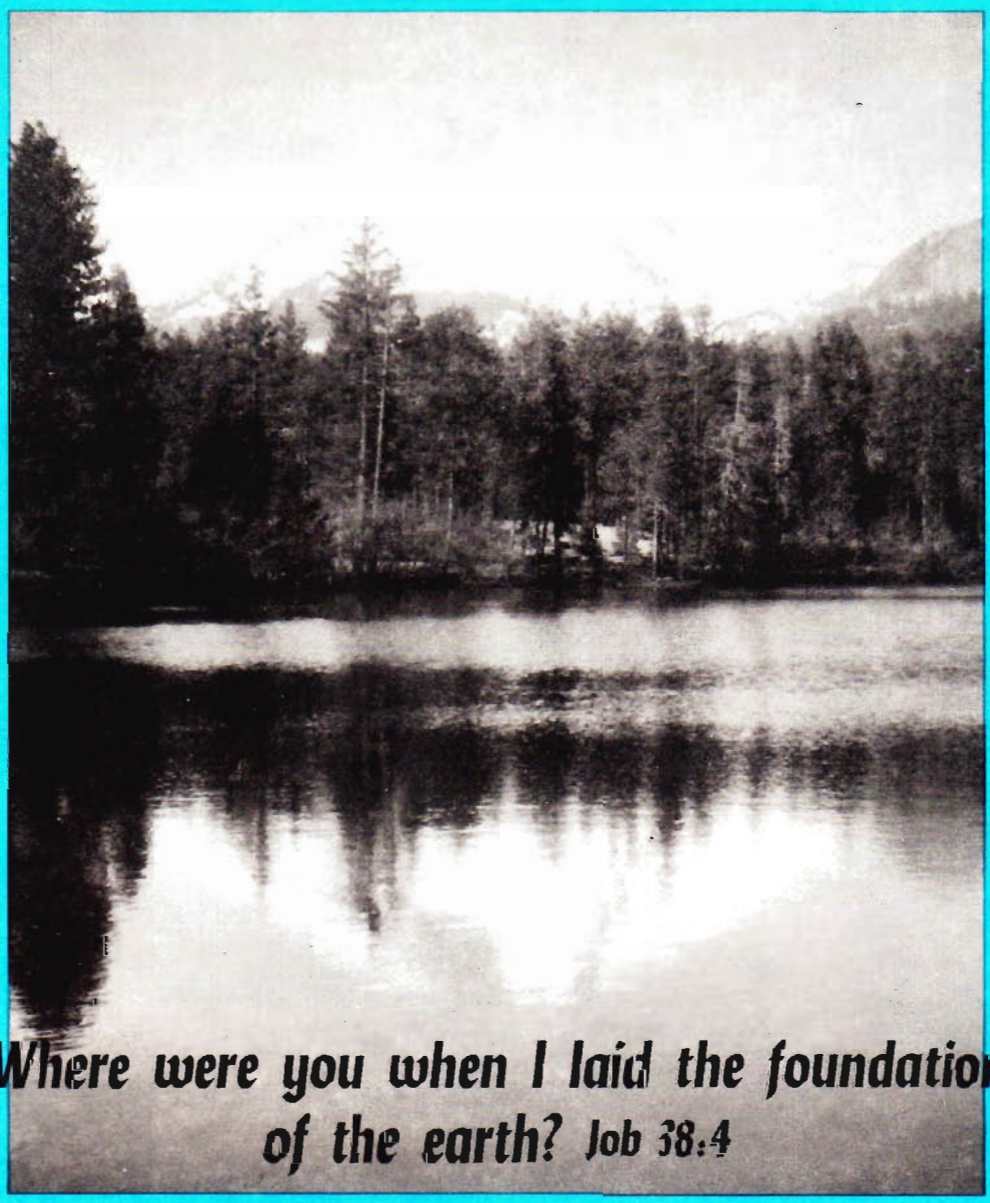
JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

An evangelical perspective on science and the Christian faith



"The fear of the Lord is the beginning of Wisdom." Psalm 111:10

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Cover: Mt. Lassen over Reflection Lake, Lassen National Park, California.

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

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A CALL FOR NON-ACADEMIC PARTICIPATION

A glance at the list of Consulting Editors for the *Journal ASA* on the opposite page reveals that 45% are in academic positions at Christian colleges or seminaries, 45% are in academic positions at other colleges or universities, and 10% are in non-academic positions. A quick survey of the various participants in the publications of the ASA reveals that these figures are representative. One can look almost in vain for participation by scientists in industrial or government laboratory positions dealing with problems of interest to them in the interaction between science and Christian faith.

What do these statistics mean? Several interpretations may be suggested.

1. There are very few Christian scientists in non-academic positions.

2. Most of the Christian scientists in non-academic positions are not members of the ASA.

3. Christian scientists in non-academic positions are not accustomed, or are too busy, to write papers.

4. Christian scientists in academic positions are more interested in theoretical problems that lend themselves to writing, whereas Christian scientists in non-academic positions are more involved with practical problems.

Interpretations 2 and 4 seem the most likely to be responsible for the almost negligible participation by non-academic Christian scientists. It seems to me that the ASA must tap this deep reservoir of insight and practical input which non-academic Christian scientists can contribute. Some of the ethical problems for Christians involved in research are real crunchers; they have to be met almost immediately by action and not by abstract theory alone.

To all readers of this page I urge you to pass along a copy of the *Journal ASA* with a good word to your non-academic friends. To those of you who are in the non-academic world, may I urge you to share with our readers those things you learn while attempting to live a Christian life while following a career in science or engineering.

R.H.B.

Alternative Views of Evolution

DAVID L. WILLIS

Department of General Science

Oregon State University
Corvallis, Oregon 97331

The world of life poses questions to every thinking man who examines it. These questions are the same whether the examiner is oriented philosophically toward theism or atheism. Some of these questions might be stated as follows:

1. How can the tremendous diversity of distinct forms of life (species) found on earth today be explained?
2. Why is it that certain of these species are very similar to one another, while at the same time quite markedly different from other species?
3. Why do living species, which are so remarkably varied in form and size, seem to show the same basic cellular and biochemical composition?
4. How do the remains of organisms of past ages (fossils) relate to present day species?
5. How and when did the first forms of life originate?

Thus, the central question centers on the seeming contradiction of an enormous diversity of living forms (organisms) of complex nature which display an apparent underlying unity of composition. The origins of such organisms and their subsequent development demand our attention.

Biologists, like all other scientists, abhor chaos. This diversity of species certainly appears chaotic at first glance. Clearly, some system of classification is the cure for chaos. Like tidy housewives we are pleased with an orderly arrangement of species. However, this arrangement must not be artificial, but should reveal the actual or presumed phylogenetic relationship of the species. Thus, it is not surprising that studies of taxonomy or systematics play such a key role in biological thinking and have done so for centuries.

General Patterns of Species Relationships

Three general patterns of relationships between the myriad species of organisms are possible: (1) the "fixity of species" concept, (2) the monophyletic idea and (3) the polyphyletic view. The first scheme suggests that each species is unrelated to any other species, but has remained unchanged since its origin (creation). This pattern is usually associated with the so-called "Special Theory of Creation." It was the dominant scientific viewpoint until the mid-18th century and was the working hypothesis of Linnaeus, the father of modern taxonomy. Evidence to support this view must show unbroken continuity of present species back to the time of their origin with no occurrence of speciation.

The second scheme proposes that all organisms (present and past) are genetically related because they are derived from a unique original form of life, thus the term "monophyletic." This pattern represents the well-known general theory of evolution. It is schematically shown in numberless textbooks as the evolutionary "tree of life." Evidence for this view must demonstrate speciation (formation of new species by natural processes) *and* show historical connections between all the major categories of organisms.

The third possible scheme of relationships is intermediate between the first two. Multiple original forms of life (thus the term "polyphyletic") have speciated through time giving rise to groups of related species. Each group of species is distinct from and unrelated to the species in other groups. This is essentially limited evolution or general creation. Evidence for this pattern, like that for the second, must demonstrate speciation. However, unlike the general evolutionary pattern, it must reveal several unrelated groups of organisms whose origins were not demonstrably in common.

Definitions

A failure on the part of a speaker to clearly define his terms often results in needless misunderstanding on the part of the listener. Therefore, before proceeding, let me define two key terms that will be important to the following discussion:

> *Evolution* basically refers to changes in populations of living organisms by natural processes over a span of time. There are really two levels of usage for this term, although the important distinctions between them are often blurred in common practice. Limited evolution (speciation or microevolution) involves the formation of new species by natural selection operating on distinct populations over a limited period of time. By contrast, general evolution extrapolates speciation as the mechanism by which all organisms have been derived from a single original source over the span of geological time. It is this broad generalization about the interrelationship of all living things that is usually intended by the term "evolution." To avoid confusion, I shall use the terms speciation and evolution to refer to the limited and general aspects of evolution, respectively. The term "chemical evolution" is frequently used today and refers to assumed pre-biotic changes on the earth which gave

rise to the first organism(s) by purely natural means. In current usage this additional concept is often added to the meaning of general evolution and I shall so use it.

Creation is the action of a supernatural power (God) in bringing the natural world into existence. The term is used with a wide range of meanings. As I shall use it, the term does *not* necessarily involve an instantaneous event or the absence of either accompanying natural processes or pre-existing material. Clearly then, it is not used here as the equivalent of the "Special Theory of Creation" referred to above.

Note that the major distinction between these definitions at this point lies in the supernatural element in creation, whereas evolution (as defined) involves purely natural causes for the origin and development of life.

Analysis of the Patterns of Phylogeny

Let us now proceed to evaluate the three possible schemes of interrelationships on the basis of evidence from (a) living species and (b) the fossil record.

A serious consideration of the diversity of living species reveals a systematic pattern of interrelationships best interpreted as resulting from speciation. The major lines of evidence that speciation (microevolution) has occurred are well known. They include comparative morphology, physiology and embryology, biogeographic distribution and population genetics, among others. Such areas of study with living species allow the employment of experimental techniques and repeated field observations. Some degree of speciation is demanded by these biological "facts" and natural selection appears to provide a reasonable mechanism. The cumulative effect of this overwhelming evidence demolished the "fixity of species" view in the last century and we shall not give it further consideration here. Note, however, that the evidence from a study of living species does not distinguish between the other two schemes. Either scheme of phylogeny could produce the present pattern of species diversity.

The fossil record of past forms of life on the earth is generally regarded as the major argument in favor of general evolution. However, the student of past life forms (a paleontologist or paleobiologist) uses a basically different methodology from that employed by the biologist investigating living forms, and this difference is often overlooked. The paleontologist uses an historical approach that is rarely amenable to planned experimentation. He is limited to the chance recovery of artifacts, usually on a very haphazard basis, due both to the process of fossilization itself and the limited opportunity for recovery of the existing fossils. His results are largly in the form of dynamic inferences based on the static artifacts available.

The application of fossil evidence to unravelling the scheme of species relationships in the past is hazardous at best. Systematists dealing with living species frequently wrangle at length over the taxonomic status of a given population. Is it a subspecies, a separate species, or even a distinct genus when compared to similar populations? This situation occurs even when living organisms are available for laboratory experimentation and repeated field observations may be made. The range of variation within a single species is often

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enormous, as witness the variety of breeds of dogs. (One wonders into how many different species paleontologists would separate fossils of the various breeds of dogs, if they had only skeletal remains and did not know that all the varieties were interfertile. Would the Dachshund and the St. Bernard even be in the same genus?)

Obviously, paleontologists are acutely aware of such handicaps. Thus, they do not use the term "species" in quite the same sense that biologists normally do. Instead, they describe "form species," i.e., species based primarily on morphological differences, and those only partial and fragmentary in many cases. It must be clearly noted, then, that fossil species may *not* be directly equated with living species. Their determinations are not based on the same range of characteristics. Furthermore, interfertility and genetic compatibility of the various members of a living species are most significant criteria in classification. Since breeding experiments with fossils are a bit out of the question, it is likely that morphologically different members of a fossil assemblage may be regarded as different species when, in fact, they may have been quite interfertile in life. (Remember the Dachshund and the St. Bernard!)

The interpretation of the fossil record is plagued with yet another difficulty—the geographic discontinuity of fossil remains. Frequently, lines of descent for a graded series of fossil species (for example, the horse) are based on fossils found at random in widely remote regions of the earth. The questionable nature of such a practice has often been noted, but the standard answer is an appeal to hypothetical dispersion routes, and assumed biogeographic corridors or filter routes. In the past five years, with the emergence of the geophysical theory of plate tectonics, a greatly renewed interest in the old idea of continental drift has developed. In a recent article in *Science*, Raven and Axelrod[1] made a strong case for the existence of the hypothetical continent of Gondwanaland (comprising Australia, New Zealand, Antarctica, South America, India, Madagascar and Africa) in mid-Cretaceous time (about 100 million years ago). Its subsequent breakup is then plotted and related to Australasian paleobiogeography. Such concepts appear to have strong support from geophysical evidence and are forcing the wholesale revision of earlier accepted paleobiogeographic conclusions. Clearly, it is too soon to be dogmatic about the past history of life from the fossil record.

A more serious shortcoming of the fossil record is noted by George Gaylord Simpson in his widely used biology textbook *Life*.

The disappointing scarcity of the earliest fossil records unfortunately applies to a long span of geological time. Life probably existed 2 and perhaps even 3 billion

> years ago, but fossils become varied and abundant only with the beginning of the Cambrian, a mere 600 million years past. Thus the reasonably good fossil record as now known may not cover more than about the last fourth or fifth of the history of life.[2] (p. 760)

Let us now apply this limitation on the fossil record to phylogenetic schemes (2) and (3). The fossil record does not enable us to distinguish between the correctness of the monophyletic and the polyphyletic patterns. Although there has been an abundance of speculation concerning the development of life before Cambrian time, there is little or no scientific evidence to support it. Simpson gives a refreshingly frank appraisal of the situation,

> The sudden contrast between the Pre-Cambrian rocks, in which animal fossils are so rare or dubious, and the Cambrian, in which they are abundant, poses a serious question: Why? A good scientist must be prepared to say, "I don't know," and that is at the present the correct answer.[2] (p. 760)

Thus, our search for complete order in the scheme of interrelationships between living and extinct forms of life ends at a blank wall. While we can discard scheme (1), we cannot distinguish between schemes (2) and (3) on the basis of the available scientific evidence.

Regrettably, at this point some of the more avid proponents of general evolution begin to speculate, hypothesize and engage in outright fantasy. Current general biology textbooks abound with dogmatic statements and pontifications about how life *might* have, *could* have, *must* have or *did* originate and evolve in the Pre-Cambrian period by purely natural means. Some texts even orient their entire treatment of cellular physiology and biochemistry around such hypothetical schemes. To the beginning student, often dazzled by the factual basis of all science, such unsupported and unsupportable speculations come across as what *did* occur. It is this speculating, pontificating and propagandising without factual evidence that I, as a biologist, find unacceptable and most irritating.

The Case for Polyphyletic Origins (General Creation)

My thesis is that the available scientific evidence fits a polyphyletic origin and development of life just as well as it does the monophyletic evolutionary view. As noted earlier, evidence for such multiple origins and separate development of distinct groups of species would take the form of systematic differences between major taxonomic categories. A series of quotations from leading biologists of this generation will summarize this evidence.

In the preface to his book *Implications of Evolution*, G. A. Kerkut, a leading invertebrate zoologist at the University of Southampton, England, succintly summarizes the case,

> May I here humbly state as a part of my biological *credo* that I believe that the theory of Evolution as presented by orthodox evolutionists is in many ways a satisfying explanation of some of the evidence. At the same time I think that the attempt to explain all living forms in terms of an evolution *from a unique source*, though a brave and valid attempt, is one that is premature and not satisfactorily supported by present-day evidence. It may in fact be shown ultimately to be the correct explanation, but the supporting evidence remains to be discovered. We can, if we like, believe that such an evolutionary system has taken place, but I for one do not think that "it has been proven beyond all reasonable doubt." In the pages of the book that follow I shall present evidence for the point of view that there are many discrete groups of animals and that we do not know how they have evolved nor how they are interrelated. It is possible that they might have evolved quite independently from discrete and separate sources.[3] (pp. vii-viii)

Current general biology textbooks abound with dogmatic statements and pontifications about how life might *have,* could *have,* must *have or* did *originate and evolve.*

Dr. John T. Bonner of Princeton University, in his review of Kerkut's book in the *American Scientist*, responded with deep feeling to Kerkut's approach,

> This is a book with a disturbing message; it points to some unseemly cracks in the foundations. One is disturbed because what is said gives us the uneasy feeling that we knew it for a long time deep down but were never willing to admit this even to ourselves. It is another one of those cold and uncompromising situations where the naked truth and human nature travel in different directions.
>
> The particular truth is simply that we have no reliable evidence as to the evolutionary sequence of invertebrate phyla. We do not know what group arose from which group or whether, for instance, the transition from Protozoa occurred once, or twice, or many times. Most of us make the tacit assumption that the origin of life, and the origin of the Protozoa themselves are unique events, but can we be sure? The evidence from fossils for these primitive groups has so far been of no help. The sole basis has been on the structural resemblances between adults or their development, but as the author shows in a most effective manner, if one were to tally the views of experts on such resemblances, then one can find qualified, professional arguments for any group being the descendant of almost any other. In a particularly illuminating chapter, he discusses the biochemical evidence for affinities between groups. What we have all accepted as the whole truth, turns out with some mild inspection, to be rather far from it. Apparently, if one reads the original papers instead of relying on some superficial remarks in a textbook, the affinities become extremely clouded indeed. We have all been telling our students for years not to accept any statement on its face value but to examine the evidence, and, therefore, it is rather a shock to discover we have failed to follow our own sound advice.[4] (p. 240)

The confused invertebrate phylogenetic relationships are further revealed in the words of Dr. Libbie H. Hyman of the American Museum of Natural History, author of the classic multi-volume reference work *The Invertebrates*, at the end of her chapter entitled "Retrospect,"

> The author regards such phylogenetic questions as the origin of the Metazoa from the Protozoa or the origin of the Bilateria from the Radiata as insoluble on present information. Also insoluble are such questions as to whether entoderm, mesoderm, and coelom have or have not some original mode of formation from which other modes are derived. Anything said on these questions lies in the realm of fantasy.[5] (p. 754)

That a similar situation exists for major plant taxa is seen from the statement of Dr. W. H. Wagner, Jr., of the University of Michigan, in the recent volume *Plant Biology Today*,

> One of the chief problems regarding ferns, of course, has to do with their origin. From what plants were ferns, as we know them now, first derived? What were the most primitive ferns? Unfortunately the modern work gives us no reliable answer. In many ways the origin of the ferns seems to become hazier and hazier. The more we learn about Devonian plants, where the origins of ferns are usually sought, the further we seem to get away from logical ancestral types.[6] (pp. 173-174)

The comprehensive volume *An Evolutionary Survey of the Plant Kingdom* by six botanists at the University of British Columbia confirms the serious lack of evidence regarding the origin and interrelationships of the higher plants,

> Many paleobotanists are actively pursuing the complex and exciting problem of the origin of the first vascular plants. However, at present no fossil evidence even suggests the likely ancestors of vascular plants; much speculation has occurred on the groups of living plants that could have been the ancestors to early vascular plants.[7] (p. 586)
>
> Lam has supplied a very comprehensive and critical review of the various theories of phylogenetic relationships of the Anthophyta. He feels that the phylogenetic connections of the flowering plants are entirely speculative, and this view is gaining favor among systematists. According to Constance, there is general agreement that sufficient evidence to formulate a satisfactory phylogenetic arrangement of flowering plants is not yet available.[7] (p. 537)
>
> However, it is doubtful if any modern taxonomist is satisfied with the sequence of families still currently followed in most floras and texts. For the great majority of living flowering plants we have no direct knowledge of the course of evolutionary history.[7] (p. 586)

Dr. John Keosian of Rutgers University, in his intriguing book *The Origin of Life*, states the case straightforwardly,

> . . . the Animal and Plant Kingdoms may have no common ancestry. Each may have had its separate beginnings in neobionts unrelated to each other except for the fact that each arose from a complex chemical milieu. Further, some of the phyla in each Kingdom may have no ancestry in common with the other phyla of that Kingdom. The difficulties met in constructing a single taxonomic scheme embracing all organisms past and present may be due to the possibility that the discontinuities in such schemes are real and represent the existence of separate lines of descent from independent neobiogenic events at different times in the history of the earth down to the present.[8] (p. 111)

The available scientific evidence fits a polyphyletic origin and development of life just as well as it does the monophyletic view.

