organisms against all experimental attempts to modify their characteristic form in a way that would be self-perpetuating, underscoring the fact that there seems to be no *direct* effect of the environment upon the germ plasm. In 1938 Huxley observed,

4. Charles Darwin: *Life and Letters*, edited by Francis Darwin, Murray, London, 1888, vol. III, p.159.
5. *Ibid*., vol. II, p.232.

> Can the hereditary constituents be permanently changed by environment? It is clear that theoretically it should be possible to induce such changes. The hereditary constitution is seen to be something material which only our lack of knowledge prevents us from defining chemically; and as such it must be possible for us to alter it. The remarkable fact, however, is its stubbornness in resistance in alteration.
>
> Sixty-nine generations of flies bred in the dark—and yet no alteration in their eyes or their instincts with regard to light. Ninety generations in an attempt to cause their resistance to heat by acclimatization and selection—without result [...].
>
> In spite of all the work that has been done, we have only established that to a great many apparent outward influences the germ plasm is quite unresponsive.[6]

Admittedly this was written four decades ago, but subsequent research has only reinforced the conclusion. Insofar as the germ plasm and nuclear genes are concerned, the results are still negative. No experimental modification of the *body* cells seems capable of bringing about inheritable changes in the nuclear genes of the organism. As some wag is reported to have said when referring to the negative results of Weismann's experiments, and with apologies to Shakespeare's *Hamlet*: "There is a divinity that shapes our ends, rough-hew them how we will."

Now it is possible by deliberately *damaging* the nuclear genes to bring about inheritable modifications. But this kind of interruption of the normal development of an organism must be a comparatively rare event in nature,[7] and when it does occur it is even less likely that the effect will be beneficial. Indeed, there are many geneticists who believe that all gene mutations which result from this kind of interference with the normal development of the organism are harmful. Individuals carrying such harmful genes would tend to be eliminated in the natural course of events, simply because they are less fit.

The amazing fitness of organisms within their own particular habitat demands an explanation. And the explanation must also account for the fact that living things seem to have a large capacity for adjustment to environmental pressures and seem to be able to pass on the benefit of these adjustments by inheritance to succeeding generations. Since experimentally it has not seemed possible to mimic nature in this respect by effecting changes on nuclear genes, we must suppose either that there is some built-in mechanism of adjustment that is inheritable by some other means than nuclear genes, or that God has been at work creatively making these adjustments throughout the past.

Certainly the fitness of things is everywhere manifest in nature and all the more manifest as the circumstances are more carefully examined. Since the environment tends to be in a state of flux, fitness must involve a similar flexibility. The ideal mechanism would be one which can capture and hold any successful adjustment made in one generation so that the next generation can build upon it. Wood Jones was one of those who argued strongly for this view, but despite his

6. Huxley, Sir Julian, "Inheritance of Acquired Characteristics" in *Essays in Popular Science*, Penguin, Harmondsworth, England. 1938, pp.36-37.

7. The very persistence of many forms over supposedly millions of years without significant change is evidence of this. The stability of many organisms over enormous periods of time is astonishing.

eloquence, current orthodoxy—having rejected Lamarck—did not allow him a hearing: he was arguing in favour of some form of inheritance of acquired characters.[8] He was arguing, in fact, in favour of the view that environmental pressures did have a *direct* effect on the development of living forms over successive generations and not merely an indirect effect through a process of natural selection by elimination of the less fit.

The negative evidence against the inheritance of acquired characters under experimental conditions in the laboratory is not always borne out by what goes on in nature. The contradiction may have been unresolved in the past, because current theory has demanded that nuclear genes provide the only pathway for inheritable factors and these genes are remarkably immune to the direct influence of environmental pressures, except those which are essentially damaging.

But in the past few years a renewed interest in the possibility of another pathway whereby the environment might have a direct influence upon an organism responding in an inheritable way has led to the conclusion that there are probably carriers of inheritable material in the *cytoplasm* of the cell and not merely in the nucleus. These carriers, which have been termed Plasmagenes, are responsive to the direct action of the environment. This responsiveness appears to be somewhat delayed, so that the environmental pressure must be held constant over several generations to influence the plasmagenes. That the response of these extra-nuclear genes can be inherited through succeeding generations is demonstrated by the fact that the effect persists even when the original stimulus is removed. If the environment gradually reverts to its original nature, the modified organisms will continue to retain their altered form for several generations, and then they too revert.

Thus the response of the organism to direct environmental pressure is demonstrated. Yet it is seen to be of such a nature that it retains its flexibility and is therefore able to adjust in either direction to its own advantage and pass on the adjustment to successive generations. In this way the mechanism contributes to the fitness of the organism without endangering it if the environmental pressure changes. This type of modification which continues for a limited time even when the stimulus which provoked it is removed has been termed a *dauermodification*.

Such a mechanism serves the dual purpose of preserving the line in its purity and maintaining the species as such, while at the same time opening the way for a form of adjustment that allows a particular species to spread successfully into different habitats which it could not otherwise occupy. The nuclear genes therefore preserve the species as such: the plasmagenes preserve the local population as a variety.

The difference between the conventional Darwinian view of natural selection and the view which is now beginning to crystallize, based on plasmagenic inheritance of acquired modifications, is this: the former depended upon a process of selective *elimination* of the unfit, whereas the latter favours *survival* by inherited adaptation. Progress, identified as increasingly successful adaptation, no longer becomes a ruthless weeding out, but a demonstration of a sensitive mechanism specifically designed to guarantee exactly the opposite result, namely, an improvement in the chances of survival of every individual. It is in some sense

8. Jones, F. Wood, *Trends of Life*, Arnold, London, 1953, especially chap.12, p.128, "The Inheritance of Adaptations."

a reflection of the benevolence of the Creator rather than of a pitiless eradication in the interests of efficiency at all costs.

The older view of nature as ruthlessly efficient is therefore replaced by a more generous view, which holds that any disadvantaged species need not be eliminated but is provided with the means of contributing to the greater fitness of its descendants. This is achieved by passing on to these future generations the benefits of its own response to the environment even though these were not overtly expressed in its members at the time.

It is as though the Lord has so designed the mechanism of inheritance in order that the "kinds" of Genesis will not be destroyed or blurred, while yet allowing modification which greatly increases the range of climate, altitude, food resources, and so forth, that the particular species can occupy. There are numerous illustrations of this type of response among plants and animals; and there are some striking illustrations of it for man himself.