Dr. Jay M. Savage of the University of Southern California, in his textbook Evolution, clearly distinguishes between the mechanisms of speciation and the undetermined mechanism(s) required for general evolution to occur,

> The essential features of microevolution and speciation are now fairly well understood by biologists, but the complex processes leading to evolution on a grander scale remain an area inviting investigation. At the present time, we have only the most shadowy impressions of the forces contributing to the adaptive radiation and diversification of life. For example, can the evolution and diversity of the flowering plants be explained simply on the basis of microevolutionary change, or are other forces contributing to macro- and megaevolution? The interaction of variation, selection, and drift and the taking on of new adaptive efficiency must play an exceedingly important part in these processes, but is the grand pattern of evolution only the result of simple population change? To many paleontologists, and to those biologists interested in major evolutionary shifts, the question remains open. No satisfactory mechanism or mechanisms have been proposed that might explain these phenomena, but the characteristics, modes, patterns, and pathways of evolution at this level all suggest that other factors besides those operating at the population level must contribute to adaptive radiation and to the origin of new biological systems.[9] (pp. 118-119)

Perhaps the clearest summary of the case is found in the statement by Dr. Austin H. Clark, long associated with the United States National Museum, in his book of a past generation, *The New Evolution Zoogenesis*,

> Since all our evidence shows that the phyla or major groups of animals have maintained precisely the same relation with each other back to the time when the first evidences of life appear, it is much more logical to assume a continuation of the parallel interrelationships further back into the indefinite past, to the time of the first beginnings of life, than it is to assume somewhere in early pre-Cambrian times a change in these interrelationships and a convergence toward a hypothetical common ancestral type from which all were derived. This last assumption has not the slightest evidence to support it. All of the evidence indicates the truth of the first assumption.
>
> To this plain statement of fact the objection might be raised, "This is all very true so far as it goes, but we must admit that the earliest evidences of life are the traces of simple and primitive forms; and, anyway, there was an enormous lapse of time between the first appearance of life and the period wherein are found the earliest fossil remains. So it is easier to believe that life gradually developed from simpler to more complex forms than that the major groups arose simultaneously."
>
> The answer to this is that science is based upon ascertained facts. We take the facts as we find them and coordinate them into broad generalizations. The facts are that all of the fossils, even the very earliest of them, fall into existing major groups. This is indisputable.[10] (pp. 104-105)

The Origin of Life

Up to this point we have examined primarily the scientific evidence relating to the development of life. Let us now consider the question of the origin of life. Many schemes of chemical evolution have been proposed to account for the appearance of living organisms from non-living matter. Some intriguing experiments have even been performed to show that some rather complex molecules can be formed under circumstances duplicating those assumed for the primordial earth. At this point, it is instructive to note Dr. G. G. Simpson's terse summary of the evidence here,

> Nothing is *directly* known about the origin of life.[2] (p. 752)

Unfortunately, he could not bring himself to stop

here, but continued on,

> Scientific consideration of the origin of life must thus be based on indirect evidence. Nevertheless, it need not be entirely speculative. The diverging paths that life has followed can be extrapolated backward into time and can give us some idea of what the most primitive organisms of all must have been like.[2] (p. 734)

Despite his plea that such considerations are not entirely speculative, they certainly violate the rules of logic. He holds that extrapolation backward in time allows one to know what the earliest forms of life "must have been like." From the standpoint of logic, he is assuming the point to be proved (namely that monophyletic origins led to all subsequent divergence) and then using it as the basis of his argument. This is known as circular reasoning.

Dr. Simpson next enunciates dogma on majority opinion,

> In the first place, most biologists agree that the earliest forms of life could and almost certainly did arise from non-living matter *by a natural process* (emphasis mine). On the basis of what is now known there is, at least, nothing improbable in this view.[2] (p. 734)

No evidence is proffered as a basis for this statement, except that "most biologists agree." This is not the voice of science, but of philosophical speculation. One might with equal fervor and logic say that "the earliest forms of life could and almost certainly did arise from nonliving matter by a *supernatural* process."

A more intellectually honest approach is stated by Kerkut in his concluding chapter,

> (1) The first assumption was that non-living things gave rise to living material. This is still just an assumption. . . . There are many schemes by which biogenesis could have occurred but these are still suggestive schemes and nothing more. They may indicate experiments that can be performed, but they tell us nothing about what actually happened some 1,000 million years ago. It is therefore a matter of faith on the part of the biologist that biogenesis did occur and he can choose whatever method of biogenesis happens to suit him personally; the evidence for what did happen is not available.
>
> (2) The second assumption was that biogenesis occurred only once. This again is a matter for belief rather than proof. . . .
>
> It is a convenient assumption that life arose only once and that all present-day living things are derived from this unique experience, but because a theory is convenient or simple it does not mean that it is necessarily correct. If the simplest theory was always correct we should still be with the four basic elements—earth, air, fire and water! The simplest explanation is not always the right one even in biology.[3] (pp. 150-151)

Perhaps the most striking analysis of the problem of origins is given by Drs. Fuller and Tippo of the University of Illinois in their widely used textbook *College Botany*,

> Some people assume, entirely as a matter of faith, a Divine Creation of living substance. The only alternative seems to be the assumption that at some time in the dim past, the chance association of the requisite chemicals in the presence of favorable temperature, moisture, etc., produced living protoplasm. In other words, if one subscribes to this theory, he admits that the first protoplasm to appear on our earth was a product of spontaneous generation. Then, if he accepts the evidence of Pasteur and others against spontaneous generation, he must reverse his explanation of the origin of the *first* protoplasm to explain the origin of all subsequent living protoplasm from that first protoplasm. In other words, spontaneous generation, according to these opponents of the idea of Divine Creation, worked when the first living substance was formed, but probably hasn't worked since. Actually, biologists are still as far away as they ever were in their attempts to explain how the first protoplasm originated. The evidence of those who would explain life's origin on the basis of the accidental combination of suitable chemical elements is no more tangible than that of those people who place their faith in Divine Creation as the explanation of the development of life. Obviously, the latter have as much justification for their belief as do the former. It is possible that the problem of life's beginning on our planet will always remain insoluble, a philosophical question rather than a subject capable of experimental investigation and solution.[11] (p. 25)

The Biblical Record of Creation

Up to this point we have dealt strictly with scientific evidence. Let us now consider historical literary evidence. Questions of origin and the past history of life have intrigued men of all times. Most cultures have produced some folklore explaining how life and the earth began. Nearly all such material is fanciful in the extreme and bears no relation to the real world. Multiple deities interacting in bizarre circumstances give rise to the world and its biota in these myths.

Of particular interest are those stories from the Near East, where archeological investigations of literate civilizations have been most extensive. One of the most lengthy and well preserved is the Babylonian creation story recorded in cuneiform on seven clay tablets. Dr. Alexander Heidel of the University of Chicago has produced a complete translation and cogent analysis of these tablets (12). Even a cursory examination of this narrative will show its total incompatibility with a scientific view of the world.

In sharp contrast, the book of Genesis in the Jewish-Christian scriptures presents an abbreviated, but majestic account of the origin of the earth and its organisms. The account outlines in its broader aspects a series of creative actions by a supernatural being (God) that closely parallels present scientific understanding. This cannot be said of any other ancient creation story. Magical and fanciful elements are notably absent. The opening statement sets the tone, "In the beginning God created the heavens and the earth." (Genesis 1:1)

The antiquity of the Genesis account is unquestioned. Its existence raises the obvious question, "How could its author have been so accurate in his statements that thousands of years later it can reasonably be viewed as an acceptable summary of the sequence of events connected with origins?" One cannot pass off Genesis as just a lucky guess, for compared to its contemporary creation stories from surrounding cultures it is unique. This document cannot be dismissed out of hand. It constitutes a valid form of historical evidence. Its very existence and accuracy demand that it also be considered when the problem of origins is examined.

It is inappropriate to attempt to relate the Genesis record to any contemporary scientific viewpoint. However, the general tenor of the narrative appears to show a series of discrete creations of major groups of organ-

isms at successive intervals. These groups are then said to subsequently reproduce "after their own kind," presumably maintaining their distinctiveness from other created "kinds." In broad outline, this would seem to be reasonably accommodated by a scheme of polyphyletic origins, which, as we have seen, appears favored by the available scientific evidence today. The major point here is that the Genesis record is *not* incompatible with contemporary scientific evidence.

We have already seen that direct scientific evidence about the origin of life is non-existent. At this time, the problem of origins lies outside the scientific realm and is purely philosophical. One may *believe* that life originated by purely natural causes, but this is one's philosophy, not his science. Alternatively, one may *believe* that supernatural intervention was involved in the origin of life. (This latter view does not necessarily rule out the operation of some natural processes.) However, in the latter case the existence of the Genesis record and its eerie accuracy from a scientific standpoint lends additional weight. *If* a supernatural being (God) did oversee the origin of life, and *if* he desired to communicate some summary information about these events to his rational creatures (men), then the Genesis record would seem to qualify. In no other way does it seem possible for human beings to be informed of such events. Furthermore, Genesis claims to be just such a record.

Implications and Conclusions

In conclusion, let me summarize the implications of the foregoing:

1. Recognize the theory of general evolution for what it is—an unverified hypothesis whose basis in speciation is sound enough, but whose more extensive aspects are mere extrapolations from limited evidence. Kerkut summarizes this viewpoint in his closing paragraph.

> There is a theory which states that many living animals can be observed over the course of time to undergo changes so that new species are formed. This can be called the "Special Theory of Evolution" and can be demonstrated in certain cases by experiments. On the other hand there is the theory that all the living forms in the world have arisen from a single source which itself came from an inorganic form. This theory can be called the "General Theory of Evolution" and the evidence that supports it is not sufficiently strong to allow us to consider it as anything more than a working hypothesis. It is not clear whether the changes that bring about speciation are of the same nature as those that brought about the development of new phyla. The answer will be found by future experimental work and not by dogmatic assertions that the General Theory of Evolution must be correct because there is nothing else that will satisfactorily take its place.[3] (p. 157)

2. Recognize that insufficient evidence is available to answer the ultimate questions of phylogenetic relationships. As Bonner so frankly stated in his review of Kerkut's book,

> The message is that the great phylogenetic schemes, no matter how delicious and tempting, must wait. They must wait because our present evidence is inadequate to decide between schemes, and working hypotheses lose their glitter if there does not seem to be any possible means of critically testing them.[4] (p. 244)

3. Recognize that the question of how life originated is a philosophical one at present, not subject to direct scientific inquiry. On an equally valid scientifc basis one may hold to a natural or a supernatural (creation) origin of life. Dr. A. H. Clark even felt that the odds were in favor of the latter view, even though he was by no means a creationist.

> Thus so far as concerns the major groups of animals, the creationists seem to have the better of the argument. There is not the slightest evidence that any one of the major groups arose from any other. Each is a special animal complex related, more or less closely, to all the rest, and appearing, therefore, as a special and distinct creation.[13] (p. 539)

One cannot pass off Genesis as just a lucky guess, for compared to its contemporary creation stories from surrounding cultures it is unique.

4. Recognize the uniqueness and majesty of the Genesis record of origins. The relevance of this historical document cannot be dismissed from consideration. It constitutes valid evidence.
5. Recognize that all informed scientists are *not* agreed on the factual nature of general evolution or wholly natural origins. The extensive quotations presented above bear this out.
6. Recognize and emphasize the difference between observed or experimental "facts" and unsupported speculation, or, as Bonner stated it,

> All that is asked is that a sense of proportion is always maintained and that an hypothesis is never allowed to sneak into the false clothing of a fact.[4] (p. 242)

In more everyday terms, Sgt. Joe Friday, the TV hero of *Dragnet*, would say, "Just give us the facts, Ma'am, only the facts!"

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The Doctrine of Special Creation
Part I. The Design Argument

RICHARD P. AULIE

Department of Natural Science

Loyola University of Chicago
Chicago, Illinois 60611

This study examines the anti-evolutionary views that are promulgated in the high school biology text recently published by the Creation Research Society. Three main features of the doctrine of special creation—the design argument, catastrophism, and the ideal type—are examined in a historical context. It is argued that this creationist model, here distinguished from the Judaeo-Christian doctrine of creation, is essentially non-Biblical in character.

The creationist model in the textbook is very similar to the interpretation of similarity and variability that prevailed in the late 18th and 19th centuries. Moreover, with its emphasis on fixity, creationism represents in large measure an extension of Greek philosophy. It was part of the biology that, until the publication of Darwin's Origin of Species, *was strongly influenced by the thought of Plato and Aristotle. By contrast, the theory of evolution could only arise where, in the West, the antecedent ideas of progress, origin, linear time, and future fulfillment were part of the Judaeo-Christian tradition.*

The Judaeo-Christian doctrine of creation and the theory of evolution may be complementary, but they can never be alternative views of organic nature.

The handsome textbook *Biology: a Search for Order in Complexity* (Moore and Slusher, eds., 1970) will startle all ASA members who have been taking the teaching of evolution for granted. (See other reviews in the *American Biology Teacher* 33 [7]: 438-442; and *Journal ASA* 23 [4]: 150-152.) The authors assert that "special creation" is as reasonable and scientific an account of origins as the theory of evolution and that it should be given equal time in high school biology classes. This book therefore raises anew the entire question between religion and science.

Actually, the special-creation doctrine, as presented in this textbook, is quite old. It was widely held during the first half of the 19th century. In order to assess the implications of the doctrine for our time—whether we agree or disagree—we need to see what it was in the past. The antecedent views will be discussed in the course of examining the doctrine's main points.

The Book and Its Sponsors

This book was produced by the Creation Research Society, which holds that "science should be realigned within the framework of Biblical creationism," according to a recent CRS leaflet.

Although the CRS textbook is attractive, its publication has dismayed those who had hoped the evolution controversy was at last over in American education. The care and expense that have been invested in this *apologia* for a 19th-century view are astonishing: 20 writers, all with graduate degrees (many in the sciences), contributed to its development. Yet although the book is an anachronism, it may be welcomed by some church-related schools and by school board members who are worried about atheism among the young. And there may even be readers of this journal to whom the arguments may appeal as an

A slightly revised reprint from the April and May 1972 *American Biology Teacher, this article will appear in four parts during* 1975.

alternative to the theory of evolution. They may say to themselves: surely if so many qualified people—not a preacher in the lot—have gone to all this trouble, there must be something to what they say. Thus, this book may well rekindle an old controversy.

If so, let us hope that decorum may prevail. In the history of biology, different investigators often have interpreted the same data from opposite points of view. Those investigators who argued with calm, goodwill, and reason, now seem the more dignified, even though their interpretations were later replaced. By contrast, those who resorted to invective and exaggeration, even when in the right, in retrospect seem only entertaining. In any case, let us be calm.

We have here a splendid opportunity to note the strong historical antecedents of the "special creation" doctrine—stronger, perhaps, than the authors imagine. What, after all, is "creationism"? May it be viewed as a scientific theory, as distinguished from a theologic doctrine? We may also appreciate the complex factors involved in resistance to change.

The older high school biology textbooks differed widely from the approach ushered in by the Biological Sciences Curriculum Study in 1960. The CRS text carries a strong resemblance to the former; that is, biology is presented as an established body of knowledge rather than a method of inquiry into organic nature. Nor does the book reflect the major innovations in teaching methods—process and inquiry—that revolutionized high school biology in the 1960s and are now penetrating the new elementary-school science curricula.

Nevertheless, except for the sections on creationism and on evolution, together with certain factual errors and questionable emphases, the book is a well-organized source of information on what is traditionally called biology. Moreover, the authors have achieved a style that writers of texts may well envy. It is interesting to read.

The major arguments for creationism appear for the most part in unit 9, "Theories of Biological Change," and this section is read first by those who want to know what the fuss is all about. Elsewhere the authors' views obtrude from time to time; some of these passages I shall examine below.

Pages 3-13, on the scientific method, is a thoughtful introduction to the text. But how would the authors document the view on p. 9 (reasserted on pp. 4, 12, 61) that "the Greeks did no extensive experimentation because of a prejudice against work?" Can they be referring to Galen, whose vivisection experiments, as described in his *Natural Faculties* (book 2) and *Anatomical Procedures* (books 7, 12, 14), were far-reaching in their impact on later biology? Contempt for manual labor does not necessarily imply disregard for experiments. That the Greeks placed less emphasis on experiments, in the sense in which we use the term, has more to do with the questions they asked of nature than with any notion that experimentation was "degrading work," as we are told on p. 4. Moreover the Greeks did not find regularity and pattern in nature "through a study of cause and effect relationships" (p. 12). Their scientific method—as represented, for example, in Aristotle's *Generation of Animals* (book 1) and *Parts of Animals* (book 1)—was quite different from the modern scientific method, now associated with the phrase "cause and effect," that began to emerge during the Renaissance.