Chapter 2

The Nature of Dauermodifications

The term *dauermodifications* (original German: *dauermodificationen*) seems to have been first used by V. Jollos in 1913.[9] It has still not found its way into evolutionary literature in general, because the climate of opinion is not sufficiently favourable toward the concept for which it stands. Yet the phenomena which it was coined to define have been observed and demonstrated experimentally for many years. Dauermodifications are the kind of modifications which are observed in living things in response to environmental pressures and which, when they occur in one generation, appear to be inherited by the next.

Jollos originated the term to describe what he observed to be long-lasting changes induced in paramecia by heat treatment and by various chemicals, which he was persuaded were being transmitted through the cytoplasm rather than the nucleus. Moreover, he noted that such induced changes, or "modifications," continued to be propagated over successive generations even after the inducing agent had been removed.

In a textbook on organic evolution in 1952, A. W. Lindsey reported experiments by F. B. Sumner and others, reinforcing the evidence for cytoplasmic inheritance of this kind.[10] Sumner raised white mice at 20-30 degrees C. and found that at the higher temperatures they developed longer bodies, tails, ears, and hind feet. In these experiments Sumner took normal mice and exposed them to an environmental pressure in the form of a higher temperature than they were accustomed to; he discovered that within a few generations the mice had modified their bodies to improve their chances of survival by increasing the amount of body surface area from which heat could be radiated. This included elongation of the body, enlarging the ears and tail (both of which are excellent heat exchangers), and also enlarging the hind feet for reasons which are not altogether clear at the moment. These modified animals were then returned to a normal environment and mated. Their offspring were raised at temperatures normal to the species. It was found that these offspring retained the modified form for some generations even though they were no longer being subjected to above-normal temperatures.

Thus Sumner demonstrated experimentally that the modified form had become inherited. He also demonstrated that with a return to a normal environment, the inherited modification only gradually reverted to original type. This seemed to be clear evidence that the elongated shape which was an acquired

9. Jollos, V., "Experimentelle Untersuchungen an Infusorien," Biol. Zblt., vol.33, 1913, p.222-36.
10. Lindsey, Arthur Ward, *Principles of Organic Evolution*, Mosby, St. Louis, 1952, p.342.

character in response to heat had indeed become inherited, but only in a semipermanent way. Sumner was convinced that this was a form of cytoplasmic inheritance, since it had been demonstrated so clearly by others that the nuclear genes are not subject to environmental influences.

That the cytoplasm was capable of influencing the form and function of daughter cells had already been argued by a number of developmental physiologists and embryologists on the following grounds. Since all cells in an organism share the same nucleus and yet differentiate specifically into different kinds of tissue—bone, tendon, nerve, muscle, skin, and so forth—the power of differentiation was presumed to be under the control of the cytoplasm rather than the nucleus. Moreover, since millions of cells *retain* their ability to produce any one of these specifically different structures in the body, there must be some inheritable factors unique to the controlling cytoplasm which governs the proliferation of cell lines in certain directions. Boris Ephrussi put it succinctly:

> Unless development involves a rather unlikely process of orderly and directed gene mutation, the differential must have its seat in the cytoplasm[...]. If the cytoplasm causes differentiation, it must be endowed with the power of perpetuation of cell type.[11]

Bone cells continue to reproduce bone and not skin—not because their nuclei are different from cells producing skin, but because their proliferation as bone cells is under some cytoplasmic control which so directs them. Since these cells replicate as bone and not as, say, muscle, the control must be passed on from cytoplasm to cytoplasm by some process of inheritance. We seem therefore to be driven to the conclusion that there is a cytoplasmic form of inheritance as well as a nuclear gene form of inheritance, and it seems likely to be of a somewhat similar particulate nature.

Certain experimental difficulties continued for many years to leave the matter in doubt, especially by contrast with the easily demonstrable and therefore undoubted hereditary factors in the nucleus. Lindsey complained that the experimental evidence of cytoplasmic inheritance existing by 1952 was ignored by most geneticists because of their anti-Lamarckian bias. It was simply denied that any environmental pressure could influence the nuclear genes, which were held to be the sole determiners of inheritable characters.

In 1953 Boris Ephrussi published a report of his work with paramecia in such a lucid manner as to draw fresh attention to the evidence of cytoplasmic inheritance. He wrote:

> These studies confirm the view that cytoplasm, like the genes, is endowed with genetic continuity. The genes are therefore no longer to be regarded as the sole cell-constituent with this property.[12]

Ephrussi's book is a delight to read. He is full of enthusiasm for his subject, and this enthusiasm is communicated to the reader in a flow of language which seems easily to be able to handle the most complex details. At that period

11. Ephrussi, Boris, *Nucleo-cytoplasmic Relations in Micro-Organisms*, Oxford University Press, 1953, p.4.
12. *Ibid.*, p.6.

Ephrussi did not seem certain that the mechanism always involved active particles of some kind in the cytoplasm which would be comparable to the genes in the nucleus. But certainly the mechanism of this type of inheritance resided in the cytoplasm and not in the nucleus. Toward the end of his book he wrote:[13]

> Considering that embryonic development results in a restriction (and some widening, too) in different cell lineages of the manifold potentialities originally carried by the egg, we may picture the process of differentiation as consisting, for example, in the segregation or sorting out of an initially mixed population of cytoplasmic particles. Or we may suppose that the egg, to begin with, contains a mixed population of inactive particles and that development consists in the activation by nuclear genes of different sorts of lineages.

In 1959 C. L. Prosser was able to report:

> Several types of non-genic inheritance and of indirect effects of environmental selection on the genotype are recognized. Cytoplasmic inheritance is being discovered in more and more groups of organisms, and cytoplasm is more readily influenced by the environment than is the nucleus.[14]

Now, the ovum in many species, including man, is much larger than the spermatozoon. In man the ratio is about 500 to 1. Since the nucleus is of equal size in both, the difference in mass results from the far greater amount of cytoplasm which the ovum contains.

It is considered that this fact is related to the greater importance (in some matings) of the female contribution rather than that of the male, and it results in such instances in a greater resemblance of the offspring to the female parent. This in itself reinforces the likelihood that some real contribution to inherited factors is made specifically by the cytoplasm. In his book on the architecture of the cell, Verne Grant proposes that if a cytoplasmically controlled character does not persist for more than a generation or two, it could be explained as a maternal effect in which the nuclear genes of the mother, by imposing some condition on the cytoplasm of the egg, predetermines a phenotypic trait of the offspring. The trait in question is not therefore carried by some particles in the cytoplasm acting autonomously.

On the other hand, if the cytoplasmically controlled characteristic persists for several generations but still eventually disappears, it should be regarded as a dauermodification. The decisive test is persistence for a number of generations even when the stimulus which was the determining factor is removed. As Verne Grant observed:

> We are forced to conclude that particles with a gene-like property of self-reproduction exist in the cytoplasm. Inheritance

13. *Ibid.*, p.100.
14. Prosser, C. L., "*The Origin* After a Century: Prospects for the Future" in *American Scientist*, vol.47, 1959, p.545.

> through the cytoplasm has been verified for a number of plants, animals, protista, and fungi.[15]

A little later Grant refers to a plant experiment undertaken by P. Michaelis[16] in which enucleated cells retaining only the original cytoplasm were supplied with nuclei from other cells. These structurally modified cells were then cultured, and it was demonstrated that "the cytoplasmic constituents responsible for the characters in question maintain their identity and produce their specific action even though under the influence of a foreign nucleus for 24 generations."[17] This would seem to indicate that the hereditary factors in the cytoplasm do, in some cases, have genuine autonomy. Grant was writing in 1964. Since that time the principles of cytoplasmic inheritance have been elaborated somewhat, as may be seen from Alfred Kuhn's treatment of the subject.

Alfred Kuhn published his lectures on developmental physiology in 1971. He observed:

> The form and size of [certain protozoans] can be modified strongly and in various ways by environmental factors. Certain modifications of form are retained as dauermodifications for a long time after the conditions change, and it often takes a large number of generations before a new form corresponding to the new conditions is acquired.[18]

And we shall see in the next chapter, the response of the organism to the environment may be extraordinarily rapid, even in man. Toward the end of his volume, Kuhn wrote:

> In dauermodifications the consequences of transient environmental influences can last for many cell generations in single-celled organisms and for several individual generations in multi-cellular organisms. The norm of reaction of the cells is in all these cases controlled by alterations of the cytoplasm [...]. In dauer-modifications, cytoplasmic components with altered properties must replicate.
>
> Thus, in order to understand the nature of determination one is led to the possibility that certain cytoplasmic structures are capable of self-replication and that their relative numbers and properties can he altered by appropriate conditions. That part of the hereditary mechanism lies in the cytoplasm cannot be doubted.
>
> A cytoplasmic property which shows extra-nuclear inheritance has been called the *plasmotype* or plasmon by von

15. Grant, Verne, *The Architecture of the Germplasm*, Wiley, New York, 1964, p.15.
16. Michaelis, P., "Cytoplasmic Inheritance in Epilogium and its Theoretical Significance" in *Advances in Genetics*, vol.6 1954, p.287-401.
17. Grant, Verne, *The Architecture of the Germplasm*, Wiley, New York, 1964, p.19.
18. Kuhn, Alfred, *Lectures on Developmental Physiology* translated by Roger Milkman, Springer-Verlag. New York, 2nd edition, 1971, p.83.

> Wettstein. The name *plasmagene* has been given to the bearer of properties inherited in an extra-nuclear fashion.[19]

At this point Kuhn lists a number of references to work in this area by E. Caspari (1948-55), F. Ochlkers (1952), P. Michaelis (1954), and R. Hagemann (1964).

Thus we come in a kind of circular course from a general acceptance of Lamarck's common-sense doctrine of the inheritance of acquired characters in the early eighteenth century to a position of uncertainty by the mid-nineteenth century, followed by outright rejection in the first half of the twentieth century. And now we are back again to the original position, but on an entirely new basis. As soon as the doctrine began to receive more favourable attention by a few members of the scientific community whose opinion was not to be lightly set aside, then a host of lesser authorities suddenly began to observe any number of potential examples of cytoplasmic inheritance, and a whole new field of experimental inquiry was opened up.

Today there is a wide measure of agreement that organisms have the power to improve their fitness by adjusting their form and function and passing on these adjustments to their offspring. Nuclear genes do not seem to be involved, and for the most part the older established doctrines of nuclear genetics remain valid. Nuclear genes are indeed surprisingly impervious to environmental pressures, but plasmagenes are not. A way is thus opened for any organism to contribute to the greater fitness of its descendants, and the whole of nature is in a position to reinforce the fitness of things without becoming in bondage to an altered form which in a later reversion of the environment would spell its doom.

We shall now examine some of the growing evidence that such a mechanism does exist.

19. *Ibid.*, p.489.

Chapter 3

Evidence for Dauermodifications Below Man

There is a built-in stability accompanied by a responsiveness to environmental pressures in all living things—plants, animals, and man. This built-in stability guarantees order and therefore a measure of predictability which provides man with the means of controlling the development of things to his own advantage. Responsiveness, on the other hand, fits all these creations of God to their physical world and to one another, to produce a grand harmony. The former is maintained through nuclear inheritance; the latter is achieved through cytoplasmic inheritance.

It has always been obvious enough, really. Naturalists of an older generation with Christian leanings saw in the fitness of things evidence of God's directive providence at work. Evolutionists later came to attribute this fitness entirely to the operation of chance, rejecting the idea of direct intervention of the Creator. Today it seems that we may once again be in a position, on the basis of hard evidence, to recognize a mechanism by which both stability and adjustment are combined to allow a measure of freedom of variation in form and function without inviting a total breakdown of order.

The ability of plants to acquire a new character which enhances fitness, and to pass it on to succeeding generations as long as the environment favours it, has been recognized for many years. It was the transient character of this kind of inheritability that defied explanation in conventional Mendelian terms. Yet it is this transient character which seems so necessary to ensure fitness when environmental conditions change. The environment is changed, not merely when a shift in temperature or humidity occurs, but also when a species is forced to migrate into a new habitat due to the pressure of numbers or other competing forms of life. In either case, from the point of view of a particular species, the environment has changed and it is essential that the species adjust or become less fit to survive.

Julian Huxley many years ago remarked upon the fact that plants are able to make this kind of adjustment when they are transplanted. He noted that dandelions whose natural habitat was lowland country changed their size, form, and proportions surprisingly quickly when transplanted to a higher altitude.[20] But the adjustment was transitory, for if these modified plants were then returned to their former habitat, they quite quickly recovered their previous size and form. This phenomenon is common enough in nature. Since the nuclear genes remain

20. HuxIey, Sir Julian, "Inheritance of Acquired Characteristics" in *Essays in Popular Science*, Penguin, Harmondsworth, England, 1938, pp.36-37.

constant, the change in either direction has to be attributed to some factor in the cytoplasm.

The change in such a case is rapid but not always immediate, and the reversion to type follows the same course. Such a circumstance can only be accounted for on the basis of some kind of inheritableness, since it is progressive and carried over cumulatively. Had mutations of nuclear genes been involved, the effect would be instantaneous rather than occupying several generations. Slow adjustment, even if it occupies only two or three generations, clearly indicates a carry-over effect which demands explanation in terms of some inheritable influence. These dandelion observations ought to have suggested non-nuclear inheritance, but the climate of opinion did not allow such a suggestion—or if it was made, it did not gain a serious hearing.