What is "creationism"? May it be viewed as a scientific theory, as distinguished from a theologic doctrine?

This section on zoology deals with animals "with backbones" and "without backbones"—a surprising division, in view of the creationist presuppositions. This was the division made by Jean Baptiste Lamarck (1744-1829), who was an "evolutionist."

THE DESIGN ARGUMENT

In at least nine passages the CRS authors assert that providential design may be discerned in nature. Examples are the purpose of the Creator as observed in the direction of plant growth (p. 12); the apparently purposive behavior of the amoeba (p. 65); the variability of flowers, birds, songs, and animal behavior (p. 147); the taxonomic categories of plants (p. 183); the marvels of human vision (p. 281, 443); the sexual reproduction of bacteria and the life cycles of algae (p. 173-174, 396); and particular adaptations of plants and animals (p. 476).

Because teleology is anathema to modern biology, these passages will be taken as marks of an unscientific attitude. In the context of the book, however, the authors do not argue that design is *always* a substitute for scientific research or a full explanation of biologic phenomena. They do include a considerable fund of chemic, physiologic, and genetic information concerning organic processes that once were given a teleologic explanation. Nevertheless, their teleologic passages perhaps represent the core of the long controversy over special creation. They illustrate why it is so easy to misunderstand the theologic problem of design in nature. High school students may now conclude that if God created *Spirogyra* with its own special life-cycle (p. 396), then natural processes did not, for the two interpretations are mutually exclusive.

Definition of Design

These passages express the traditional view of design, which implies that the end precedes the means. According to this view, the preordained end is executed in the form of a structure or process by (i) an immaterial agency—that is, some vitalistic force residing in the organism; or (ii) an intelligence, or God, external to the organism, as therefore an expression of divine providence. The CRS authors advocate the latter version. In the former version, and sometimes in the latter, the importance of secondary causation is reduced. (Vitalists are not necessarily theists, and vice versa.) Design is often suggested when the observer experiences a feeling of wonder as he contemplates the exquisite and intricate character of a particular adaptation.

The design argument is even older and more prestigious than the doctrine of special creation. For example, the vitalistic version is a unifying theme in Galen's *On the Usefulness of the Parts of the Body*, in which he approved the Aristotelian view that "nature

does nothing in vain" (May, 1968, II, p. 501). Galen argued that the forethought exhibited by the skillful way in which the structures of the eye are joined together surely expresses the "wisdom of the Creator," which he ascribed never to an external intelligence, for he was not a theist in the usual sense, but sometimes to a beneficent "Nature" (May 1968, II, p. 463-502). Modern biology has rendered unnecessary this vitalistic version of design, but it cannot rule out divine providence, as Darwin recognized in his own discussion of the eye (*Origin*, 1st ed., p. 188, 189).

But to affirm that biology cannot rule out divine providence is not the same as saying, as the CRS authors seem to say, that providential design is an *a posteriori* conclusion one draws from observing events in nature. We do not observe design in nature. Rather, our minds seem to be so constructed that we can perceive regularities to which, if we have religious presuppositions, we apply the concept of design. Furthermore, to make of design a biologic principle, as in these passages in the CRS book, is to reduce the need to interpret biologic processes as precursors of the adaptation that evokes wonder. Modern biology is then in jeopardy. The CRS position must lead inevitably to the view (although the authors do not go this far) that biologic processes cannot express cause-and-effect relationships; that is, they must be merely a series of discrete and unrelated events. If design is a sufficient and exclusive explanation of how an amoeba moves (p. 65), then it is all right to study its environmental conditions but we can never be sure that they are causal agencies that influence such behavior.

By contrast, biology cannot say that such causal agencies, whether operating within the life-span of a single organism or joining together many different organisms over long periods of time, as in evolution, do not themselves, from the theologic point-of-view, represent the expression of divine providence in design. While the CRS authors reject the latter—the evolutionary process—their position cannot sustain the former, as they hope, because they apparently hold that the argument for design is *a posteriori*. That is, they argue from observed effects *to* design, a wholly conjectural procedure that can never be theologically satisfying.

The question of design worried Asa Gray (1810-88), the American friend of Charles Darwin (1809-82), even more than did the new questions concerning the *Genesis* account of creation. When he found out, in 1857, what Darwin was up to (F. Darwin, 1887, I, p. 477-482), he hurried off a letter to ask whether natural selection were now to become a substitute for divine providence. Darwin assured him that natural selection was not such an agent; it only described various actions in nature, much as a geologist uses the term "denudation" (F. Darwin, 1903, I, p. 126; Dupree, 1968, p. 247; Greene, 1961, p. 296, 297). If design were to explain variation, Darwin went on, then the number and direction of Fantail feathers would have been created to suit some pigeon-fancier (F. Darwin, 1887, II, p. 146).

Gravity

There was a striking parallel in the 1860s between the religious objections first raised against natural selection and those formerly raised against the idea of gravity, which was feared in the time of Isaac Newton (1642-1727) as unfriendly to religion. Gray saw at once the parallel between Darwin and Newton but had to agree, in his review of the *Origin*, that gravity was no longer a religious question concerning design (Dupree, 1963, p. 44).

In this respect the CRS authors apparently are not worried about any threat to theism posed by a physical agency. It may be pertinent to inquire why. If natural selection, which is a biologic process, is a threat to theism, why should not gravity, a physical process, also be considered a threat, particularly since it is more universal in its applications? After all, if gravity holds the planets in orbit, then the Almighty is not on the job. Why not simply say that Mars was "designed" to travel in an elliptical orbit?

Darwin pointed out in the first edition of his *Origin* that using the term "design" is not an explanation but a restatement of the fact (p. 185, 186, 452). He wondered whether those who argued for special creation really believed that at "innumerable periods in the earth's history certain elemental atoms have been commanded suddenly to flash into living tissue" (p. 483). Darwin was trying to suggest that merely using the term "design," however appropriate it might be as an expression of faith, leaves unanswered the question of method. In the third edition (ch. 4) he complained that, since no one objected to gravity, his critics should not erroneously interpret natural selection as an "active power or Deity."

Gray soon came to terms with Darwin and became one of his staunchest supporters. He maintained his religious orthodoxy, although the question of design continued to fascinate him. He examined in depth this most complex question in two essays—"Design versus Necessity" and "Natural Selection and Natural Theology"—in which he seemed to conclude that Darwin had eliminated only an *inherent*, finalistic version of the design argument (Dupree, 1963). This argument states that it is possible for us to observe in nature the only, the final, and the ultimate purpose of the Creator, such as beauty in flowers. In other words, one could just look at a plant and decide what the Almighty had in mind. Moreover, this purpose is the essence and meaning of each organism and structure. If so, then what Darwin had done was to eliminate from biology not the Biblical view of divine providence but Aristotelian final causation as a sufficient and exclusive explanation of biologic events.

We do not observe design in nature. Our minds seem to be so constructed that we can perceive regularities to which, if we have religious presuppositions, we apply the concept of design.

Value of Religious Thought

While teleology may be at times a useful and even a necessary accompaniment of a full interpretation of a biologic event, it cannot be, as the CRS implies, a

sufficient condition for such an explanation. Today we try to eliminate teleology from a scientific description of a biologic event. But we should not gainsay the power of the design argument in the history of biology, even though it is fashionable in our age to ignore the contributions that religious ideas have made to science in the past. We are more aware of how biology has changed religion (Greene, 1963). Beginning in the 17th century and continuing as late as the opening decades of the 19th century a strong trend in biology, with prominent themes from the Greek past, saw the study of the handiwork of God as a religious responsibility. The works of the Rev. John Ray (1627-1705), the Rev. William Paley (1743-1805), and the Rev. William Buckland (1784-1856) are prototypes of this trend. Whatever its negative aspects—the strong tendency to propaganda and the dubious analogy between nature and revelation—it was an energizing force that helped to set in motion the scientific enterprise.

When we interpret animal behavior in terms of design (p. 147) we may only be following a habit we have inherited from Aristotle. And when we add that an animal behaves in such and such a way so as to fulfill the Creator's wish we are imposing on nature an *a priori* view we have derived from religion. Both are legitimate expressions of the sensitive mind.

Let us give the ancients their due. They remind us that the model of nature put together by modern science may not represent ultimate reality. But we must render to science, also, its due, which is to determine the material connections among contingent events. The trick is to disentangle these components—Aristotelian, religious, and scientific; but this, I think, has not been done in the context of the CRS text. I question whether religious truth is served by implying that anthropomorphic final causes, themselves Aristotelian in conceptual origin, may be observed in the operations of nature.

If natural selection, which is a biologic process, is a threat to theism, why should not gravity, a physical process, also be considered a threat?

(To be continued)

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It needs to be made clear . . . that God is declared in the Bible to be creatively active and supreme in every twist and turn of this great Drama, whether "chance" or "law-abiding" in the scientific sense, which he has thought into being by the word of his power (Hebrews 1:2,3). It is a theological blunder to speak of his "designer's mind" as an alternative, rival explanation to what the scientist may technically classify as "the operation of chance;" or to regard the success of such scientific explanations as discrediting the Bible. . . . The idea that the biological theory of evolution supports anti-Christian "Evolutionism" is false; and it would be a shame for any Christian literature to align itself with atheistic rationalism in continuing to give currency to it.

Donald M. MacKay

The Clockwork Image,
InterVarsity Press, 1974, p. 55

Darwin and Contemporary Theological Reflection on the Nature of Man

JOHN C. GIENAPP

Concordia Senior College
Fort Wayne, Indiana 46825

I am sorry that I have no 'consolatory view' as to [the] dignity of man: I am content that man will probably advance, and care not much whether we are looked at as mere savages in a remotely distant future.[1]

So wrote Charles Darwin to Charles Lyell in 1860 and in so doing introduced his own views on perhaps the most difficult theological issue connected with the development of evolutionary views—the question of the nature and dignity of man.

This, of course, was not the only religious or theological question raised by Darwin's work. The controversies have been extensively explored[2] and variously described. In essence, however, there were three important questions: the question of how to interpret the Bible; the question of the role of natural theology in supporting belief in God; and the question of the nature and dignity of man. Of these three, it seems to me, the last question was the most important. This becomes clear, I think, if we examine each of the questions from the perspective of the present.

Biblical Interpretation

The first question in which Darwin was embroiled was the question of the interpretation of the Bible. After the Reformation, Protestants tended to interpret the Bible literally—that is, to avoid much of the allegorizing and spiritualizing of patristic and medieval exegesis. Moreover, as prose styles during the 17th and 18th centuries became simpler, emphasizing the narrative or expository content, people tended to interpret the Bible as similar narrative or exposition. In so doing they often failed to see the great cultural distance between the Scriptural writers and themselves. As a result, the so-called "historical books" were treated as straightforward narrative and, with a few exceptions, as literally true. Doctrines of revelation and inspiration then needed to be elaborated to account for the special knowledge that writers of such documents seemed to possess. Darwin's work, of course, carried the implication that at least the early chapters of Genesis could not be literally and historically true. Yet Darwin neither initiated criticism of the literal interpretation of the Scriptures nor alone caused it to be swept away. Within the sciences the development of cosmology, geology, and paleontology had already suggested changes in the interpretation of the Bible before Darwin's work. Moreover, the gradual extension of the concept of a law-bound system of nature made many of the miraculous elements in the Scriptures appear dubious. In response to this there had been at least a century of higher criticism before 1859 aimed at revising the understanding of Scriptural documents. In his autobiography Darwin attributes his own doubts about the truth of Christianity as much to the impact of higher criticism as to the development of the evolutionary theory itself.[3] In short, the question of the interpretation of Scripture was raised by the development of science in general, and by literary considerations, which I have not detailed here, not merely by the development of the evolutionary theory. All these factors together, especially a better understanding of the literary and cultural background of the Biblical documents, induced changes in the way Scripture is interpreted but they have not at the present time destroyed theological claims about the authority of the Scriptures or about their central message.

Natural Theology

The second religious question seemingly exacerbated by Darwin's work was the question of the natural knowledge of God, or natural theology. Natural theology in England, based in large measure on the views of the "virtuosi" of the Scientific Revolution,[4] was later shaped by William Paley into physico-theology, a particular form of the argument from design. Its most important characteristic with reference to evolution was that it emphasized adaptation and functional structure in living creatures as evidence of the wisdom,

power, and benevolence of God. By its lights Darwin's work seemed "atheistical," for in explaining adaptation as the result of random variations and the operation of natural selection, Darwinism undermined the foundations of physico-theology. Darwin agreed, for he could not see how a natural process which produced adaptation through struggle, suffering, and extinction could indicate the benevolence of God.

> There seems to me too much misery in the world [he wrote]. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of caterpillars, or that a cat should play with mice. Not believing this, I see no necessity in the belief that the eye was expressly designed. On the other hand, I cannot anyhow be contented to view this wonderful universe, and especially the nature of man, and to conclude that everything is the result of brute force. I am inclined to look at everything as resulting from designed laws, with the details, whether good or bad, left to the working out of what we may call chance. Not that this notion *at all* satisfies me. I feel most deeply that the whole subject is too profound for the human intellect. A dog might as well speculate on the mind of Newton. Let each man hope and believe what he can.[5]

It is possible, however, to overemphasize Darwin's challenge to natural theology. As Loren Eiseley points out, "Darwin did not destroy the argument from design. He destroyed only the watchmaker and the watch. . . . Only a certain kind of design argument had been eliminated by Darwin, namely the finalistic one."[6]

While Darwin and even more so Huxley felt that the overthrow of physico-theology rendered discourse about God nearly meaningless,[7] their view today seems overly pessimistic. As James Collins points out, they failed to see that the Paley position "falls pitiably short of encompassing all the resources of the philosophy of God, and hence that it does not deserve to be treated as natural theology without qualification."[8]

The argument from design could be reformulated in a way that appealed to many, including the Americans Asa Gray and John Fiske, although it then required the removal of God from a role of active benevolence. In addition, natural theology could be cast in other forms. Most importantly of all, Christian tradition could be cast in neo-orthodox forms that had little dependence on natural theology at all. Thus Darwin's work, devastating as it was to physico-theology, had a more modest effect on other types of Christian discourse.

Nature of Man

The third religious or theological question was the question of the nature of man. This question was particularly troublesome because there was no obvious Christian tradition that could provide the basis for an evolutionary, yet orthodox view of man. Such a position would have to be a new formulation. To many this seemed impossible. In the first place, the nature and dignity of man was grounded in the Biblical accounts of creation and allusions to them. Theologically formulated, these accounts led to the doctrine of the *imago dei*. What separated man from the animals was that man had been created in a special way in the image of God. However this image was interpreted, it was difficult to reconcile with the evolutionary development of man. As Origen conceived it, the *imago dei* consisted of an immortal soul, but an immortal soul that evolved gradually was philosophical nonsense. Perhaps more commonly the image of God was thought of as man's *humanitas*, those things that make him distinctly human, such as his rationality, his moral responsibility, and his freedom of will. But if these had developed gradually, man could hardly be said to have a nature or dignity different from any other living creature.[9] In the second place, orthodox Christianity held man to be a fallen creature, marked by a perversion of his originally perfect nature. This too was difficult to conceive of in an evolutionary way. Thus Darwin and most of his religious opponents would have agreed: if the evolutionary theory was correct, there seemed to be no consolatory view of the dignity of man. The point was emphatically made in the review of the *Descent of Man* in the *Edinburgh Review* of 1871.

Darwin's work raised three important questions: how to interpret the Bible, the role of natural theology in supporting belief in God, and the nature and dignity of man. The last question was the most important.

> Mr. Darwin does not confine his argument to the origin of man's body from pre-existent forms; he ventures to carry it into the region of mind, and to account for man's spiritual powers by a process of natural selection from rudiments in the lower animals. It is indeed impossible to overestimate the magnitude of the issue. If our humanity be merely the natural product of the modified faculties of brutes, most earnest-minded men will be compelled to give up those motives by which they have attempted to live noble and virtuous lives as founded on a mistake; our moral sense will turn out to be a mere developed instinct identical in kind with those of ants and bees; and the revelation of God to us and the hope of a future life, pleasurable daydreams invented for the good of society. If these views be true, a revolution in thought is imminent, which will shake society to its foundation, by destroying the sanctity of the conscience and the religious sense; for sooner or later they must find expression in men's lives.[10]

Darwin did not stress his view of man's origin in the *Origin of Species*. But in the *Descent of Man*, published slightly more than a century ago, Darwin addressed himself to man's origin. Darwin's main purpose was to marshall additional biological evidence that man was indeed descended from an earlier anthropoid—evidence that would complement Lyell's *Geological Evidences of the Antiquity of Man* and Huxley's *Man's Place in Nature*. In addition, Darwin hoped to show that natural selection (with some help from sexual selection) could explain nearly everything about man, including the gradual development of his mental, moral, emotional, and religious faculties. In so doing he developed (partly explicitly and partly implicitly) an anthropology that today appears somewhat inconsistent. A necessary corollary of the gradual development of man was that man differed only in degree, not in kind, from other animals. Thus, ac-

cording to Darwin, he had no special nature or dignity by virtue of his origin.

To support the idea of man's gradual evolution Darwin developed what he felt were plausible accounts of man's intellectual, moral, and religious development. In the case of intellectual faculties Darwin emphasized mainly the gradation in mental powers in various animals to make plausible the idea of development.

> If no organic being excepting man had possessed any mental power, or if his powers had been of a wholly different nature from those of the lower animals, then we should never have been able to convince ourselves that our high faculties had been gradually developed. But it can be shown that there is no fundamental difference of this kind. We must admit that there is a much wider interval in mental power between one of the lowest fishes, as a lamprey or lancelet, and one of the higher apes, than between an ape and man; yet this interval is filled up by numberless gradations.[11]

Darwin went on to enumerate various mental faculties, such as imagination, curiosity, reason, and to give examples of animals supposedly exhibiting these traits.

The development of the moral sense, which Darwin seemed to regard as the chief attribute of man, presented Darwin with peculiar difficulties. Darwin seemed to think that man's social instincts coupled with his superior intelligence would lead to higher morality.

> It must not be forgotten [Darwin wrote] that although a high standard of morality gives a slight or no advantage to each individual man and his children over the other men of the same tribe, yet . . . an increase in the number of well-endowed men and an advancement in the standard of morality will certainly give an immense advantage to one tribe over another. A tribe including many members who from possessing in a high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection. At all times throughout the world tribes have supplanted other tribes; and as morality is one important element in their success, the standard of morality and the number of well-endowed men will thus everywhere tend to rise and increase . . . Looking to future generations, there is no cause to fear that the social instinct will grow weaker, and we may expect that virtuous habits will grow stronger, becoming perhaps fixed by inheritance. In this case the struggle between our higher and lower impulses will be less severe, and virtue will be triumphant.[12]

The difficulties with this view become apparent when one tries it in any known historical context. One hardly thinks of the European supplanting the American Indian because of his higher degree of patriotism, fidelity, obedience, courage, and sympathy. Studies of animal behavior suggest that aggression and a killer instinct may be selected for as well as "virtue." Darwin's difficulty was that he operated with moral categories not grounded in the evolutionary process. If man indeed has no special nature or dignity apart from the animals, how can he be said to be in struggle—his higher nature against his lower? Darwin, it seems, retained some contemporary values without realizing their conflict with his evolutionary anthropology.

Development of Religion

In his discussion of the development of religion Darwin encountered similar difficulty. As an anthropologist he could place the origin of religion in the dreams and superstitions of primitive people; and he could suggest how these led to other beliefs: fetishism, polytheism, and various superstitions and customs. But he also described the belief in a universal and beneficent Creator arising in "high" cultures. In addition he said "the question of whether there exists a Creator and Ruler of the universe has been answered in the affirmative by some of the highest intellects that have ever existed." But on what criteria did Darwin know that the intellect that affirms a Creator is higher? Certainly not because of the actual existence of a Creator, since his own ideas seemed to cast doubt on the existence of God. As he said, "the horrid doubt always arises whether the convictions of man's mind, which has been developed from the mind of the lower animals, are of any value or at all trustworthy. Would anyone trust in the convictions of a monkey's mind, if there are any convictions in such a mind?" Here, too, Darwin seemed to have accepted values that were not grounded in the evolutionary process as he elsewhere described it.

There was no obvious Christian tradition that could provide the basis for an evolutionary, yet orthodox view of man.

Besides the idea that man differs only in degree from animals, Darwin's anthropology contained a second assertion—the assertion of universal human progress. "I am content that man will probably advance and care not much whether we are looked at as mere savages in a remotely distant future," Darwin wrote to Lyell. He echoed this view in the *Descent of Man.*

> Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope for a still higher destiny in the distant future.[13]

Darwin faced a similar problem with the concept of progress as he did in his discussion of human morality. There was nothing in the evolutionary theory itself that required progress of the sort that Darwin envisioned. In fact, he felt that the ultimate disappearance of man, which his view of nature implied, was intolerable.

> Believing as I do that man in the distant future will be a far more perfect creature than he now is, it is an intolerable thought that he and all other sentient beings are doomed to complete annihilation after such long continued slow progress.[14]

If the evolutionary process is a matter of random variations, natural selection, and increasing adaptation, and if it involves specialization, and often over-specialization and extinction, then, how can one determine whether man really is the line on which the evolutionary future depends? Darwin never conceived of the possibilities we know today, that man can easily cause his own extinction, that the history of the human

race, instead of being a glorious pathway to the future, may be simply a cruel hoax of nature, an evolutionary blind alley.

In short, Darwin made a strong case for the evolutionary origin of man. The balance of probability now lay heavily with the idea that man had developed slowly long ago from a precursor anthropoid form. However, if man was only different in degree from the animals, as Darwin argued, then Darwin had no easy way to sustain the goodness of the moral values he advocated or the truthfulness of the knowledge he asserted. Even more difficult to support was his confident belief that the evolutionary process led to human progress—that higher cultures emerged and supplanted lower ones while morality was everywhere on the rise. Finally, Darwin had little concern for what the Christian tradition has called evil or sin—the capability of man to pervert his own nature and destroy himself and his society. Thus Darwin's anthropology presented several puzzles to theologians. If it was in fact true that there was direction to the evolutionary process, then exactly how was this progress to be understood in a theological sense? And how was the nature of man to be understood if it was in fact changing? How was man related to God, if not by direct creation and subsequent fall? What meaning, if any, was there in the traditional doctrine of sin?

Contemporary theological traditions have not all agreed that these are valid questions. Two contemporary theological traditions that have addressed themselves to these questions are process theology and the theology of the future.

Process Theology

Process theology takes as its starting point the metaphysical system of Alfred North Whitehead. In Whitehead's system reality is one universal process systematically governed, according to certain laws, by a cosmic mind or God. While God in his primordial nature is unchanging and complete, the source of all ideals and new possibilities, God in his consequent nature, as Whitehead describes it, shares in the creative advance of the world. The world is not mere flux and change, because somehow God is the ground of all becoming and moves toward greater and greater integration with his primordial nature. Religion is the vehicle by which men get some understanding of the direction of this process, although their understanding of it will never be complete.

Besides the idea that man differs only in degree from animals, Darwin's anthropology contained a second assertion—the assertion of universal human progress.

> Religion is the vision of something which stands beyond, behind, and within, the passing flux of immediate things; something which is real, and yet waiting to be realized; something which is a remote possibility, and yet the greatest of present facts; something that gives meaning to all that passes, and yet eludes apprehension; something whose possession is the final good, and yet is beyond all reach; something which is the ultimate ideal, and the hopeless quest.[15]

Whitehead's system gives a good account of the evolutionary process and indicates a kind of progress in it. However, even some of his most sympathetic interpreters admit that Whitehead had very little to contribute to the understanding of the nature of man. Thus theologians within the process tradition have attempted to elaborate Whitehead's philosophy to incorporate facets of Christian anthropology.

John B. Cobb, for example, has attempted to show that two Christian doctrines, namely the doctrine that man is a responsible sinner and the doctrine that personal existence continues beyond this life, can be incorporated into a Whiteheadian scheme. The doctrine of man as a responsible sinner is vulnerable to scientific-philosophical criticism on two counts, Cobb says. On the one hand, if man is completely determined by natural forces, to talk of his responsibility is meaningless. On the other hand, if there is no objective claim upon man in terms of which right and wrong can be defined, it is equally meaningless. In response to the first criticism Cobb argues that Whitehead's concept of freedom permits the understanding that man has freedom "within the context of cumulative individual and social relations," thereby retaining the view that men cannot escape the causal nexus. The objectivity of moral standards can also be maintained within a Whiteheadian scheme, Cobb asserts. Such a formulation, he feels, is in fact preferable to Kantian or existentialist formulations. We shall not here detail Cobb's view on personal existence after death.[16] However, it can be seen that Cobb attempts to develop an anthropology that is traditionally Christian in accepting the reality of man as sinner. What is less clear is how Cobb would integrate traditional redemptive and Christological elements into his scheme.

Another process theologian who deals with the question of man's nature is Daniel Day Williams. In his book *The Spirit and the Forms of Love,* he makes full-length interpretation of the concept of love based to a large extent on the categories of process thought. In so doing, he discusses the traditional concept of the *imago dei* in man. According to Williams the *imago dei* in man is not an ontological quality; it is a relationship. It must be conceived "in dynamic terms as the relatedness which God has established between himself and man and to which man can respond." In Williams' view

> the *imago dei* should not be conceived as a special quality, but as the relationship for which man is created with his neighbor before God. The image of God is reflected in every aspect of man's being, not as a special entity but as the meaning of the life of man in its essential integrity. But surely this can be most clearly grasped if we say that love is the meaning of the *imago dei*.[17]

By describing the concept of the *imago dei* in this way Williams can easily formulate a concept of sin. "The root of sin is the failure to realize life is love." Williams can then provide an analysis to correlate his position with traditional doctrines about the sinfulness of man without, however, resorting to a concept of a historical fall. Williams admits that his view of the *imago dei* as a relationship is not new or unique to him, but he asserts:

> the process theology which informs our interpretations of the Christian faith proposes a distinctive addition to the doctrine (of the image of God), for process theology sees love disclosed in a history in which the spirit of God creates new forms. In this history God is involved with the world both as its eternal ground and as the supreme participant in the suffering which his creativity involves. In process theology therefore the 'analogy of being' which holds between God and the creatures must be related to a fully historical conception of what being is. Man bears the image of God in his temporality as well as his participation in eternity, in suffering as well as in peace. His loves are in process.[18]

From this conception of human nature set in the image of God, Williams is able to make a strong plea for ethical behavior and for social action. Man himself ought to live out the purposes of God and in so doing his nature and his society will change, as it "participates in the infinite life of communion within the everlasting creativity of God."[19]

In summary, the process theologians have been able to give a view of man that sets him within an evolutionary framework and yet grounds that framework upon a concept of God, albeit not a very traditional concept of God. In addition, they have argued for many of the traditional anthropological doctrines within Christianity, the *imago dei*, man's responsibility for sin, and the moral claims upon him, while rejecting the ontological categories and (circular) *urzeit-endzeit* typology in which these were traditionally expressed.

Theology of the Future

Another contemporary theological movement that has attempted to express Christian faith in categories that are evolutionary is the theology of the future—a theology that has ties with the Marxian philosophy of Ernst Bloch. Bloch's philosophy develops an ontology of the future. "It is only the horizon of the future," he suggests, ". . . which gives to reality its real dimension." A thing is not what it is, but what it will be. To be human then is to have a utopia, to be in hope, ahead of oneself, to be in quest of one's essence to establish it in the future. Bloch, however, does not expect the future to be eschatological in any traditional Christian sense. According to Carl Braaten, one of Bloch's American interpreters, Bloch demythologizes the eschatological myths of messianic religion. "Man," Bloch says, "is the God of Christianity, and anthropology is the secret of Christian theology."[20]

In spite of the anti-theological tone of Bloch's philosophy some theologians have found the category of the future exceptionally useful in illuminating the eschatological content of Christian faith. Drawing on Biblical material they have emphasized in the *Heilsgeschichte* of Israel and the Christian Church the continual cycle of promise and fulfillment in which the fulfillment gives new dimension to the promise and foreshadows in turn further events. The process is grounded in the nature of God himself who continually make all things new. As Jürgen Moltmann says,

> God is the power of the future and is believed in as the creator of a new world. Out of this qualitatively new future, new power already forces its way into the present so that man can find possibilities for rebirth and renewal, personal and revolutionary social change. We are confronted here with an eschatologically oriented faith. It is not interested in an event that took place at the beginning of time or in explaining why the world exists and why it is as it is. It wants to change the world rather than explain it, to transform existence rather than elucidate it.[21]

Thus the theology of the future, while not in explicit dialogue with Darwin, has taken up the claim of progress and attempted to ground it on a wholly different level. There is a direction to nature and to human history not because laws of nature determine it, not because the evolutionary structure of the cosmos is inherently creative, but because God continually creates things anew.

Anthropology within the theology of the future is explicated by Wolfhart Pannenberg in his book *Was ist der Mensch*? According to Pannenberg, the characteristic of man—that which makes him really man, which distinguishes him from animals, and lifts him out above non-human nature in general—is his "openness to the world." Man has a world that can take an almost infinite variety of forms, rather than a mere environment like animals. Man transforms his world from a natural world to a world of culture, but he is never satisfied with it; he is always searching for something beyond. Urged on by a multiplicity of drives, he relentlessly seeks to master nature and the world of his own making, and then to inquire beyond. The reason for this, Pannenberg argues, is that man's "openness to the world" presupposes a relation to God. "The necessity that man inquire beyond everything that he comes across as his world. . . is understandable only as the question about God." "What the environment is for animals, God is for man. God is the goal in which alone his striving can find rest and his destiny be fulfilled."[22] Pannenberg here picks up a thrust in evolutionary anthropology—that man must ask about his destiny; indeed, more than that, that man must shape it—and suggests that ultimately the shape of that destiny can only be discovered in God.

Pannenberg deals with the traditional Christian doctrine of sin by saying that man's nature as "openness to the world" can be contradicted by self-centeredness. In fact, man constantly lapses into self-centeredness. He cannot by himself solve the conflict between "openness to the world" and self-centeredness. Here Pannenberg would probably take issue with Darwin's confident belief that moral virtues and hence man's nature are constantly improving. According to Pannenberg, it is only beyond death that the conflict between self-centeredness and openness to the world can be overcome. For Pannenberg the Christian tradition mediates this life beyond death in the union of believers in the death and life of Jesus Christ.

Pannenberg sees both individual destiny and the destiny of the human race as something that can never be adequately fulfilled or disclosed within the world as we know it. It will only be fulfilled when the world is transformed. This cannot come about of itself; it can be effected only by God. The Christian hope that such a transformation will take place is grounded in action that God has already taken in the historical person of Jesus. "The unity of history as it is established in Jesus' fate makes it possible for each individual to attain the wholeness of his own life by knowing that he, together with all men, is related to that center."[23]

Pannenberg's anthropology is an attempt to deal

seriously with man's possibilities for changing his future —with man's progress, as Darwin might put it. He has moved away from the traditional expressions of Christian anthropology that talk of a perfect beginning, a fall into sin, and an ultimate restoration to perfection. Yet he retains the traditional Christian concept of the radical sinfulness of man in his assertion that man cannot by any of his own powers overcome the conflict between his self-centeredness and his "openness to the world." Furthermore, he maintains a traditional Christian position in asserting that change in destiny (of a much more profound sort than Darwin described in his suggestions of moral improvement) comes only at the initiative of God, an initiative that Pannenberg grounds Christologically.

Summary

What I have tried to show here is that of the three religious questions connected with Darwinism, the question of the nature and destiny of man was the one on which Darwinism had the greatest effect. The positive findings associated with the evolutionary theory required changes in the formulations of Christian anthropology, if the Christian doctrines of sin and redemption were to be related to an evolving human nature. But beyond that, the difficult claim of individual and social progress required attention. Darwin's formulation of the claim was not profound, but the idea persisted. Process theology and the theology of hope each attempt to ground progress in the nature of God; each in its own way attempts to understand traditional Christian anthropology in a framework in which man is continually changing. Each requires a philosophical framework developed in the post-Darwinian era.

The question remains whether these are "consolatory views," whether they are improvements on Darwin's strange blend of scepticism about human dignity and naively confident belief in human progress. Certainly they provide religious alternatives to Darwin's view, grounding human nature in its relationship to God, without denying some of Darwin's insights. Whether they are views that satisfy men deeply cannot now be answered; that answer can only be estimated in the future by the power of these views to move men to highest human actions. Ultimately the question of human nature will puzzle men until that *homo novus*, that new man, anticipated each in its own way by both Christian tradition and evolutionary biology, is fully formed.

Two contemporary theological traditions that have addressed themselves to these questions are process theology and the theology of the future.

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A hundred years after Goethe's death, the inheritors of the German Enlightenment pushed tens of thousands of Jews, political opponents, and evangelical Christians through the iron gates of the concentration camp in the beech forest just above Weimar; most of them never came out again. On that iron gate, the camp motto remains: "Jedem das seine"—"To each his own," i.e., "Each man gets what he deserves." Note the logical (and inevitable) sequence: The Enlightenment makes man the measure of all things; modern man establishes the measure as he wills; and the strong, having devalued the weak, exterminate them. From Goethe to Nietzsche to Hitler is as short a step as from Weimar to Buchenwald.

John Warwick Montgomery

"From Enlightenment to Extermination," *Christianity Today*, October 11, 1974, p. 58

Science Falsely So-Called: Evolution and Adventists in the Nineteenth Century

RONALD L. NUMBERS

Department of the History of Medicine

University of Wisconsin
Madison, Wisconsin 53706

Historians of science in America have known for some time now that within two decades of the publication of Charles Darwin's *Origin of Species* in 1859 large numbers of educated Americans had embraced some theory of organic evolution.[1] They have also known that the nineteenth-century debate over evolution did not focus on the question of Scriptural authority, like the fundamentalist controversy the following century, but rather centered on the possibility of successfully harmonizing biological development with the popular doctrines of natural theology.[2] Yet scarcely anything is known about the response of the larger segment of the population with little or no formal education, that element of the citizenry which several decades later filled the ranks of the fundamentalist army. Did these people, if indeed they had any knowledge of evolution at all, share the concerns of their better educated countrymen? Or were their attitudes more like those of the twentieth-century fundamentalists? In hope of finding a partial answer to these questions, I have investigated the literature of the Seventh-day Adventist church, a denomination active in the crusade against evolution in the 1920s.[3]

Seventh-day Adventists

Seventh-day Adventists trace their origins back to the Millerite movement of the 1830s and early 1840s. Following the failure of Christ to appear either in 1843 or 1844, a number of disappointed Millerites returned to their Bibles to search for new light. They concluded that the Second Coming was truly imminent, but that it would not occur until the world had been warned of the importance of keeping the Sabbath on the seventh day of the week. In 1863 this group, led by James and Ellen White and Joseph Bates, formally organized itself as the Seventh-day Adventist church. At the time of organization the church consisted of about 3,500 members and twenty-two ordained ministers, concentrated east of the Missouri River and north of the Confederacy. Headquarters were set up at Battle Creek, Michigan. By the end of the century the church had a worldwide membership of over 75,000, with more than 500 ordained ministers.[4] Only a handful of these members had been exposed to higher education.[5]

Unlike most of the leaders of the mainline Protestant churches of the nineteenth century, who even before 1859 had abandoned belief in the literality of the Mosaic story of creation, Adventist writers defended both the historical and scientific accuracy of the first chapters of Genesis. Their primary concern was not harmonizing science with natural theology but preserving the authority of the Scriptures. Ellen White, a prophetess with approximately three years of elementary schooling and the most influential voice among early Adventists, consistently relegated scientific knowledge to a position much subordinate to that of revealed knowledge. "The Bible is not to be tested by men's ideas of science," she wrote, "but science is to be brought to the test of this unerring standard." Since Moses had written his account of creation "under the guidance of the Spirit of God," any theory contradicting it was to be rejected out of hand. So far as she was concerned, Moses had left no doubt that the days of creation were six in number and of twenty-four hours' duration, and that the mode of creation had not involved the use of natural laws.[6]

The editors of the official church paper, the *Review and Herald*, shared Mrs. White's views on the relationship between science and religion. Early in 1859, several months before the publication of the *Origin of Species*, they reprinted an excerpt from a non-Adventist source claiming that "while the Bible does not teach science, when it does refer to science it is always correct." In support of this claim the author ironically cited Biblical allusions to the earth's rotundity.[7] A couple years later the same periodical carried an article by a youthful Adventist evangelist, J. N. Loughborough, affirming the superior role of revealed

knowledge. God's will must be understood through a written revelation, argued Loughbrough, because reason and nature are untrustworthy.[8] This was a theme frequently repeated in Adventist literature.