Now, for many years there has tended to be far greater popular interest in animals than in plants, because the theory of evolution has occupied such a large place in our thinking and comparatively few people connect the theory with plant life. The renewed possibility of the inheritance of acquired characters in animals has begun to excite more interest in recent times, because it could provide an alternative to natural selection as the *modus operandi* of progressive change. An increasing number of authorities are having second thoughts about the adequacy of the concept of natural selection today, and cytoplasmic inheritance would seem to provide a new and exciting alternative.

It often happens that when an idea which has hitherto been repudiated begins to receive more favourable attention, a whole wealth of new evidence in its favour is suddenly discovered. It is certain that a number of authorities whose standing in the scientific community is unchallengeable have for some time been questioning the validity of natural selection as an explanation of the fitness of things. Lucien Cuenot in France, Wood Jones and Sir Alister Hardy in England, W. R. Thompson in Canada, and many others have openly challenged it.[21]

The factors which cause modification tending to greater fitness are observed in animal species at every level of complexity. The pressures which operate to spark these adjustments are of at least three kinds: climatic (which would include environmental temperature, humidity, altitude, wind, etc.); biotic (other living things which exert selective pressures due to predation, crowding, altered breeding habits, etc.); and edaphic (the nature of the rocks and the soil insofar as they influence the *types* of food available, their varying nutritional character, and the kind of water).

Sir Cyril Hinshelwood has shown that even such lowly forms as bacteria respond to such pressures.[22] Various kinds of bacteria will "learn" to cope with a new food or poison and will transmit their acquired biochemical wisdom more or less durably (according to the number of cell generations for which the treatment has been applied) to their descendants. We are only too well aware of the fact that various insecticides applied to plants—and antibiotics applied to ourselves—tend to lose their potency if they are used in one form for too long a period. The organisms under attack develop an immunity (or fitness, from their

21. See Lucien Cuenot, *L'evolution biologique: les faits, les uncertitude*, Masson, Paris, 1951; F. Wood Jones, *Trends of Life*, Arnold, London, 1953; Sir Alister Hardy, *The Living Stream*, Collins, London, 1965; W. R. Thompson, introduction to Centennial edition of *Darwin's Origin of Species*, Dent, New York, 1959.

22. Sir Cycil Hinshelwood: quoted by Donald Michie, "The Third Stage in Genetics" in *A Century of Darwin*, ed. S. A. Barnett, Heineman, London, 1958, p. 65.

point of view) without becoming specifically different at a species level. Only by modifying the treatment every so often can they be held in check by reason of the constant upsetting of the mechanism of adjustment whereby they are able to develop immunity. This is clearly a case of dauermodification.

But it is not merely in these lower forms of life that we observe this phenomenon. We have a number of instances of species of frogs or salamanders which have gradually spread along either side of some natural barrier such as a mountain or a lake and diverged sufficiently as they spread that, when they were again brought into contact at the far end of the barrier, they show themselves to be no longer a naturally interbreeding community.[23] The two populations that demonstrably began as one are now isolates and continue to be so even though sharing a single habitat again. This separateness may stem from several causes, depending upon the particular route taken by the migrating sub-populations. A different food supply along the way may induce different tastes that become inherited and *persist*. This in turn may cause a divergence in body odour[24] or size or colouration or mating calls or other changes[25] which are preserved by the two divergent lines even after they come together again in a single habitat. The new tastes may in no way affect the fitness of the individual, and there will therefore be no immediate pressure tending to its reversion.

It is clear that such divergent subspecies are still genetically a single species, for it can be shown in many cases that they will interbreed in the laboratory.[26] Yet, for what might be called psychological reasons,[27] they no longer do so in nature. It seems likely that in some instances the single habitat shared by both subspecies will tend to draw them together again; but this does not necessarily happen, since their divergent forms may both be very well-suited to their survival so that there is no pressure driving them toward convergence again. The persistence of the divergent forms under these circumstances is clearly an example of dauermodification. T. M. Sonneborn notes that:

> Differing conditions for mating reactivity (temperature, light), once they arise, constitute such effective barriers to interbreeding that different varieties (of protozoa) can and do intimately coexist in the same body of water without losing their integrity. Even when the mating type specificities are only slightly different and interbreeding is possible, the varieties are found to coexist in the same body of water in nature. From these

23. Frogs: Maynard Smith, *The Theory of Evolution*, Penguin, Hammons, England, 1958, p. 189; and salamanders, Edward Dodson, *A Textbook of Evolution*, Saunders, Philadelphia, 1952, pp. 318,321.
24. Dodson, Edward, *A Textbook of Evolution*, Saunders, Philadelphia, 1952, p. 321.
25. Moore, John A., "An Embryologist's View of the Species Concept" in *The Species Problem*, edited by Ernst Mayr, A.A.A.S., Washington, D.C., 1957, p.329.
26. Dodson, Edward, *A Textbook of Evolution*, Saunders, Philadelphia, 1952, p.318.
27. See *New Scientist*, 26 February, 1976, p.439 under the heading "Green Toads Sing their Way through Evolution." The frequency and pitch of the toad's mating call is modified by the range of temperature within which the young are matured, and only toads with the appropriate calls any longer attract one another. The community is therefore broken up somewhat by the effects of different temperatures on the young.

> observations, it would seem that even relatively slight changes in mating type specificity could lead to isolation of a new variety.[28]

The opposite of a divergence is convergence. In this case, two distinct species which cannot be shown to have a common ancestry may increasingly become alike in form and function as a result of sharing similar needs under similar environmental conditions. Some of the evidence of this well-established phenomenon is examined in a previous volume in this series.[29] Such a mechanism must also involve the principle of dauermodification; otherwise each generation would have to start from scratch and the offspring would be born without the advantages accruing from their parents' experience. The gains would not be cumulative. But we know that such gains are cumulative, because the neonate is usually found to bear in miniature most of the structures which the adult has acquired to its own advantage. For example, a number of animals which live in and out of water display an alignment of nostrils, ears, and eyes that permits them to submerge themselves almost entirely below the water while yet being able to breathe and see and hear what goes on around them. The hippopotamus and the crocodile are among such animals, and *their young are similarly equipped*.