John Harvey Kellogg

One of the few warnings against an unreasoning dependence upon the Bible in matters of science came from a member of the small educated minority in the church, a physician named John Harvey Kellogg, recently graduated from the Bellevue Hospital Medical College in New York City and serving as professor of physics in the denomination's newly founded Battle Creek College. Writing in 1879 in a small volume entitled *Harmony of Science and the Bible,* Kellogg (better remembered by Americans as the inventor of peanut butter, corn flakes, and other dry cereals) listed as one of the chief factors responsible for the recurring conflict between religion and science the habit of religionists of "Holding the Bible as unimpeachable authority on *all* subjects, as the universal test of truth, and attaching all importance to a particular interpretation of its language." Though Kellogg apparently believed in a special creation, he expressed a willingness to recognize the legitimacy of science within its own sphere. "Science deals chiefly with one sort of truths, religion with another class of truths." If only this division were honored, all conflict would cease.[9] The leaders of the church, especially Mrs. White, did not look favorably upon the ambitious physician's habit of thinking and operating independently, and eventually Kellogg and the Adventists parted ways.[10]

Geology and Uniformity

As we have already mentioned, Adventists placed their faith in the Bible rather than science because of a deep suspicion of human reason. And nothing tended to confirm this suspicion better than the science of geology, which depended so crucially on the *assumption* of uniformity. Thus, while the leaders of American thought were discussing the merits of Darwinism, Adventists were often preoccupied with the real or imagined fallacies of geology, which they saw as providing a foundation for organic evolution—both theories going "hand in hand to destroy faith in the word of God."[11] Seldom did they pass up an opportunity to point a scoffing finger at "the dreamy, incoherent utterances of geologists."[12] Uriah Smith, editor of the *Review and Herald,* occasionally led the attack himself. Though he had never attended college, he had no fear of doing battle with the Goliaths of the scientific world. Who, he asked, had "ever proven or tried to prove" the validity of the uniformity principle? "Nobody" was the obvious answer. "Usually it is either 'presumed that the reader will be convinced' of the matter, or certain results are 'supposed to have been effected by such causes as are operating at present.' "[13] The numerous controversies and lack of consensus within the geological community seemed to lend credence to Smith's charges of unreliability. Even the foremost geological authors of the day—William Buckland, Hugh Miller, Charles Lyell, and Edward Hitchcock—frequently contradicted one another.[14]

The consequences of giving up one's belief in the literality of Genesis seemed to be immense, because the reliability of the entire Bible rested upon the truth of the creation story.

Quite naturally Smith opened the pages of the *Review and Herald* to other critics of geology. The titles adequately reveal the recurring message: "The Blunders of Geologists," "The Uncertainty of Geological Science," and "False Theories of Geologists."[15] Typical is the comment of George W. Amadon, the 28-year-old editor of the *Youth's Instructor,* a periodical for Adventist young people: "No class of scientific men are more hasty and rash in making assertions than some geologists." "As a science it is not demonstrative, and its oracles are contradictory and clash with each other."[16] Likewise, the secretary of the General Conference of Seventh-day Adventists, C. W. Stone, warned that "the guess-work of geologists is a very unsafe foundation on which to build theories that go back of the record of Moses," and then went on to deny the validity of the principle of uniformity.[17]

The editors of the *Review and Herald* regularly reprinted what they considered to be devastating examples of the "extravagant pretensions" and the "absurdity" of geology. In one of these a Reformed Presbyterian minister in Chicago, Robert Patterson, observed that to construct the earth's history from processes currently going on was like measuring "a youth of six feet high, and finding that he grew half an inch last year, [concluding] thence that he was a hundred and forty-four years old."[18] In another, President Joseph F. Tuttle of Wabash College was said to have scored "a capital hit on that popular farce and prime minister of skepticism, geological guess-work," when he suggested that fossils—particularly human ones—found in geological formations much lower and earlier than usually assigned to men had probably dropped to that level during earthquakes.[19] On a third occasion, an article in the *Scientific American* estimating the age of the earth to be six hundred million years elicited the following critique:

> The reader will see at once the basis of this wonderful conclusion: first, an "estimate," then a "probability," then an "assumption," then a fact which is available only if the assumption is correct, then another "assumption," then the grand "conclusion." And having thus positively proved Moses to be five hundred and ninety-nine millions, nine hundred and ninety-four thousand years from the truth, they are happy! How nice it is to have such clear and positive knowledge about these things![20]

Alonzo T. Jones

Among the sizable group of Adventists to comment on geology, not one had any first-hand acquaintance with the science and few gave any evidence that they had read more than popular accounts of what geologists did. A notable exception was the West Coast minister Alonzo T. Jones, a self-taught ex-soldier converted while stationed at Fort Walla Walla, Washington. Unlike many of his colleagues, Jones took geology seriously—at least seriously enough to read Archibald Geikie's

Text Book of Geology, one of the most authoritative works in the field, three times through. All this study, however, merely convinced him of the total unreliability of geology, a theme he developed at length in a series of lead articles for the *Review and Herald* in 1883.[21] Here he accused geologists not only of beginning their reasonings with an assumption, but of using circular arguments. The most blatant instances of the latter were two statements by Geikie on dating. "One of these says that the *relative age of the rocks* is determined *by the fossils*. The other says that the *relative age of the fossils* is determined *by the rocks*." "What is this but reasoning in a circle?" asked Jones. This example and others like it forced him to conclude that "the only *certain* thing about [geological science], is its *uncertainty*."[22]

Science Falsely So-Called

Seventh-day Adventists were understandably reluctant to admit having any hostility toward what they liked to call "true science," that is, science based upon "facts" and in agreement with the Bible. Their criticisms were directed solely at "science falsely so-called," hypothetical science in conflict with revelation.[23] Scientific theories and hypotheses regarding the history of the earth were acceptable only under the severest restrictions. In formulating them, scientists were not to "assume any condition of the world, the existence of any agents, or the occurrence of any events, the reality of which they cannot demonstrate; and all their assumptions and reasonings must be consistent with all the facts, and all the laws of nature, which the question affects."[24] It did not disturb Adventists that these stipulations also ruled out as unscientific all supernatural explanations of the creation of the world. They were happy to remove the entire question of origins from the sphere of science to the realm of faith. "It is by *faith* and not by exploration and observation, that we understand that the worlds were framed by the word of God," wrote R. F. Cottrell, an Adventist author and minister. "The believer walks by faith, not by sight. In those things which are beyond his own observation he takes the word of God, simply believing what God has said."[25]

In defending their extreme Baconian view of science, Adventists revealed a deep-seated anti-intellectual prejudice, not uncommon among overly-democratic and under-educated Americans. In 1872 the *Review and Herald* reprinted an address by the Presbyterian minister John Hall, in which he warmly thanked scientists for collecting so many useful facts, then denied them an exclusive right to interpret what they had discovered. "When they come to reason upon these facts," he said,

> they use just the same kind of mind that God has given me; and I endeavor to use my mind upon these facts aright, just as truly as they claim to use their minds upon the facts. Hence . . . I claim the right to reason upon them just as truly as they can claim it; and I do not think the less of myself if in many instances I draw conclusions from the facts that have thus become common property that are not the conclusions that they venture to draw![26]

Adventists could not have agreed more.[27]

Conflict with Revelation

The heart of Adventist opposition to developmental theories, both organic and inorganic, was not the uncertain status of these ideas; it was their apparent conflict with revelation. The Bible clearly stated that the world was made in "six natural days," and Adventists rebelled at the thought of sacrificing this divine truth "on the altar of geological speculation."

Ellen White consistently relegated scientific knowledge to a position much subordinate to that of revealed knowledge.

The consequences of giving up one's belief in the literality of Genesis seemed to them to be immense, because the reliability of the entire Bible rested upon the truth of the creation story. Few spelled out the implications more sharply than David Nevins Lord, a New York millenarian and former editor of the *Theological and Literary Journal*. Genesis and geology, he asserted, are mutually contradictory. If the geologists are correct, the Mosaic record is false and God is a liar. And "it is impossible that God should not have spoken the truth." The decision to accept or reject geology thus took on tremendous theological significance. "If founded on just grounds, [geology] disproves the inspiration, not only of the record in Genesis of the creation, but of the whole of the writings of Moses, and thence, . . . of the whole of the Old and New Testaments, and divests Christianity itself of its title to be received as a divine institution."[28]

Compounding the difficulty of harmonizing any developmental view with the Bible were the statements of Ellen White. Writing in *Spiritual Gifts* in 1864, she claimed to have seen in vision the actual creation of the world. Specifically, she was shown "that the first week, in which God performed the work of creation in six days and rested on the seventh day, was just like every other week."[29] For many Adventists, the rejection of her testimony would have been tantamount to repudiating God's own word.

A Threat to Seventh-Day Sabbath

Adventists were especially fearful of anything that might weaken their arguments for observing the seventh-day Sabbath as a memorial of a six-day creation. And theories of evolutionary development threatened to do just that. According to Ellen White, "the infidel supposition, that the events of the first week required seven vast, indefinite periods for their accomplishment, strikes directly at the foundation of the sabbath of the fourth commandment."[30] Her husband, James, a founding father of the denomination and president of the General Conference, also warned that any deviation from the traditional view of creation would undermine the doctrine of the Sabbath along with the rest of the Bible. If the days of creation were assumed to be long, indefinite stretches of time, then

> the period of man's toils and cares before a day of rest, is also immense, covering millions of years. And if the last day of the first week, the day on which Jehovah rested from his work, was another immense indefinite period, the weekly Sabbath of the Old and New Testaments, which was made for man and commanded in the moral laws to be kept holy, is also an immense period of time.

Equally distressing was the thought that

> if the six days of creation, as we are told, were six indefinite periods, each covering millions of years, Adam, created in the early part of the sixth immense period, and dying at the age of nine hundred and thirty, leaving millions of years to reach to the close of that sixth period, died without keeping a single Sabbath.

Such ideas, making the Bible seem absurd, obviously could not be tolerated.[31]

The only accommodation to natural history Adventists were ever willing to discuss was the possibility of allowing an extended period of time between an initial creation of inorganic matter "in the beginning," depicted in the first verse of Genesis 1, and a later six-day creation about 6,000 years ago. In the opinion of at least one Adventist, a midwestern minister named J. P. Henderson, this view did "no violence to a single statement in the Bible."[32] Yet, despite its innocuousness, this idea never gained much popularity among Adventists. The prevailing attitude was that expressed by the French-Canadian evangelist D. T. Bourdeau. "Mark! the Bible says that God made the heaven and earth, as well as all that in them is, in six days," he wrote in the *Review and Herald*. "It is in the beginning of the first day, therefore, that God created the heaven and the earth, as spoken in Gen. i, 1."[33]

Literal Reading of Genesis

Their strict adherence to a literal reading of Genesis prevented Advestists from adopting even the most theistic of evolutionary ideas and thus separated them from the mainstream of American thought. Well before 1859 educated Americans had reinterpreted Genesis to make room for the advancement of science. During the 1830s and 1840s Edward Hitchcock of Amherst College influenced many to embrace a view similar to that advocated by Henderson above, with the significant difference that Hitchcock's disciples allowed for the appearance of a succession of plants and animals prior to the Mosaic creation. In the following decades the educated often found it more reasonable to assume that the six days spoken of by Moses were not twenty-four hours in length but long intervals, a compromise advocated by scientific notables like Yale's Benjamin Silliman and James Dwight Dana and Princeton's Arnold Guyot. Either of these interpretations permitted the orthodox to adopt a theistic brand of evolution without seeming to depart from the intended revelation.[34]

Among the sizable group to comment on geology, not one had any firsthand acquaintance with the science and few gave any evidence that they had read more than popular accounts of what geologists did.

Intervention vs Providence

Adventists also ran counter to prevailing theological currents in their insistence upon miraculous special providences as the mode of creation. By the second half of the nineteenth century the religious leaders of America were placing less emphasis on supernatural interventions in the natural order and more on God's general providence through the secondary laws of nature. Thus they could without difficulty explain evolution simply as God's way of creating with natural laws.[35] The Adventists, however, saw evolution as restricting, if not altogether abolishing, God's role in the work of creation. It "is the last and most plausible attempt of infidelity to vote the throne of the adorable Creator vacant," wrote one author in the *Review and Herald*.[36] Another described it as "only an attempt to eject God, and to postpone him, and to put him clear out of reach."[37]

Because of its impious tendencies, evolution was commonly labeled "atheistic" or "infidel," and its founders and supporters fared no better. The *Review and Herald*, for example, unapologetically published Thomas Carlyle's description of Darwin as an unintelligent atheist, and reprinted a statement that "All the leading scientists who believe in evolution, without one exception the world over, are infidel."[38] The fact that theistic evolution was widely held in the Christian world—"almost all-pervading in the orthodox and evangelical churches, schools, and colleges"—carried no weight with the Adventists. It was merely additional evidence of the apostasy afflicting the nation's leading churches, explained W. H. Littlejohn, the blind president of Battle Creek College.[39]

Of special concern to many Adventists, as well as to twentieth-century fundamentalists, was the possible effect of evolutionary theories on the spiritual lives of their children. "This is a very serious matter," warned J. O. Corliss in a Sabbath-afternoon sermon to the Adventists of Battle Creek in 1880.

> We are forced to see our children, before they are old enough to carefully weigh these matters, and become enabled to discriminate between truth and error, imbibe sentiments from text books at school, that, despite the religious influence at home, ripen them into skeptics and infidels at an early age.[40]

To guard against this eventuality, Adventists turned increasingly to the protection of denominationally run schools, from the first grade through college.

Nontheological Considerations

Nontheological considerations played a secondary, but significant, role in the Adventist resistance to organic evolution. Human vanity rebelled at the prospect of relinquishing an honored position at the head of created beings, only to be herded together "with four-footed beasts and creeping things," over which man had formerly had dominion. Darwinism, complained

one unhappy critic, "tears the crown from our heads; it treats us as bastards and not sons, and reveals the degrading fact that man in his best estate—even Mr. Darwin—is but a civilized, dressed up, educated monkey, who has lost his tail."[41] For those who believed they had been created in the image of God himself, the demotion was indeed humiliating. The descendants of baboons are certainly not entitled to pride, wrote Adolphus Smith, an Adventist layman from Grand Rapids, Michigan.[42]

Though Adventists seldom took the scientific basis of evolution very seriously, they always welcomed the opportunity to point out its supposed shortcomings in this area. After all, Darwinism, like geology, had to be exposed as "science falsely so-called." The objections raised by P. R. Russel, whose writings were reprinted in the *Review and Herald*, are representative. He maintained that the present existence of lower forms of life was "fatal to the whole theory," because if evolution had been occurring for millions of years, all life would inevitably "climb the ladder of progress and pass into men," leaving nothing but humanity on the face of the earth. Somewhat inconsistently, he also regarded the absence of intermediate links as a weakness of Darwinism. If the theory is true, he argued, "monkeys are naturally, gradually, and surely passing into men," and the transitional forms should be seen everywhere.[43]

The Flood as Solution

Those who rejected the evolutionary history of life necessarily had to provide an alternative explanation of the fossil record, and Adventists invariably turned to the Noachian flood for virtually all solutions to their geological and paleontological problems. Encouragement to do this came from Ellen White, who wrote that if individuals would only recognize "the size of men, animals and trees before the flood, and . . . the great changes which then took place in the earth," they would have no trouble accepting the "view that creation week was only seven literal days, and that the world is now only about six thousand years old." She believed that the recent findings of earth scientists were providential, designed by God to "establish the faith of men in inspired history."[44] Following her lead, the editors of the *Review and Herald* widely publicized any new discoveries that might conceivably corroborate the occurrence of the flood. When J. N. Loughborough ran across a book that "successfully [met] the objections which are raised in regard to the flood," he had excerpts of it reprinted, together with the admonition to "preserve this article, for reference in case of an attack on this point."[45] Occasionally a writer was hopeful enough to suggest the likelihood of scientific confirmation of the flood and thus of the Biblical story of creation. "A little further progress in [geology]," wrote one optimist, "will probably show that its teachings wonderfully harmonize with the scriptural statements on the same subject."[46] Unfortunately, in this, as in their expectation of the Second Coming, the Adventists faced continued disappointment.

Summary

This brief look at the Adventist response to developmental theories reveals the extent to which the debate over evolution spread in nineteenth-century American society. It suggests that many uneducated Christians, sometimes ill-informed and not always very visible, were indeed aware of the challenges presented by evolutionary ideas to their traditional beliefs. Not surprisingly, these people reacted in much the same way as the fundamentalists of the early twentieth century.[47] While the nation's more learned religious communities were attempting to reconcile organic evolution with the doctrines of natural theology, the less sophisticated were fighting to preserve the authenticity and literality of the Mosaic record and agonizing over the prospect of kinship with the apes. They, like the later fundamentalists, turned their backs on worldly knowledge to defend divine revelation against the encroachments of science and to protect their children from its insidious influence. Clearly, the fundamentalist controversy of the 1920s was not, as one historian has recently claimed, "merely a continuance of the conflict first precipitated within theological circles after the appearance of Darwin's theory in the last half of the nineteenth century."[48] It was rather a natural outgrowth of the much different debate begun in the nineteenth century by Adventists and other fundamentalist foes of "science falsely so-called."

I wish to thank Mr. Tom Gammon for his assistance in the preparation of this study.

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[3]The Seventh-day Adventist teacher George McCready Price was "the one scientific authority most frequently cited by antievolutionists," and other Adventist leaders, notably Francis D. Nichol and Alonzo L. Baker, participated in public debates; Willard B. Gatewood, Jr. (ed.), *Controversy in the Twenties: Fundamentalism, Modernism, and Evolution* (Nashville: Vanderbilt University Press, 1969), pp. 141, 263. It should be noted, however, that on nonscientific issues other fundamentalists sometimes shied away from the Millerite Adventists; see Ernest R. Sandeen, *The Roots of Fundamentalism: British and American Millenarianism* 1800-1930 (Chicago: University of Chicago Press, 1970), p. 150.

[4]Don F. Neufeld (ed.), *Seventh-day Adventist Encyclopedia* ("Commentary Reference Series," Vol. X; Washington: Review and Herald Publishing Association, 1966), pp. 929-41, 1180-82.

[5]A study of biographical sketches in the *SDA Encyclopedia* of 315 prominent Adventists born between 1790 and 1870 yields the following data:

	Ministers	Educators	Physicians	Others
	(203)	(30)	(23)	(59)
Attended no college	68.5%	26.7%	----	72.9%
Attended SDA college	27.1%	36.7%	4.3%	20.3%
Attended non-SDA college	4.4%	36.7%	95.6%	6.8%

If the *leading* Adventists had so little education, we can safely assume that the vast majority of the rank and file had no college experience whatever. And whether or not the nineteenth-century "proto-Fundamentalists were frequently men in high esteem in their own denominations and communities," as Ernest R. Sandeen claims ["Toward a Historical Interpretation of the Origins of Fundamentalism," *Church History*, XXXVI (March, 1967), 83], they certainly do not appear to have been well educated.

[6]Ellen G. White, "Science and Revelation," *The Signs of the Times*, X (March 13, 1884), 161; *Spiritual Gifts: Important Facts of Faith, in Connection with the History of Holy Men of Old* (Battle Creek, Mich.; Seventh-day Adventist Publishing Association, 1864), p. 93.

[7]"Science and the Bible," *Advent Review and Sabbath Herald*, XIV (February 24, 1859), 107. This statement is attributed to a Dr. Cumming, probably Dr. John Cumming, the Scottish divine known for his studies of Biblical prophecies. Hereafter the *Advent Review and Sabbath Herald*, better known as the *Review and Herald*, will be cited as *R&H*.

[8]J.N. Loughborough. "Guidance of Nature," *R&H*, XVIII (November 5, 1861), 177.

[9]J. H. Kellogg, *Harmony of Science and the Bible on the Nature of the Soul and the Doctrine of the Resurrection* (Battle Creek, Mich.: Review and Herald Publishing Association, 1879), pp. 10-11, 28-29. Later Kellogg seems to have become a theistic evolutionist. See Richard W. Schwarz, *John Harvey Kellogg, M.D.* (Nashville: Southern Publishing Association, 1970), p. 190.

[10]See Schwartz *John Harvey Kellogg, M.D.*, pp. 174-92.

[11]A. T. Jones, "The Uncertainty of Geological Science," *R&H*, LX (August 21, 1883), 530.

[12]"Geology and the Bible," *R&H*, XXVI (October 17, 1865), 157.

[13][Uriah Smith], "False Theories of Geologists," *R&H*. LIX (September 5, 1882), 568. Smith had attended Phillips Exeter Academy for several years, but financial considerations had prevented him from going on to college.

[14][Uriah Smith], "Geology," *R&H*, XIII (December 16, 1858), 28.

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[18]"Geological Chronology," *R&H*, XXXV (February 8, 1870), 51. Reprinted, with an introduction, from an article by Patterson in the *Family Treasury*.

[19]"That Old Skull," *R&H*, XXXVI (October 25, 1870), 146. Reprinted from a work by Tuttle.

[20]"A Specimen of Knowledge," *R&H*, LIII (May 15, 1879), 156.

[21]A. T. Jones, "The Uncertainty of Geological Science," *R&H*, LX (August 7, 1883), 497-98; (August 14, 1883), 513-14; (August 21, 1883), 529-30. The following year Jones published another series on "'Evolution' and Evolution," *R&H*, LXI (March 11, 1884), 162-63; (March 18, 1884), 178-79; (March 25, 1884), 194-95.

[22]Jones, "The Uncertainty of Geological Science," pp. 513, 530.

[23]J. O. Corliss, "Geologists vs. the Mosaic Record," *R&H*, LV (February 19, 1880), 116-17; Ellen G. White, "Science and the Bible in Education," *The Signs of the Times*, X (March 20, 1884), 177; Stephen Pierce, "Does the Bible Agree with Science?" *R&H*, XXXVIII (October 3, 1871), 121; and Jones, "'Evolution' and Evolution," p. 195.

[24][D. N. Lord], "The Structure of the Earth," *R&H*, LV (February 12, 1880), 99. Lord was an evangelical editor, known for his writings on science and religion and on the fulfillment of Biblical prophecies.

Those who rejected the evolutionary history of life necessarily had to provide an alternative explanation of the fossil record, and Adventists invariably turned to the Noachian flood for virtually all solutions to their geological and paleontological problems.

[25]R. F. Cottrell, "The Antiquity of Man," *R&H*, XLV (January 21, 1875), 29. See also Jones, "The Uncertainty of Geological Science," p. 530.

[26]"Turning the Tables," *R&H*, XXXIX (April 9, 1872), 130. This article was taken from an address by the Rev. John Hall, a Presbyterian minister and writer.

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[30]*Ibid.*, p. 91. E. J. Waggoner, an Adventist physician and minister, repeats Mrs. White's views in *The Literal Week* ("Apples of Gold Library," No. 18; Oakland, Calif.: Pacific Press Publishing Co., 1894), p. 2.

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[45]J. N. Loughborough, "Scripture Account of the Flood, Vindicated," *R&H*, XVIII (October 29, 1861), 173. The recommended work was the first volume of Horne's *Introduction to the Study of the Bible*.

[46][Plumer], "Geology," p. 49.

[47]For a survey of fundamentalist attitudes toward evolution, see the "Introduction" to Gatewood, *Controversy in the Twenties*, pp. 3-46.

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A Revolution in Ancient Radiocarbon Chronology

RONALD D. LONG

325 East "B" Street
Colton, California 92324

Disregard for the divine inspiration of the Bible and its historical accuracy has resulted in error. Dangers in the indiscriminate use of radiocarbon determinations have been overlooked, and this has led to serious and premature alterations in the prehistoric chronology of Southeast Asia and Europe. Without proper consideration of the geophysical evidence, and lingering problems in the carbon 14 dating technique, theories are being formulated which completely change and distort the prehistory of these two areas. Within the historical framework of Genesis, however, we can view the early beginnings of world civilization in a valid context.

Introduction

Two areas on opposite ends of the Eurasian continental landmass, Southeast Asia and Western Europe, are presently the scenes of revolutions in the interpretations of their prehistory and chronology. Carbon 14 dating was the catalyst which precipitated the revolutions. Those who adhere to the radiocarbon data recently published for the two regions claim that the prehistoric chronology must be transported back to earlier periods. The implications of this theory are that:

1. Pottery, agriculture, and bronze were developed in Southeast Asia (in particular, Thailand) centuries before their appearance in other parts of Asia.
2. Metallurgy, and architectural and artistic innovations were utilized in Europe (especially Western Europe, and the Balkans) centuries prior to their development in the Aegean and eastern Mediterranean empires.

The vital question remains, however, as to whether the carbon 14 method of dating is reliable to a sufficient degree at this time to cause major modifications in history. More importantly, the origins and early progress of man's sojourn on this planet are already summarized in Scripture. Carbon 14 theories do not agree with the Bible.

New Ideas

Needless to say, both of these theories clash with the traditional and previously accepted explanations for the prehistoric picture in Asia and Europe. Indus civilization centering in Mohenjo-daro and Harappa and the Chinese Neolithic of the Lung-shan, and Yang-shao cultures have been, until recently challenged, the most ancient, undisputed purveyors of agriculture and pottery in Asia. The majority of scholars date the initial utilization of bronze in India about 2300 B.C., and in China about 1500 B.C. A few in the field of Southeast Asian archaeology question these widely accepted opinions.

Southeast Asia

We shall examine the theory behind the Oriental revolution first. In 1969, Dr. Chester Gorman announced that domestication of plants occurred in northeastern Thailand approximately 9000 years ago.[1] This figure is derived from radiocarbon determinations of samples from an ancient limestone shelter in Thailand known as Spirit Cave. Seeds of beans, cucumbers, Chinese water-chestnuts, and peas have been found in Spirit Cave in a context which proves that they were used in agriculture. On the basis of this evidence the claim is being made that the Thais were the first farmers in Asia and perhaps in the world.

Domestication of plants, and also the use of pottery in the Hoabinhian Mesolithic has been reassigned a date as early as 9000 B.C. The ramifications of this theory, according to Dr. Wilhelm Solheim, Department of Anthropology at the University of Hawaii, is that

the southeast Asian Hoabinhian Mesolithic was the source of the Chinese Neolithic cultures of the Lung-shan and Yang-shao.[2] From Thailand the Hoabinhian culture advances were transmitted to the south of China where the Lung-shan developed further and spread north.

Solheim now believes that bronze was being molded in northeastern Thailand approximately two centuries before it was used in the Indus river-valley cultures of Harappa and Mohenjo-daro, and almost a thousand years before bronze appeared in Shang Dynasty China.

In 1963 exploration in Thailand was initiated by the University of Hawaii. Excavations began at Non Nok Tha, Thailand towards the end of 1965. Twenty layers of Early Bronze Age material were uncovered. Layer 19, in which bronze implements were discovered, was dated by radiocarbon analysis. Two dates were chosen as the most representative of the site: 4275±200 B.P. (TF 651), and 4120±90 B.P. (GaK 956). Both samples related an age in the late third millennium B.C.

On the basis of these two dates, the Dongson culture (originating in North Viet Nam) can no longer be considered the earliest Bronze Age assemblage in this sector of the Orient. Dongsonian Bronze Age has been described as the early bronze age which began *circa* 500 B.C. Solheim's discoveries, however, demonstrate the utilization of bronze in Thailand around 2500 B.C.—if the C-14 data is valid. This predates the bronze age in China beginning with the Shang Dynasty (1500 B.C.) and the bronze age in India during the period of the Harappian cultures commencing *circa* 2300 B.C.

Dr. Solheim's theory certainly disagrees with the accepted explanation for the prehistory of Southeast Asia. Grahame Clark expressed the traditional view in the following statements:

> Claims that it [Southeast Asia] was in itself the cradle of an early civilization based on the cultivation of rice are not substantiated by the archeological evidence. . . .[3]
>
> So far from south-east Asia being an early focus of settled life, the indications are that Neolithic culture arrived there somewhat belatedly.[4]

The vital question remains whether the carbon 14 method of dating is reliable to a sufficient degree at this time to cause major modifications in history. These theories do not agree with the Bible.

Does C-14 dating now nullify Clark's interpretation? Should the origins of Asian civilization be revised? Perhaps an investigation of the evidence will answer these questions.

Radiocarbon Evidence

Of the ten C-14 dates from Non Nok Tha, Solheim reported that three were ". . . obviously not the correct dates for the layers from which their samples were collected."[5] This again brings us to a quite painful realization. Archaeologists and anthropologists possess the prerogative, however dishonest, to declare an already preconceived chronology for an area as established. Then, when specimens dated by C-14 do not fall in the range of the presumed limits, those determinations are discarded as irrelevant—when perhaps these may be the correct figures for the true age.

There are additional criticisms of the data which were arbitrarily chosen. One of the samples (GaK 1030) was from Layer 18. Laboratory investigation related a radiocarbon age that was modern. This happens occasionally, and is not a cause for undue alarm. In this situation, however, where we are working with so few specimens a modern date should make us cautious concerning the other data. Serious evaluation should precede radical departures from a prehistory already established through archaeology.

PROBLEMS OF RADIOCARBON DATING AND OF CULTURAL DIFFUSION IN PRE-HISTORY

Ronald D. Long's article, "A Revolution in Ancient Radiocarbon Chronology," presents some information which is both fascinating and important for our understanding of prehistoric chronolgy. The author is to be commended for his clear presentation of developments, which have hitherto been presented only in technical journals or but cursorily reported in the secular press.[1]

On the other hand, Long labors under certain presuppositions which seem to color his perception of scientific developments and which apparently threaten what he understands to be the biblical teaching with regard to the origin and the diffusion of agriculture and metallurgical technology.

Radiocarbon Dating

It is quite unjust to charge scholars with "the indiscriminate use of radiocarbon determinations," since scholars who use these data are well aware of the problems of measurement, contamination, etc.[2] To

Long labors under certain presuppositions which seem to color his perception of scientific developments and which apparently threaten what he understands to be the biblical teaching with regard to the origin and the diffusion of agriculture and metallurgical technology.

There are unanswered questions regarding dendrochronology itself. This is quite important because without dendrochronology there is no calibration.

Two of three specimens from Layer 9 were over 2000 years old: 2200±110 B.P. (GaK 958), and 2480±80 B.P. (GaK 1027). These figures had to be discarded because the sample was a timber which must have come from another house. Solheim feels that the Layer 21 result of 1860±140 B.P. (GaK 959) is unlikely. Obviously, Layer 21 should be older than Layers 19, and 20. Yet, the radiocarbon date for Layer 21 is the first century A.D.! Solheim commented, "Finally, it does not fit with the other dates."[6] It most assuredly does not fit. In other words, this situation is similar to that described by the eminent Egyptologist, Säve Söderbergh, at the Twelfth Nobel Symposium on radiocarbon variations and absolute chronology: "If a C-14 date supports our theories, we put it in the main text. If it does not entirely contradict them, we put it in a foot-note. And if it is completely 'out of date', we just drop it."[7]

Two results for Layer 9 were discarded in favor of a single date 710±90 B.P. or 1220±90 A.D. (GaK 908). This latter date coordinates with the theory, and that is why it is used. Is there any valid reason for dismissing the other two dates? Without many samples, sealed to specific strata, free from contamination, and dated by several laboratories, it is impossible to determine. Layer 20 revealed a date of 1315±200 B.C. (GaK 17/18). Yet, two other laboratories reached different results for the later and, therefore, younger in age Layer 19: 2290±90 B.C. (Y 1851), and 2325±200 B.C. (TF 651). In fact, not only can this not be reconciled, but how are the other two dates (for Layer 19 & 20) to be explained: 4120±90 B.P. (GaK 956), and 1860±140 B.P. (GaK 959)? By the Law of Supposition older layers should be older in age, i.e. Layer 21, 20, and 19 —oldest to youngest. This is not the case; therefore, certain data are used only for publication if it confirms the author's hypothesis. There is no support for even suggesting that Southeast Asians had agriculture, pottery, and bronze before the great civilizations of China and India. The Biblical, and historical records prove that agriculture and other aspects of civilzation originated in the Near East, not Far East. In fact, the bibliography for the origin of civilization in the Near East is so great that we will pass on to a few Bible proofs and historical proofs from the history of Indo-china itelf.

The Biblical Framework

Our Bibles do not reveal detailed information about the pre-Flood world or the immediate post-Flood beginnings of ancient civilization. Rather God has provided an outline of major occurrences: Creation of man, an antediluvian society which was in general a depraved era, the Noachian deluge, post-Flood political-social-economic development, the Tower of Babel, and dispersion of mankind over the surface of the earth. In Genesis, Moses defined the area of the Garden of Eden in 15th century B.C. terminology. Exact geographical coordinates for the Garden are not given; however, it was certainly in the Near East. Later, Noah's Ark rested on the mountainous plateau of Armenia. Thus, human activity began in this centrally oriented location, and man spread out in all directions from Ararat. It should not surprise us, therefore, that peoples in as diverse places as Polynesia, Africa, Mesoamerica, and Southeast Asia have oral and written traditions regarding Creation, the Flood, and Babel. In fact, the historical reality of the Flood was known to the ancient inhabitants of Indo-china.[8]

Eight human beings stepped out of the Ark on to a planet devoid of others of their kind. They multiplied, and migrated from the region of Armenia to the Mesopotamian plain.[9] Apart from Noah and a few other righteous men, their designs were again contrary to

charge that "Archaeologists, and anthropologists possess the prerogative, however dishonest, to declare an already preconceived chronology for an area as established," is an unwarranted *ad hominem* attack. If anthropologists such as Solheim wished to buttress their theories dishonestly, they could do this by simply omitting any mention of discordant C-14 readings. Discordant readings are to be expected because of the very nature of radiocarbon dating and its limitations. This does not invalidate the use of such datings as long as these limitations are recognized.

Long's citation of a remark by the Egyptologist, T. Säve-Söderbergh, might lead readers to believe that scholars simply use radiocarbon dates only when these dates suit their preconceived theories. To be sure, this danger exists and some scholars may misuse radiocarbon readings.

Nonetheless, there is an impressive correlation of radiocarbon dates with the absolute chronology of the Egyptians, which was meticulously maintained.[3] It should be noted that there is an apparent discrepancy between the Egyptian data and radiocarbon readings as one goes back in time before 2000 B.C. Whereas Egyptian records date the beginning of the 1st Dynasty *c.* 3100 B.C.; radiocarbon dates for this dynasty are some four to five hundred years younger.[4] These discrepancies, however, are explicable and can be corrected.

As Long himself explains, these variations can be correlated with changes in the earth's magnetic moment.[5] On the basis of the new information from dendrochronology, i.e., the analysis of bristlecone pine tree-rings, it is possible to establish correction factors which succeed in achieving an excellent correlation of radiocarbon dates and Egyptian data.[6] Renfrew himself points out that the new developments do *not* change the dates for Egypt: ". . . the calibrated carbon-14 dates for Egypt agree far better with the historical chronology than the uncalibrated ones did."[7]

Dendrochronology

Noting that more than 100 rings may exist within an inch of the *Pinus aristata*, the long-lived bristlecone pine, Long wonders "how very much accuracy is obtainable." He further remarks, "By some magical process, known only to a few, dendrochronologists claim to be able to join tree-rings from different trees for a stage chronology of growth in time." His main con-

the plan of God. In rebellion they constructed a tower as a symbol of human unity against the Creator. Under the guise of protection against another catastrophe by water, Nimrod organized his blind followers into a religio-political community of diabolical conception. God knew that these creatures speaking one language and determined to follow a lifestyle in opposition to peace and happiness, had to be separated before miscegenation and their inventions of destruction resulted in the same pattern of the pre-Flood period. Therefore, the Eternal performed a miracle which resulted in an ethno-linguistic division of mankind. As groups of the same color, and language gathered together, they gradually migrated out of the land between the rivers. Post-Deluge civilization began in Babylonia—not in Thailand. The roots of all mankind reach back to the ancient Near East.

Southeast Asians, including the Thais, can tell the story of Babel because their ancestors were part of Nimrod's system. One interesting "legend" comes from the Chin of the Tibeto-Burmese tribes in Indo-china.[10] They tell of a time when humanity lived in one large village and spoke one language. One day the Chin noticed how the phases of the Moon changed. This natural phenomenon caused so much consternation that it was decided the people would build a tower which would reach into the heavens. Their purpose was to capture the Moon.

In time the tower reached such a height that the masons and carpenters were unable to descend for food on a daily basis. To solve this problem the Chin permanently settled workers at various stages in the tower so that others could bring food to those doing the actual building. In time the group of laborers stationed in a particular level adopted their own language and customs. Meanwhile, the spirit of the Moon was so filled with anger that it unleased a series of violent storms which caused the tower to fall back to the earth. As the tower fell, peoples were distributed in many localities depending on the height of the level they were constructing. Mankind was dispersed, and hence the origin of civilization over the earth.

A variation of the Chin story is narrated by Tawyan, also of Southeast Asia. In this case the natives tried to capture the sun, but their ladder collapsed, and as they fell so man was scattered. Indo-chinese tribes, therefore, have the story of Babel because this was part of their history. They are an offshoot of civilization in the West—not the originators, but recipients of agriculture.