F. Wood Jones wrote eloquently about many of these examples of fitness of animals for the kind of lives they live. But unfortunately he attributed it to what can best be described as a kind of mystical goal-seeking drive in all living things directed toward satisfying needs begotten by the circumstances of ecological demands. He commented:

> Exactly how these could be explained on the supposition that structural alterations are due solely to random genetic variations acted on by "natural selection" determining the "survival of the fittest" in a "struggle for existence" is a thing which seems very difficult to conceive.[30]

It is a principle broadly applied in the history of the development of scientific ideas that a useful theory is not overthrown by the mere citation of contrary evidence, but only by the presentation of a better theory. Natural selection, rightly or wrongly, is a concept which has much to commend it. It appeals to our sense of the obvious, and in terms of human experience, the history of man seems to bear it out. Moreover, natural selection can rationally justify why the powerful among men freely exhibit some of the worst aspects of human nature.

But it is not at all certain that animal nature and human nature are the same. What is appropriate in nature may not at all be appropriate in human society, so that neither the reasonableness nor the unreasonableness of the concept of natural selection in human terms has any real bearing on whether it is an appropriate concept to apply in nature. Man is a fallen creature, and his present behaviour makes him un-natural by almost every standard of judgment. We do not find the struggle to survive in nature taking the same form as it does in human society.

28. Sonneborn, T. M., "Breeding Systems, Reproductive Methods, and Species Problem in Protozoa" in *The Species Problem*, edited by Ernst Mayr, A.A.A.S., Washington, D.C., 1957, p.233.
29. On this, see A. C. Custance, "Convergence and the Origin of Man," Part III in *Evolution or Creation?*, vol.IV in The Doorway Papers.
30. Jones, F. Wood, *Trends of Life*, Arnold, London, 1953, p. 84.

There is no certainty that nature is ruthless in the sense that human society constantly tends to be.

The fitness of things in nature is everywhere apparent. The un-fitness of man is also everywhere apparent. One would suppose that if man is really part and parcel of the web of nature, he will become increasingly fit by the same kind of dauermodifications. There is some evidence that such modifications do indeed improve man's fitness, but there is the disruptive factor of man's fallen nature constantly placing his survival in jeopardy.

As we shall see in the next chapter, man shares in the web of life to the extent that dauermodifications at least contribute this much to his well-being, namely, that he is better able to obey the command to fill the earth and subdue it. It is dauermodifications that have enabled him successfully to become truly ubiquitous. He can thrive in any climate. It is a remarkable fact that wherever dauermodifications can be demonstrated in man, they seem to serve this purpose above all—which may be one more evidence of benevolent design.

Chapter 4

Dauermodifications in Man

The human race is known to be a single species, since men and women everywhere in the world freely mate and produce fertile offspring if they are so inclined. Yet there are some remarkable differences in stature and body build, from the diminutive Pygmies of the Ituri Forests in the Congo to the Negro giants of the Upper Nile in Abyssinia. The range in height is from less than four feet to over seven.

Very few, if any, anthropologists today would challenge the assertion that *Homo sapiens* is a single species. The divergences in type, therefore, are presumably the result of environmental influences, although some distinguishing characteristics such as hair form, skin and eye colour, and supernumerary fingers and toes are probably the consequence of gene mutations. That skin colour is not a result of climatic conditions seems to be borne out by the persistence of fairer skin among many peoples living near the Equator, and the persistence of darker skin (often almost black) of many peoples who have for centuries lived nearer the north and south poles.

But we have considerable evidence of dauermodifications of various kinds in man in certain regions of the world where environmental pressures are extreme. Two particularly notable examples have already been mentioned—the forest Pygmies and the Nilotic Negro giants. Both varieties of the human species have almost certainly arisen as the result of a combination of high temperature and high humidity throughout most of the year.

The human body must operate without overheating. We are so constructed that we can sustain a remarkable *fall* in body temperature; but a *rise* above normal (98.6 degrees F.) of only a few degrees can rather quickly prove fatal.

The body has a series of defences against a fall in temperature. The first defence is usually a change in the character of peripheral blood circulation during which the smaller capillaries and venules are closed off and the blood is channelled to circulate at a deeper level and not at the skin surface, where its heat would be lost by conduction or radiation. This is known technically as vasoconstriction. The skin accordingly turns whiter, and numbness is experienced at the extremities due to the loss of circulating blood at the nerve endings. If this initial defence mechanism fails to conserve heat adequately and deep body temperature continues to fall, certain muscles are automatically tightened in such a way that metabolic activity—and with this, metabolic heat—is increased. Some of these surface muscles erect skin hairs as a consequence, causing the familiar phenomenon of "gooseflesh". The nerve impulses to the muscle fibres, which

cause the fibres to contract, are fired at random so that the overall effect is a generalized increase in muscle tone. When one returns to the warm, the sudden sense of release and relaxation is a pleasant experience.

If this second defence mechanism still proves insufficient, the nerve impulses are no longer fired randomly but are suddenly coordinated into rhythmic contractions. Firing in unison, they produce shivering. The first form of general muscle tension in the cold can increase metabolic heat production by as much as 100 percent; shivering can increase it by 300 percent! One should not try to suppress it: it is a powerful mechanism for the maintenance of deep body temperature and the preservation of life itself.

Now, in the heat there is a somewhat analogous series of mechanisms. The first is a sudden opening up of peripheral blood vessels, called vasodilatation. As vasoconstriction causes whitening of the skin so vasodilatation causes reddening. Alcohol is a vasodilator, and the characteristic reddening of the skin which accompanies excessive drinking is a demonstration of this. The deep body heat which has begun to increase is now conducted by the blood to the skin surface at a higher rate of transport. Here it is radiated away into the environment.

If this radiation proves inadequate because the temperature of the environment does not permit the radiant heat to be absorbed rapidly enough, a second mechanism is triggered. The rising temperature of the blood flowing through the anterior hypothalamus triggers the sweating mechanism. This mechanism is extremely sensitive and capable of responding to a change in temperature of the blood of one hundredth of a degree Centigrade. Through some two million sweat glands of very complex design, a remarkably pure watery fluid is expressed with considerable force onto the skin surface. There it evaporates and, in doing so, cools the skin with extraordinary effectiveness.

It is not uncommon for a man exercising on a treadmill in a hot chamber to lose as much as five pounds of body water by this means within one hour. Meanwhile his body temperature will experience surprisingly little rise. If, by the use of drugs (atropine, for example), the sweating mechanism is blocked, body temperature will rise precipitously; fatal heat stroke becomes a real probability within a comparatively few minutes unless steps are taken to reduce the body temperature by some other means and as quickly as possible.

But to be effective, cooling by this means demands that the environment be able to absorb the water thus evaporated. If the water content of the atmosphere is already near the saturation point (we commonly say, "The relative humidity is high"), then our sweating mechanism becomes almost useless. It does serve a secondary purpose, the fluid itself acting in part as a fungicide on the skin. But apart from this, the sweat water merely runs down and collects in our shoes! Thus, in any environment which combines high temperature and high humidity, maintaining a normal body temperature is a serious problem.