Claims that these traditions are the outcome of recent missionary efforts are lame excuses of disbelief in a proof of the Bible. The burden of proving such allegations rests with the accuser. Scripture clearly denotes the first agriculture and the domestication of animals—the wherewithal of civilization—in the Near East. Agriculture is as antique as Cain, and domestication as old as Abel. A few questionable carbon 14 dates do not overthrow the Word of God. Indeed, history and Scripture are in agreement against this hypothesis.

Historical Facts

Southeast Asians did not evolve in the Orient and create agriculture independently. We will cite a few examples where the origin of peoples are known. History shows that the Arakan of Burma lived in Mesopotamia until a few years after the confusion of tongues.[11] Arakanese records tell of a movement into the Ganges Valley before they were driven by Aryan invaders out of India into coastal Burma. "Sand-ra" an Indian suffix was attached to the names of the rulers of the Arakan until they left India. According to Phayre:

> At first sight it appears improbable that any of the royal Kshatriya tribes of northern India should, at the early period indicated, have left their homes and penetrated through the wild country of Eastern Bengal to the Upper Irawadi. This, however, is what the Burmese chronicles, repeating an ancient tradition, assert. . . .[12]

Today living in Laos and Thailand are a scattered group of people known as the Miao-Yaou. Their origins

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tention is that the Suess calibration curve derived from the California trees has no validity for European dates inasmuch as trees of similar longevity have not been discovered in Europe.

Dendrochronology is not a magical, arcane discipline. Magnification of the tree rings is a very simple matter. Nor is the correlation of patterns of signatures, i.e., sequential arrangements of wide and narrow rings forming recognizable patterns, from different trees to obtain a series of overlapping plottings a mysterious process.[8]

As to the validity of the Suess calibration for Europe, Renfrew maintains:

> Tests of nuclear weapons have shown that atmospheric mixing is rapid and that irregularities in composition are smoothed out after a few years. The California calibration should therefore hold for Europe. There is no need to assume that tree growth or tree rings are similar on the two continents, only that the atmospheric level of carbon 14 is the same at a given time.[9]

Support for the validity of the changes in the carbon 14 inventory as set forth by the dendrochronological data from bristlecone pines comes from correlations with varve chronologies, with deep ice cores, and with other methods of dating.[10]

The Diffusion of Agriculture

As Long notes, the earliest center for the development of the so-called Neolithic revolution—the transition from hunting and gathering to the domestication of plants and animals—seems to have been in the Near East. The earliest Neolithic site seems to be Jericho just north of the Dead Sea, a site dated to 7000 B.C.[11] Neolithic stages of development at a slightly later date are in evidence at Jarmo on the hilly flanks of the Fertile Crescent[12], and in south central Anatolia.[13] About 6000 B.C. the Neolithic revolution reached Europe.[14] The spread of agriculture from the Near Eastern center may be traced through the expanding distribution of einkorn and emmer wheat and of barley.[15]

These facts are beyond dispute. Long, however, labors under the assumption that the development of agriculture and the domestication of animals occurred

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Dendrochronology is not a magical, arcane discipline.

Theories proposing views contrary to the Word of God can always be examined and found to be false and without support in fact.

can be traced back to the banks of the Yangtze river in China. In early times they were in the provinces of Hupeh and Hunan. According to the *Shoo King*, Mencius, Chuang-tzu, and Han-fei-tzu, the Miao revolted during the reign of Yaou (the name of one of the first emperiors, and not to be confused with the name of the broad category of Miao-Yaou).[13] The revolt can be dated to a few years before the Hsia Dynasty which began in 2205 B.C. or within a few decades after the Towel of Babel. Thus, the Miao, another Indo-chinese people, lived in the shadow of Chinese civilization.

Tai-Kadai is the major ethno-linguistic division of Southeast Asians living in Thailand and some adjacent provinces. Within the Tai-Kadai group is the Lao or Ai-Lao who, within ancient times, lived between the Hwang-ho and Yangtze rivers. Military campaigns initiated by the Chinese drove the Lao south during the Han Dynasty (parallels the period of the Roman Empire). Emperor Chin Shih Huang-ti (*circa* 215 B.C.) was in large part responsible for forcing the Lao south. Here again is proof that Southeast Asians are late-comers just as Grahame Clark described.

O. Janse, a noted expert in the field, has outlined the cultural diffusion which took place from west to east—rather than the reverse.[14] Prince Dhaninivat traced the Thais from Lake Tali in Yunnan province China in their trek southward.[15] The Thais were the recipients of culture, and not the originators as Solheim and company would like to believe. In short, the radiocarbon evidence offered as support for the theory is quite weak. The Biblical and historical records negate all attempts to make Indo-chinese history appear too early or more advanced than it actually was.

Prehistoric Europe

Since the time of V. Gordon Childe, European prehistorian, it has been known that artistic, and technological advances in European antiquity were due to cultural diffusion from the more "civilized" peoples of Egypt, Greece, Asia Minor, and Babylonia. Current interpretations have primitive and rather sluggish Europeans receiving inventions and other products of civilization only through the transmission of these from the Mediterranean empires of the ancient Near East. An alternative interpretation has been offered based on carbon 14 dating. According to this view, Europe progressed technologically before the Egyptians, Mesopotamians, and Greeks.

Dr. Colin Renfrew, a noted archaeologist, would now have us believe that Europe was the source of metallurgical technology, and many artistic and architectural developments previously explained as originating in the ancient Near East. Renfrew's challenge to traditional explanations is based upon "corrected" C-14 dates, i.e. "corrected" by use of the Suess calibration curve. The calibration curve is derived from radiocarbon dating dendrochronologically dated tree-rings of bristlecone pine (*Pinus aristata*). Plotting carbon 14 data on the curve throws the dates back centuries so that they appear much older. For example, 2350 B.C. is a determination for a specimen from Los Millares in Spain. After calibration this date would be 2900 B.C.

All European C-14 dates from antiquity, Renfrew asserts, can be calibrated with this curve based on a pine tree which grows in the White Mountains of California. "This revelation has destroyed the intricate system of interlocking chronologies that provided the foundation for a major edifice of archaeological scholarship: the theory of cultural diffusion."[16] We will see, however, that Renfrew's hypothesis, his attack on European prehistory, and disbelief in cultural diffusion are all based on a fallacious understanding of radiocarbon dating, and premature conclusions regarding the Suess calibration curve. The curve cannot be used for European material.

One ramification of Renfrew's theory is that copper metallurgy in Europe began an entire millennium be-

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only in one area. The basis for this assumption is Long's interpretation of the early chapters of Genesis which provide him with definitive information on "the origins and early progress of man's sojourn on this planet."

With these presuppositions in mind, Long is anxious to contest Gorman's claim that evidence from the Spirit Cave in Thailand also reveals the domestication of plants there *c.* 7000 B.C. He further seeks to prove that the Arakan of Burma were driven out of India into coastal Burma and that the Miao-Yaou came into Laos and Thailand to a few years before 2205 B.C., which Long would date to a few decades after the dispersion of the Tower of Babel.

But neither Gorman or Solheim make any claim that Neolithic techniques were diffused from Thailand throughout the world; they simply claim that the Neolithic revolution occurred very early in Thailand and then influenced developments in China. After all, the plants which were domesticated in Thailand were peas, beans, cucumbers and Chinese water chestnuts! The plants which were domesticated in the Near East were primarily wheat and barley.

Long does not deal with the issue of the development of agriculture in Mesoamerica, where the plants which were domesticated were pumpkins, peppers, and beans.[16] It is true that the domestication of plants in Mexico occurred at a relatively later date and played a very minor role for a long time. By 5000 B.C. only 10% of the diet came from domesticated plants.[17] Nonetheless the Neolithic revolution in America seems to have developed quite independently of Old World influence. Given the fact that men in many areas had been gathering domesticable plants and hunting domesticable animals for millennia, it should not be surprising at all to discover that the domestication of plants and animals was developed independently in several regions.

The author's attempts to demonstrate that various peoples migrated to Southeast Asia at a relatively late date after the dispersal of mankind dated by him to the end of the 3rd millennium B.C., are misguided. When Long lauds Herman Hoeh's *Compendium of World History*, published by Ambassador College Press,[18] as "the most outstanding world prehistory outline," we are not inspired with confidence in his historiographical competence.

fore Aegean prototypes. Neolithic Vinca culture found in the Balkans, when calibrated relates a date of 4000 B.C. Of course, the radiocarbon figures for the Vinca culture without calibration substantiate the accepted explanation for cultural diffusion from the ancient eastern Mediterranean civilizations to Europe. With the bristlecone pine calibration applied to European antiquity, however, the Neolithic metallurgy of the Vinca culture is older than the metal technology of the ancient eastern kingdoms.

Scholars have described the influence of Mycenaean or Aegean design and artistic motifs on the construction of Stonehenge. With calibration, however, the construction of Stonehenge is pushed back to make it appear to be older than 1500 B.C. This would mean that Stonehenge is no longer contemporary with the Mycenaean period, but earlier than Aegean prototypes. Thus, cultural diffusion from Mycenae, Argos, Pylos, *et al.*, to the Salisbury Plain in England is, according to Renfrew, no longer tenable. Similarly, cultural diffusion which brought corbelled tombs to Brittany from Spain and France is denied. For many years it has been believed that the corbelled tomb reached Brittany from Spain and France after 2500 B.C. By using the artificially inflated Suess calibration curve for chronology, tombs in Brittany date earlier than 3000 B.C.

Calibration

Renfrew's theory and conclusions are built upon the assumption, or "revelation" as he calls it, that the Suess calibration curve for C-14 dates applies to European prehistoric radiocarbon data. To understand this theory based on sand, we must rehearse the development of the techniques during recent years. One of the foundational points of radiocarbon dating, as developed by Libby, was that the concentration of available radioactive carbon 14 in the atmosphere is constant in time for all locations on the earth. Then, in 1958, de Vries found that there were variations in the concentration of C-14 with relation to time.[17] This fact was discovered when de Vries radiocarbon dated tree-rings of established age from some eighteenth century A.D. forest timbers. Tree-rings were counted, and assigned their calendar age. When analyzed for C-14 content, however, the C-14 age was different from the true age or calendar age of the tree-rings. Investigation continued under Willis, Tauber, and Münnich on California *Sequoia gigantea* with similar results. In 1966, Stuiver, and Suess stated that the large variations in the production of C-14 by cosmic rays was due to modulation of the galactic cosmic ray flux.[18] This established that the intensity of cosmic radiation in time changed—another blow to a basic premise of the technique.

During the 1960's radiocarbon chronologists could not understand the reason for the 500 and 600 year discrepancies between their C-14 dates, and the so-called "astronomically established" chronology of the ancient Egyptian Old Kingdom. In 1970, Prof. Libby stated: "The long experience with radiocarbon dating has taught me . . . on absolute dates it can be incorrect by as much as 600 or 700 years at the peak of the deviation some 7000 years ago."[19] Geophysicists came to recognize the situation. There were variations in the amount of C-14 in the atmosphere in time. Cosmic radiation changed in time and therefore modified the production of C-14 in the atmosphere. Ancient Egyptian samples dated by C-14 disagreed with Egyptian history because of these new factors—or so it was postulated.

Magnetic Field

Why did the quantity of radioactive carbon 14 oscillate in time? Prof. Libby answers: "The speculation at the moment is that the main deviation is due to a weakening of the Earth's magnetic field. . . ."[20] As the earth's magnetic dipole moment shifts, so does the amount of cosmic rays allowed to enter the atmosphere to produce C-14. Thus, the static composition of the atmosphere, the constant intensity of cosmic rays, and the stability of the earth's magnetic field—all initial assumptions of carbon 14 dating—are all

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It should hardly be necessary to point out that Long's demonstration that various groups migrated into Southeast Asia from China and elsewhere does not disprove the existence of earlier indigenous populations.

The Diffusion of Metallurgy

As in the case of the development of agriculture, Long wishes to trace all examples of early metallurgy to a single point of origin. He therefore takes issue with Renfrew's new thesis in regard to the development of metallurgy in Europe.

We again discover that what Renfrew proposes and what Long suspects are quite distinct "animals." The former believes in multiple origins, and the latter is committed to diffusion from a single origin as an explanation for parallel phenomena. When Renfrew now asserts the priority of megalithic structures in western Europe and metallurgy in the Balkans he is denying the older theories of diffusion from the Near East in the first case and from the Aegean in the second case. As he makes quite clear, he is not claiming that Europe provided the prototypes for developments in the Near East:

> Nor is there any case for turning the tables on the old diffusionists by suggesting that the early monuments and innovations in Europe inspired the pyramids of Egypt or other achievements in the Near East. That would merely be to reverse the arrows on the diffusionist map, and to miss the real lesson of the new dating.[19]

In actuality, the only point which Renfrew makes in regard to metallurgy is that it is now attested in the Balkans at an earlier date than in the Aegean area; Balkan metallurgy therefore cannot be derived from Greece as formerly maintained. Renfrew does not exclude the possibility of an ultimate derivation from the Near East: 'The possibility remains, however, that

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Long's desire to defend the scriptural account against scientific interpretations which threaten to impugn the Bible is understandable, and from a Christian point of view commendable. But his tactics in achieving this end are short-sighted and self-defeating.

now known to be wrong.

Prof. Bucha of Czechoslovakia, one of the foremost experts on magnetism, has commented that: ". . . The earth's magnetic field has shown significant changes not only during the last centuries . . . but also in the prehistorical and geological past including reversals of geomagnetic polarity."[21] Fluctuations in C-14 production rate correlate inversely with changes in the earth's magnetic moment. Decrease in the magnetic moment means an increase of cosmic ray flux and therefore an increase in production of C-14. Bucha made the following important observation:

> Archaeomagnetic investigations based on the measurement of remanent magnetization in baked archaeological objects and rocks show considerable changes in the Earth's magnetic field in the historical past. The curve characterizing the Earth's intensity during the past 8500 years has its maximum around 400 to 100 B.C. when the field reaches 1.6 times its present intensity.[22]

Knowing these facts meant major adjustments in understanding the value of the carbon 14 method of dating.

Bristlecone Pine

A means had to be found by which the geophysicist could know the relative amount of C-14 in the atmosphere for any given year in historical time. That is, they had to find the relationships between true or calendar age, and C-14 age for the past. Dated tree-rings had led to the first discovery of variation in carbon 14 in the atmosphere. A tree growing in antiquity with an age several thousand years old would enable researchers to ascertain the needed relationships. Thus, tree-rings provided the answer again. The radiocarbon dating of dendrochronologically dated tree-rings of bristlecone pine (*Pinus aristata*), from the White Mountains of California, produced a curve which demonstrated the relationships between true/calendar age, and C-14 age. C. W. Ferguson, of the Arizona Tree-Ring Research Laboratory, selected and counted the rings. Hans Suess, radiocarbon chronologist at the University of California, La Jolla, dated the rings. The work at La Jolla resulted in a Suess calibration curve for radiocarbon data. Thus, Renfrew felt that, "Remote as it may seem from European archaeology, it was the venerable pine trees in the White Mountains of California that brought about the revolution of Old World prehistory."[23] The vital question remains as to whether a calibration based on a pine from high in the Sierras of the New World has any bearing on dates for the Old World with the vast differences in altitude, topography, and climate.

Problems

First, there are unanswered questions regarding dendrochronology itself. This is quite important because without dendrochronology there is no calibration. Living and dead tree-rings were dated to create the calibration curve. When more than 100 rings exist per inch in *Pinus aristata*, it is difficult to perceive how very much accuracy is obtainable piecing old and young rings together for a consecutive chronology of great duration. By some magical process, known only to a few, dendrochronologists claim to be able to join tree-rings from different trees for a stage by stage chronology of growth in time. It is this author's opinion that this science has not been sufficiently tested to be absolutely certain that this is possible. Other species should be analyzed, but the problem is that no trees have been found of the order needed.

Secondly, Lal and Suess have suggested the possibility that at high altitudes bristlecone pine has *in situ* production of radiocarbon.[24] Yet, this factor is not present in all parts of Europe in the exact same proportions as that found in *Pinus aristata*. Dr. Berger, member of the Departments of History, Anthropology.

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the art of metal-working was learned from the Near East, where it was known even earlier than in the Balkans."[20] In an earlier article Renfrew acknowledged the priority of metallurgy in Anatolia and Mesopotamia, and derived Aegean metallurgy from these areas to the east.[21]

False Options

It is apparent that Long believes that the early chapters of Genesis provide us with a universal history which explains the ultimate origins of agriculture and of metallurgy. Although he does not believe that "exact geographical coordinates" are given for Eden,[22] Mesopotamia is the center from which these arts were diffused throughout the world after the dispersion following the Tower of Babel incident.[23] His assertion that Noah, Shem, and Nimrod are attested in historical accounts is unfortunately incorrect; his equation of Shem with a Tuitsch of a 16th-century A.D. document is simply fantastic.

The author concludes: "The Bible and history stand in agreement." His desire to defend the scriptural account against scientific interpretations which threaten to impugn the Bible is understandable, and from a Christian point of view commendable. But his tactics in achieving this end are short-sighted and self-defeating.

When there is an apparent discrepancy between the Bible and scientific discoveries, it is possible to: 1) reject the Bible, as many non-Christian scientists have done; 2) restructure science, as Whitcomb and Morris have done with regard to the geological data and the Deluge. Long has chosen to impugn the integrity of scholars using radio-carbon dates and dendrochronology.

A third possibility, which does not seem to present itself to the author, is to acknowledge that our understanding of the Bible may need to be informed by scientific discoveries. Christians once thought that the Bible taught that the earth was the center of the universe. They feared that a heliocentric universe would undermine confidence in Gods Word. This fear has proven to be unfounded.

The demonstration that agriculture and metallurgy may have been independently discovered in areas outside the Near East does not threaten the accuracy of the Bible, properly understood. The Old Testament is rooted in the Near East; it does not profess to be a universal history; it does not tell us everything that happened in Asia, Africa, and the Americas.

God and His Word are infallible. The human interpreters of the Bible are not.

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[1]E.g., *Time* (Feb. 9, 1970), p. 66; (Nov. 29, 1971), p. 64.

and the Institute of Geophysics and Planetary Physics at UCLA, has noted the danger of internal sapwood contamination which would affect dating. Therefore, what proof is there that bristlecone pine calibration can be applied to Europe? The answer is, none whatsoever.