In two areas of the world, just such a situation seems to have existed for a very long time, yet man has spread into these places and established himself successfully. So have a number of warm-blooded animals whose body temperature is equally critical to their survival. The environmental pressure in these areas, acting day and night upon man and the animals, has caused a modification of body form which is greatly to the advantage of the individual in this respect. In the Congo region, body *mass* has been substantially reduced,

giving rise to communities of Pygmy people. In Abyssinia, body *shape* has been surprisingly elongated into a wirelike form, giving rise to the Negro giants. Both responses serve the same end, making for increased fitness in areas of a combined high heat and high humidity. The reasons why these two forms are an advantage are well-enough understood in terms of the physics of heat transport.

To accelerate cooling, it is desirable to shorten the distance that the heat must be conducted to escape to the environment. Consequently the smaller the body, the better the rate of heat removal, since it has less distance to travel from the centre to the surface. Fortunately a further advantage of a smaller body is the fact that the surface area increases relatively as the mass is reduced, and this again makes it an even better heat radiator. It is an advantage in every way to be small, if we have in view the maintenance of body temperature in the heat.

Suppose we have a cube measuring twelve inches on each side, having therefore a volume of one cubic foot. And let us say that one cubic foot weighs one pound. This one-pound body has a total surface area of six square feet. If we enlarge the cube so that it now measures twenty-four inches on each side, we shall now have a body of eight cubic feet, which (assuming it is made of the same stuff) would have a comparative weight of eight pounds instead of one. But the surface area has now become enlarged to twenty-four square feet. This looks like a great improvement. However, relatively it is quite the opposite. The surface area relative to body weight in the smaller cube is 6 to 1; in the larger cube the surface area relative to body weight is 24 to 8, or only 3 to 1. Therefore, the smaller body with its smaller heat capacity has a much larger surface area from which to radiate any excess heat: it is better off in every way.

There is an alternative method of improving the relative radiating surface area. This is to elongate the body into a long, thin, wirelike form. The effect is basically the same, namely, to increase the surface area relative to the mass and to decrease the distance from the centre to the surface. This is precisely what has happened to the Nilotic Negro.

It is a striking fact that the Pygmy and the giant occupying a similar environment in Africa are parallelled by Pygmies and giants occupying a similar environment in South America. The Pygmy tribe known as the Yushes, who average about thirty-nine inches in height, live along the banks of the Curanja River in the border area common to Brazil, Peru, and Bolivia. They are neighbour to a community of people called the Hurayos, who are found to be more than six feet tall.[31] Pfeiffer notes that Louis Leakey, excavating in Nairobi in 1961 and in Zaire, found the remains of a pygmy giraffe and a pygmy elephant.[32] Perhaps these animals also responded to a hot, humid environment in a similar way.

That both the Nilotic Negroes and the Ituri Pygmies are examples of dauermodifications in man is suggested by the fact that transplantation to a different environment leads to a gradual shift to the normal proportions of the majority of human beings in the new environment surprisingly quickly. The speed with which such modifications can occur was remarkably demonstrated by the findings of Franz Boas when he was asked by a United States Senate Committee in 1911 to undertake a survey of the effect on the population as a whole of the

31. Reported in the *Toronto Telegram*, 20 October, 1970, from a published statement by the Roman Catholic Church, vicariate in Puerto Maldonado, Peru, 1970. See also, Thomas Gladwin, "Climate and Anthropology" in *American Anthropologist*, new series. vol.49, Oct.-Dec., 1947, p.607ff.
32. Pfeiffer, John E., *The Emergence of Man*, Harper and Row, New York, 1969, pp. 40, 94.

admission into the New World of a large number of immigrants of different physical type. The question at issue was whether these immigrants were really being absorbed into the population or forming communities which preserved their physical identity. Was America truly a "melting pot," or merely a "gathering place"? Boas set out to measure, among other things, successive changes in head form, first of immigrant parents and then of their children born in America. If the trend was toward the American mean, all was well. If the children in successive generations preserved their parental head form, then it was clear that physically at least they were not "melting."

What Boas found was so unexpected that, even after nearly twenty years, the interpretation of his data was still being violently disputed. He discovered that the conformity of the head form of children born to immigrant parents converged more nearly toward the American mean in proportion to the time spent *by the parents* in America before each child was actually born. A child born one year after the parents arrived showed a measurable convergence toward the American mean. A child born three years after their arrival showed a greater measure of convergence. A child born to the same parents ten years after the parents landed showed even greater conformity to the American mean—and greater divergence from the parents' head form. Thus the New World environment evidently began to influence the head form of the children prenatally and with greater and greater force the longer the period of time spent by the mother and father in their adopted country before the conception of the child. In some way the environment was influencing the germ plasm.

Boas measured nearly eighteen thousand subjects. His data were unequivocal. And he was as surprised as his critics by what he found. The results of this survey demonstrated undeniably that there was a positive and direct influence of the new environment at work on the parental germ plasm (or more precisely, perhaps, on the parental germ plasm plasmagenes), modifying the cranial form of the children more and more positively as the children were born later and later to the immigrant family. The parents themselves did not undergo this modification.

These discoveries created so much argument and criticism over the ensuing years that in 1928 Boas decided to publish the whole mass of data under the title *Materials for the Study of Inheritance of Man*, in the hope that his conclusions would be vindicated. But as Melvin J. Herskovits later observed in his biography of Boas: "A detailed analysis of the reactions to this study, if it is ever made, will comprise an enlightening chapter in the intellectual history of our times."[33]

Not one critic took the trouble to examine the evidence, which is now known to be unimpeachable. Herskovits comments: "One still encounters statements to the effect that Franz Boas made an extended study of the effect of immigration to the United States on the head form of immigrants, concluding that the American environment was providing a new physical type. This conclusion has since been shown to be false."[34]

In a manner of speaking, such a conclusion was indeed false—but Boas did not make any such claim for his data. He demonstrated precisely the opposite. What he succeeded in doing was providing evidence for a gradual change in head form in response to some as yet unidentified environmental pressure which was

33. Herskovits, Melville J., *Materials for the Study of Inheritance in Man*, Franz Boas, Scribners, New York, 1953, p.40.
34. *Ibid.*, p.41.

becoming increasingly embedded in the germ plasm and being passed on to the grandchildren. An acquired character was becoming inheritable. Dauermodification was being demonstrated in man. There is no reason to doubt that had the children returned to their parents' homeland and in turn raised families, these later generations would have displayed the same increasing tendency to revert back to the parental head form which, in the first place, had been the result of a response to their native environment. Dauermodifications are inherited progressively only so long as the modifying environment maintains the pressure in the same direction.

The responsiveness is pervasive. It has been largely denied in recent years because, having formulated a theory of inheritance unfavourable to it, we have become incarcerated in the straitjacket of our prejudices. We soon become unaware of these prejudices, and because they are held unawares, they are largely immune to contrary evidence or to re-examination.

Yet many authorities have continued to preserve an open mind throughout this rather bleak period of evolutionary dogmatism. Writing on "The Inheritance of Acquired Characters" in the British journal, *Nature*, E. W. MacBride observed in 1932:

> Since changed habits, by exercising different parts of the body, do modify structure, and since we know that animals can and do change their habits in response to the demands of a changed environment, it is a natural inference that the changed habits are the cause of changed structure, and that the structural response of the individual has finally become engrained in the heredity of the race. So strong is the evidence for this inference, that some of my friends among the leading systematists of the British Museum deny altogether the necessity for direct evidential confirmation of it, arguing, with probable justice, that so many generations would be needed to make the change manifest that the time required would far exceed the span of an experimenter's life.[35]

This is one of the problems. We often do not know whether laboratory experiments are or would be a test of what happens in nature. Such experiments are the best we can do, but they do not really reproduce natural conditions. Man's "interference" introduces unrecognized changes in the conditions of a test which, for all we know, may invalidate such tests. Observations of animal behaviour in zoos or in any kind of captivity severely misguided earlier naturalists about the behaviour of animals when they were free. Captivity introduced hostilities due to crowding and other unknown factors which were unforeseen but are now known to have distorted our understanding of natural behaviour. Hence arose the mistaken doctrine that nature was "red in tooth and claw", a kind of interminable battlefield of savagery.

We have spoken of changes in head form among modern immigrants. The evidence shows that such progressive head-form modifications are an ancient phenomenon. It has been reported by W. S. Laughlin for the earliest settlers in the

35. MacBride, E. W., "The Inheritance of Acquired Characteristics" in *Nature*, vol.129, 1932, p.900.

New World who entered by crossing the Bering Straits.[36] From the fossil remains of the palaeo-Aleuts to those of the neo-Aleuts a very pronounced change in head form has been demonstrated. It is quite clear from the evidence that the transition was continuous and did not represent the intrusion of new immigrant populations. Moreover, there is a clear indication of other bodily changes, including lengthening of the trunk and shortening of the limbs through successive generations.

This change, which is observed for Arctic animals also, is a response to cold, a means for the conservation of heat by producing a more massive heat reservoir (the trunk) and reducing the size of the chief areas of heat radiation loss, the limbs and the extremities (hands and feet in man, or paws in animals). Children of modern Eskimos are born with these modifications. When the adult Eskimo stands up he is shorter than the white man, but when he sits down he appears to be much the same height. The shortening is thus in the limbs, while the trunk has remained unchanged except for some thickening. According to Laughlin, the modification occurred in the earliest settlers with remarkable rapidity.

An editorial comment in *Scientific American* under the title, "Stature and Geography," makes reference to the modifying influences of cold:

> The farther from the equator you were born and raised, the bigger you are likely to be. This fact has been confirmed in some new studies by Marshall T. Newman, anthropologist with the Smithsonian Institution. Carl Bergman, a nineteenth-century German biologist, predicted that members of a species of warm-blooded animals living in cold climates should be larger than those in warmer. A bigger individual has less skin area in proportion to total volume and so less tendency to dissipate heat.[37]

It will be recognized that this is precisely the converse of animal response to high heat and humidity. The article reports that Newman tested this out for pumas also and found it to apply equally. He might have noted that the same is true for the bear family: polar bears have larger body mass but shorter limbs, in proportion, than their more southern relatives.

The author, guided by conventional Mendelian principles of inheritance, then reasons that the genes cannot have been influenced in any way and that the modification cannot therefore have become hereditary. I do not think that the evidence from bears in zoos is sufficient to allow such a conclusion. It would be important to compare the fetuses of these bears and pumas in the Arctic with those of the more southerly species. We should then be in a better position to say whether the environmental pressure had produced an *inheritable* effect.

There is evidence that fetal studies with such an end in view could be very worthwhile. Sir Peter Medawar has pointed out, for example, that both human beings and guinea pigs are born with a thicker epidermis on the sole of the foot than elsewhere on the body.[38] One might account for this by saying that it is an

36. Laughlin, W. S., "The Eskimos and Aleuts: Their Origins and Evolution" in *Science*, vol. 142, 1963, p.633-43.
37. "Stature and Geography," in *Scientific American*, April, 1954, p.46.
38. Medawar, Sir Peter, *The Uniqueness of the Individual*, Basic Books, New York, 1957, p.84.

example of pre-adaptation (a rather mystical concept, but one which is supported by a number of remarkable apparent examples), or a pure coincidence (which is possible, of course), or the direct activity of God in nature. Or it may be a good example of a dauermodification. At the moment there is no way of knowing what is the correct explanation. But Medawar seems to be in favour of the view that this is a case of an acquired character which has become inheritable.

C. H. Waddington refers to certain callosities on the ostrich breast upon which it rests its weight when squatting, and he notes that *these callosities are found in the unhatched chick*. Since the inheritance of acquired characters is still a concept to be shunned, he refers to this as a case of "genetic assimilation."[39] But, as Shakespeare put it, a rose by any other name will smell as sweet, and we have here, surely, another example of cytoplasmic inheritance concealed under a different name.

In another article titled, perhaps more significantly, "Experiments in Acquired Characters," Waddington deals with the same topic and uses the same basic examples by way of illustration.[40] However, he refers in addition to the African wart hog, which has the habit of kneeling on its wrists when feeding. The skin in both these places of contact is thickened in the newborn. Waddington prefers to term this a case of "anticipatory adaptation." Apparently prejudice against dauermodifications was still too strong to allow him to admit this as a possible example of such, in spite of the title of his paper.

The peculiar fitness which characterizes living things applies equally to the primates which are supposed to be related to or fall within the lines of man's evolutionary path. This subject interests me, because I think it may throw light on something which many Christian people find it difficult to account for. Those who believe that Adam was a separate creation find themselves called upon to explain the fact that there *appears* to have been a succession of creatures which increasingly approached man's present form and did so more and more closely as they appeared later and later in time. If one is not too concerned with their supposed chronological ordering, it is possible so to arrange these specimens serially in such a way that the idea of human evolution via some such succession of form is well-nigh logically compelling. Time-Life publications are particularly good (or bad) at presenting this kind of compulsive argument by an adept use of reconstructed forms walking across extensive fold-out pages.[41]

But there is perhaps another explanation. It could conceivably be that as the environment on the earth's surface more and more nearly approached an appropriate condition for the introduction of man, so did living forms like man appear with greater frequency. Such creatures were responding to the environmental pressures and showed by the forms they increasingly assumed that the environment, for such a creature as man was to be, was more and more nearly ready for human occupancy.

We know from Isaiah 45:18 ("For thus saith the Lord that created the heavens; God himself that formed the earth and made it; he hath established it, he created it not in vain, he formed it to be inhabited:...") that God intended the earth to be a habitation for man. This was His plan. He could have completed its preparation

39. Waddington, C. H., "Evolution of Adaptations" in *Endeavour*, July, 1953, pp.134-39.
40. Waddington, C. H., "Experiments in Acquired Characteristics," *Scientific American*, December 1953, p. 92f.
41. See, for example, *Early Man*, edited by F. Clark Howell, Life Nature Library, Time-Life Books, New York, 1965, pp. 41-45.

in a moment of time, by *fiat* creation. But why should God try to save time? Before the appearance of man, time was of no consequence whatever. Moreover, instantaneous creation would not have allowed us to enter with understanding into the planning stages by which God brought it all about and thus to share something of His own—could we say—"excitement" in prospect.

There is, after all, some precedent for this idea. We are told in Genesis 1:26 not only that God held a sort of divine conference before creating man, but also that He used the dust of the ground to form his body and then as a second step breathed into the body and gave it life. This is a form of creation by stages. It signifies a kind of deliberateness. What better reason could there be for telling us this by revelation than to let us share something of God's special interest in what He was doing, an interest which evidently did not attach in the same way to the creation of other forms of life. In these other cases we have only cryptic statements such as "Let the earth bring forth" (Genesis 1:11) or "Let the waters bring forth" (Genesis 1:20), suggesting simply the *fiat* creation of God, who needed only to speak and it was done.

In short, I am suggesting that we have been allowed to discern something of the stages of preparation of the earth for man and that what we thus see bears witness to the fact that the process was a very deliberate and carefully planned one. When it was nearly ready for man, it was of necessity also nearly ready for creatures very like him in their physical constitution, though the differences between these creatures and man himself were still so great as to place them and him in two entirely different kingdoms.[42]

Now, Wood Jones made an observation about primates in this context which I want to quote even though he certainly did not have any such elaborate concept as I have presented above. This is what Jones wrote:

> Although it is a subject not generally palatable to those Darwinian enthusiasts, who see an easy progress toward human "perfection" along the line of the supposed uniserially Primate series, it is worthwhile to note that parallel developments are seen to perfection in the Order Primates as it is at the present recognized.
>
> Animals that are universally recognized as monkeys have been produced twice over from independent stocks. The New World Monkeys (*Platyrrhini*) and the Old World Monkeys (*Cattarhini*) are of admittedly different origin and have come to resemble each other—and become, popularly, *monkeys*—by a parallel development.
>
> Even a third monkey type was developed during the hey-day of the Lemuridae in Madagascar. *Neopithicus*, upon its discovery as a fossil in Madagascar (1896), was hailed as a new and intermediate type of monkey: and were it to be living today, it would probably still be regarded popularly as a monkey. But any assumption of parallelism or convergence among the members of the Order to which man is assigned is so frowned upon by

42. For a detailed analysis of these differences, see A. C. Custance, "Is Man An Animal?", Part V in *Evolution or Creation?*, vol.IV in The Doorway Papers.

> orthodoxy that, for the moment, we will leave the question without further discussion.[43]

We need only to assume that God prepared the earth for man in an orderly way so that, just before man's appearance, the total environment was ideal for him even as he was for it. Man was ideal for the environment in the sense that while he remained unfallen, he was constitutionally a perfectly equipped governor and director and manager of all plant and animal life. We need then only assume that all living things (perhaps even including himself) were provided with an appropriate mechanism of adjustment which would permit what we now call dauermodifications in order that man might make use of and direct the development of these living things wisely and well to maximize their potential and thus enhance the work of God as His appointed representative.

Such a mechanism, operating even before man was introduced, would account for the man-like forms which preceded him, resulting from a power of adjustment found in certain species to fit them to an environment tending more and more to the ideal for man himself.

We have elsewhere set forth a hypothetical reconstruction of the events immediately preceding the creation of Adam and Eve,[44] events which I believe were catastrophic and came as a judgment and are intimated by the descriptive terminology which is employed in the original Hebrew of Genesis 1:1.[45] So I shall not elaborate further on this point here. But I think it could be argued with some cogency that when man was first created, the Garden paradise into which he was introduced was the one habitat, of all possible habitats, that was most completely suited both for himself and for all the living things which shared it with him. But it was not merely a habitat that arose by chance and was therefore chosen simply because it was most suitable. It was deliberately planted (Genesis 2:8)—that is, it was engineered by the divine Gardener and filled with just such forms of life as would constitute a paradise of harmony in which nothing was lacking and nothing in excess, no competition and no waste.

Had Adam not fallen, he would perhaps have been called upon to extend the boundaries of this Garden until it finally covered the earth. This could have been the work appointed for him by which he would have matured and been made perfect.

This expansion of paradise would have been an achievement made possible, not so much by interference with the natural order as it existed outside its boundaries, but by making optimum use of the built-in potential of all living things for both stability and cumulative adaptation. God had provided two pathways of inheritance—the nuclear to preserve order, and the cytoplasmic to allow variety and ensure fitness.

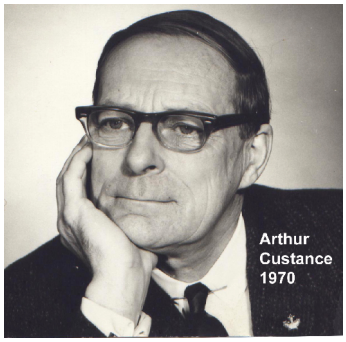
A half-truth—the recognition of the laws governing nuclear inheritance, hitherto taken as the whole truth—seems to have led us into the fundamental error of making chance the creator of order. Perhaps we are now in a better

43. Jones F. Wood, *Trends of Life*, Arnold, London, 1953, p.85.

44. See on this, A. C. Custance, "A Christian World View, The Framework of History", Part 5 in *Noah's Three Sons*, vol. I; and "The Preparation of the Earth for Man," Part 1 in *Evolution or Creation?*, vol. IV in The Doorway Papers, Zondervan Publishing Co.

45. On this see A. C. Custance, "Between the Lines: An Analysis of Genesis 1:1, 2," Part 4 in *Time and Eternity*. vol.VI in The Doorway Papers.

position to correct this incomplete picture and recognize once again the providence and wisdom of God in creation.



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