A real problem indeed arose when tree-rings from the southern hemisphere were C-14 dated, and compared with bristlecone pine results. The same calendar year tree-rings gave different C-14 ages. A local geographical factor entered the equation. It seemed from the facts that there were differences in the amount of C-14 in the atmosphere depending on location on the earth. Not only did the calendar and C-14 ages differ for a particular year, but the C-14 dates from the two types of trees from the two hemispheres did not agree for the same calendar year. "Unfortunately", according to Shawcross, "the New Zealand run reported by Jansen shows serious divergence not only from the calendar scale but also from the results obtained by the northern hemisphere laboratories."[25] *Pinus aristata* and *Agathis australis* (kauri of New Zealand) did not agree as to the amount of C-14 in the atmosphere for a specific year. An ancient European tree will have to be found, if that is even possible, to have a calibration curve valid for European samples. No tree has been found, and consequently there is no calibration curve for Europe.

There are factors affecting C-14 dating and calibration which have not been adequately researched. Problems still exist which defy premature calibration of dates. Jansen, for example, was of the opinion that changes in the movement of the vertical oceanic currents could lead to C-14/C-12 changes which could affect the amount of C-14 in local areas.[26] In another case, A. C. Smith has pointed out that more study must be made on low-altitude trees before the effects of altitude on C-14 concentration can be known.[27] Quite recently, Baxter and Walton, have shown the variability in atmospheric mixing—this too would affect dating geographically. During a period of solar maximum it was demonstrated that the rate of injection of stratospheric carbon 14 into the troposphere increased.[28]

Another calibration curve with its own values, could be drawn for a tree other than the bristlecone pine. Renfrew has chosen *Pinus aristata* because it is the only tree known to have been growing in ancient times. Renfrew's mistake was assuming that this curve applied to conditions all over Europe. Or, as Prof. Mackie stated: "Until we have a final and unequivocal explanation of exactly what is going on in the atmosphere and the biosphere between say 6000 and 1000 B.C., a complete and comprehensive alteration of the whole prehistoric chronological framework seems premature."[29] Geophysics has not progressed sufficiently with radiocarbon dating to arbitrarily change history. The basic facts remain unchanged—civilization began in the ancient Near East, not in Europe or Thailand. Cultural diffusion proceeded from the ancients to other parts of the world.

The Bible and History

Much knowledge has been buried, and forgotten by "enlightened", and super-critical, modern scholarship. In the Middle Ages and early centuries of the modern era, however, learned men did recognize the history of antiquity in the context of the Bible. Biblical figures such as Noah, Shem, and Nimrod were personalities found in historical accounts. Johannes Turmair, in his *Bayerische Chronik* (written in 1526), tells of Tuitsch who led many peoples into primeval Europe a few decades after the Flood. Tuitsch identified as Shem, the son of Noah, settled Grossgermania from the Rhine to the Don. The history of post-Flood Europe under

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[2]Cf. Harold Barker, "Radio Carbon Dating: Its Scope and Limitations," *Antiquity*, XXXII (1958), 253-63; Robert Stuckenrath, Jr., "On the Care and Feeding of Radiocarbon Dates," *Archaeology*, XVIII.4 (1965), 277-81.

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[5]Cf. Václav Bucha, "Archaeomagnetic Dating," in Henry N. Michael and Elizabeth K. Ralph (eds.), *Dating Techniques for the Archaeologist* (Cambridge, Mass., 1971), pp. 57-117.

[6]Elizabeth K. Ralph, "Carbon-14 Dating," in Michael and Elizabeth Ralph, pp. 28ff.; Robin M. Derricourt, "Radiocarbon Chronology for Egypt and North Africa," *Journal of Near Eastern Studies*, XXX (1971), 271-92.

[7]Colin Renfrew, "Carbon 14 and the Prehistory of Europe," *Scientific American*, CCXXV (Oct. 1971), 69.

[8]Henry N. Michael, "Climates, Tree Rings, and Archaeology," in Michael and Ralph, pp. 49-50.

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[19]Renfrew, p. 72.

[20]*Ibid.*, p. 70. There are clear links between the Balkans and Mesopotamia. The most startling evidences are the Tartaria clay tablets, associated with the early Vinca culture, discovered in the Transylvanian region of Romania. Cf. M. S. F. Hood, "The Tartaria Tablets," *Scientific American*, CCXVIII (May, 1968), 30-37.

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[22]Two of the four rivers associated with Eden, the Tigris and the Euphrates, are clearly in Mesopotamia. As Speiser points out, the Gihon river which encircles the land of Cush is to be associated with the area of the *Kushu/Kashu* or Kassites to the east of Mesopotamia and not with Cush, south of Egypt. E. A. Speiser, *Genesis* (Garden City, N. Y., 1964), p. 20.

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Edwin M. Yamauchi

Miami University
Oxford, Ohio

Tuitsch and his successors is in full accordance with the Bible and cultural diffusion.

Conclusions

Theories proposing views contrary to the Word of God can always be examined and found to be false and without support in fact. Mesopotamia, according to Scripture and history, was where agriculture, domestication, and pottery-making began. All mankind, Europeans and Southeast Asians, migrated from this central location, and took with them the gifts of civilization. The origins of humanity are firmly rooted in the ancient Near East. Cultural diffusion began when eight members of a single family left the Ark. Radiocarbon dates altered by calibration may be valid for the data gathered from a specific locale; however, one calibration does not apply to the whole earth. Misinterpretation of C-14 information does not nullify Bible truths. Rather the history and traditions of the peoples of the earth confirm the Bible. The Bible and history stand in agreement.

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The unbridled lust for simple "either/ors" needs to be resisted just as strongly as any sneaking desire to "have it both ways;" for it can be fruitful of just as serious distortions of truth. "Either God or chance;" "either the work of the Holy Spirit or the working of psychological machinery;" "either divine creation or biological evolution": all these have a brave sound of "no compromise" about them; but in nine cases out of ten they represent a pathetic sell-out of truth to the nothing-buttery of the opposition.

I think that Christians ought to insist that there is no need for the idea of "God" in the field of ordinary scientific explanation. If Laplace ever actually made the often-quoted remark, "I have no need of that hypothesis" (when asked why he had not brought "God" into his equations) I think he was right.

Donald M. MacKay

The Clockwork Image,
InterVarsity Press, 1974, p. 92, 97

Hemoglobin Structure and the Biogenesis of Proteins. Part I. Relation of Structure to Function for Mutant Hemoglobins

GORDON C. MILLS

Department of Human Biological Chemistry and Genetics

University of Texas Medical Branch
Galveston, Texas 77550

In recent years, there have been major advances in our knowledge of the structure of protein molecules. This has been especially true in regard to the hemoglobin molecule. Not only is the entire amino acid sequence known, but the position of each amino acid in the three-dimensional structure is also known. This has permitted major advances in our understanding of the relationship of structure to function. The study of the properties of approximately one hundred and fifty mutant hemoglobins have shown these properties are modified by single amino acid substitutions. A single amino acid change, will in a high percentage of cases, cause diminished function in the hemoglobin molecule. In Part II, the relation of the above studies to theories for the biogenesis of life will be considered.

Studies of human blood samples during the past twenty years have led to the discovery of about one hundred and fifty different mutant hemoglobins. Biochemical techniques have permitted the determination of the specific modification occurring in these abnormal hemoglobin molecules. In nearly all of these, a single amino acid substitution has been demonstrated. In six, however, deletions of from one to five amino acids have been shown, and in six other cases there has been a translocation of chain segments with the resultant formation of a new chain made up of segments of two different chains. In two others, chain elongation has occurred. Many of these abnormal hemoglobins have been found as a consequence of detailed studies of individuals with abnormal hemoglobin or red cell function. Others have been detected in routine screening procedures, with the detection based upon an altered mobility of the hemoglobin in an electric field. Electrophoretic techniques would detect abnormal hemoglobins having a charge modification due to substitution of a neutral amino acid[a] for a charged amino acid or vice versa. Electrophoresis would not, in most cases, detect neutral substitutions. Let us consider from the standpoint of structure-function relationships, some of the properties of the normal hemoglobin molecule and properties of the different types of mutant hemoglobins that are found in man. The three-dimensional structure of hemoglobin has been determined primarily by Perutz and coworkers using X-ray crystallography. For a more detailed description, the reader is referred to articles by Perutz and coworkers [1-3].

Properties of Hemoglobin

The hemoglobin molecule is a tetramer, i.e., it is made up of four polypeptide chains or subunits. For hemoglobin A (normal adult hemoglobin), there are two alpha chains and two beta chains (a_2b_2). For hemoglobin F, the primary hemoglobin during fetal life, there are two alpha and two gamma chains (a_2g_2). For a short time during embryonic life, there are two other hemoglobins containing epsilon and zeta chains[b]. There is also found in all normal individuals, very small amounts of another hemoglobin, designated A_2, containing two alpha and two delta polypeptide chains (a_2d_2).

It should be noted that an abnormality in the alpha

Part II of this paper will be published in the June 1975 issue.

chain would be evident as abnormal hemoglobins of A, F and A_2, while an abnormality in the beta chain would be evident only as an abnormal hemoglobin A. From the standpoint of function, hemoglobin A is of primary quantitative significance, and alterations in the alpha and beta chains would be most apt to have significant clinical consequences. However, alterations in the gamma chain might also have clinical consequences for the newborn infant, since hemoglobin F is of major significance during fetal life and in the first few months after birth.

Since one structural gene contains the genetic information for the amino acid sequence in one polypeptide chain, a normal individual has structural genes for the alpha, beta, gamma, and delta polypeptide chains[c]. Mutations may ocur in any one of these genes. An individual who is heterozygous for the genetic defect would have both the mutant gene and the normal gene, while a homozygous individual (one who inherits the defect from both parents) would have only the mutant gene for that particular polypeptide chain. Similarly, a heterozygous individual would have both the abnormal hemoglobin and the normal hemoglobin, while a homozygous individual would have only the abnormal hemoglobin. It should be emphasized that scientific studies are carried out on the abnormal hemoglobin, which is produced as a consequence of the abnormal gene, rather than on the abnormal (or mutant) gene itself. The latter cannot be isolated for study, and inferences as to the nature of the gene alteration are made from the study of the altered protein molecule and from our knowledge of the genetic code.

The amino acid sequence of the polypeptide chains of hemoglobin is apparently responsible for the folding and coiling of these chains to form the stable hemoglobin molecule. Each chain tends to form helical segments interspersed with non-helical segments. The eight helical segments (assigned letters of A to H) are held into the helical form by hydrogen bonding involving CO and NH groups of the backbone of the polypeptide chain (Fig. 1). The R-groups of the component amino acids are oriented outward from the helix. The designations AB, BC, etc., are used to indicate corners of non-helical regions and NA and HC are used to designate non-helical regions at the amino terminal and carboxy terminal ends of the chain, respectively. The amino acid proline, is always located either in non-helical regions of the chain or near the terminus of a helical region. The three-dimensional structure of hemoglobin is also dependent upon the binding of the four polypeptide subunits together in a very precise manner. The unlike subunits (e.g., alpha and beta chains for Hb A) are held together by predominantly non-polar interactions between the R-groups of the amino acids. There are a number of points throughout the molecule where these interactions occur. At the a_1b_1 contact, R-groups from 16 amino acids of the alpha chain are in contact with 18 amino acids of the beta chain. At the a_1b_2 contact, 10 amino acids of the alpha chain contact 9 amino acids of the beta chain. The like subunits (e.g., alpha and alpha, or beta and beta for Hb A) are not held as firmly and are held together predominantly by polar bonds (e.g., attraction of a positively charged group for a negatively charged group). It should be emphasized that the tetrameric molecule is a very tightly packed structure with very little room for water or ions within the molecule. There does appear, however, to be a channel between like subunits in the center of the hemoglobin molecule. Water and ions appear to move freely into this channel. Most of the charged groups of the molecule are on the external surface, while the internal portion of each of the polypeptide subunits contains predominantly non-polar amino acids and is very hydrophobic in nature. As we shall see, alterations in the amino acid sequence of the polypeptide chains which may modify this three-dimensional structure of hemoglobin, will often result in a less functional hemoglobin molecule.

The function of the hemoglobin molecule is to bind oxygen reversibly. Oxygen is bound to hemoglobin in capillaries of the lungs where the partial pressure of oxygen is high. The oxygen is then released in tissue capillaries where the oxygen pressure is low. An iron-porphyrin compound, heme, is the particular group on the hemoglobin molecule that binds oxygen. There is one heme group per subunit, or four hemes per hemoglobin molecule. In order for the heme to have this oxygen-binding property, the planar heme group must fit very tightly into a pocket in each of the subunits of the globin molecule. A hydrophobic region surrounding the heme is an absolute requirement for proper oxygen-binding by the heme. Also, the heme must be linked to an imidazole group of the amino acid, histidine (positions 87 of the alpha chain and 92 of the beta chain). In addition, oxygen-binding is dependent upon a second histidine (positions 58 and 63 of the alpha and beta chains, respectively). The porphyrin ring of heme has eight side chains (4 methyl, 2 vinyl, 2 propionic acid) on the pyrrole rings. These side chains and the

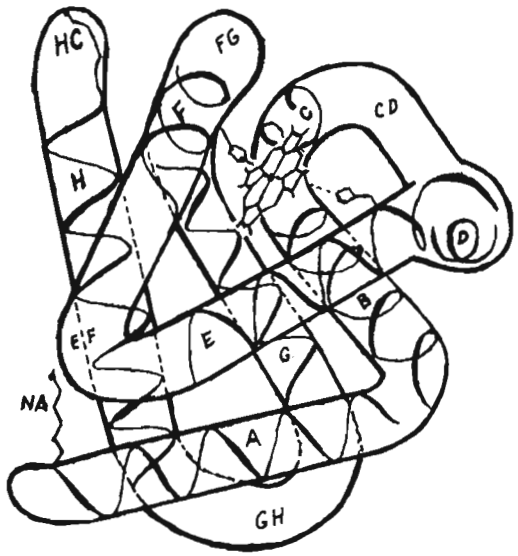

Fig. 1. Diagrammatic sketch of the beta chain of hemoglobin showing the three-dimensional structure. Helical portions are indicated by the letters A through H. There are *ca.* 3.6 amino acids per turn of the helix. Note that the heme group lies in a pocket between the E and F helices with portions of the B, C, and H helices lying beneath the heme. Numbering begins at the N-terminal end (NA). Modified from Perutz[3].

atoms of the tetrapyrrole ring are associated with R-groups of 20 different amino acids, predominantly by hydrophobic contacts. Alterations in the protein molecule that modify the nature of amino acids that are in close proximity to the heme group will nearly always produce a hemoglobin molecule with diminished function as an oxygen carrier. For the beta chain, the heme pocket region includes many amino acid residues between positions 63 and 106. It also includes short segments elsewhere in the polypeptide chain (i.e., residues 31, 38, 41-44, 137 and 141).

It is important to note that the iron of the heme groups of hemoglobin must be in the ferrous state for the hemoglobin to function as an oxygen carrier. In heme-protein enzymes (e.g., cytochrome c), the catalytic function of the enzyme as an electron carrier is dependent upon the heme iron undergoing a repeated cycle of oxidation to the ferric state followed by reduction to the ferrous state. The nature of the attachment of the heme to the protein and the nature of the amino acid environment around the heme are responsible for the varied function of the heme group when it is bound to a protein. In hemoglobin, the hydrophobic environment and the attachment of the iron to histidine produce a protein with properties of oxygen-binding. When the environment is modified, the iron in the heme group becomes very susceptible to oxidation from the ferrous to the ferric state. In addition, modifications in the heme pocket region may cause the loss of the heme group from the protein. This permits entry of water and ions into this region and may cause instability of the entire protein molecule.

In order for the hemoglobin molecule to have maximal function as an oxygen carrier, it is essential that a plot of the oxygen tension in the solution (pO_2) against the per cent saturation of hemoglobin provide a sigmoidal shaped curve. Studies have shown that the oxygen dissociation curve of hemoglobin is dependent upon: a) a tetrameric molecule (myoglobin, a monomer, gives a hyperbolic curve), and b) binding of

Major advances in our knowledge of the structure of protein molecules has permitted major advances in our understanding of the relationship of structure to function.

certain organic phosphate compounds to the hemoglobin. In man and many other mammals, the organic phosphate is predominantly 2, 3-diphosphoglycerate; in birds it is inositol hexaphosphate. The significance of the sigmoid-shaped curve is that hemoglobin, under physiologic conditions, is a very efficient oxygen carrier. In the absence of 2, 3-diphosphoglycerate, hemoglobin will pick up oxygen in the lung capillaries, but it will not release adequate amounts of oxygen in tissue capillaries. The 2, 3-diphosphoglycerate appears to bind to positively charged sites between the two beta chains of the hemoglobin A molecule.

In summary, hemoglobin is a very unique protein with its properties especially dependent upon: (1) the nature of amino acids at contact points between polypeptide chains, (2) the hydrophobic nature of amino acids within the interior of each of the polypeptide subunits and (3), the nature of the amino acids in the heme-pocket. Let us consider at this point, specific hemoglobin mutants[a] and the effect of the mutation on a) the properties of hemoglobin, and b) the physiologic function of the erythrocyte as an oxygen carrier.

Hemoglobin Mutants Where the Properties of Heme as an Oxygen Carrier have been Modified

Mutants of this type are listed in Table I. In the Hb M mutants, the iron of the hemoglobin is very readily oxidized to the ferric state (methemoglobin), and this imparts a brownish color to the blood. In most hemoglobin M mutants, either the proximal histidine

Table I. *Hemoglobin beta chain mutants where the properties of heme have been modified.*

Mutant	Residue No.	Residue Position	Replacement From	Replacement To	Location in molecule
Mutants with methemoglobinemia					
M Saskatoon	63	E7	his	tyr	heme contact
M Milwaukee	67	E11	val →	glu	heme contact
M Hyde Park	92	F8	his →	tyr	heme contact
Mutants with high oxygen affinity					
Olympia	20	B2	val →	met	external
Malmo	97	FG4	his →	gln	a_1b_2 contact
Yakima	99	G1	asp →	his	a_1b_2 contact
Kempsey	99	G1	asp →	asn	a_1b_2 contact
Ypsi	99	G1	asp →	tyr	a_1b_2 contact
Brigham	100	G2	pro →	leu	a_1b_2 contact
Ranier	145	HC2	tyr →	cys	a_1b_2 contact
Bethesda	145	HC2	tyr →	his	a_1b_2 contact
Hiroshima	146	HC3	his →	asp	a_1b_2 contact
Mutants with low oxygen affinity°					
Kansas	102	G4	asn →	thr	a_1b_2 contact
Yoshizuka	108	G10	asn →	asp	a_1b_1 contact

°Some unstable hemoglobins (Hammersmith, Louisville, Bristol, Seattle, and Peterborough) also have a low oxygen affinity.
The mutants with methemoglobinemia exhibit cyanosis clinically. Those with high oxygen affinity have polycythemia. The Hb Kansas mutant exhibits cyanosis. There are also a number of alpha chain mutants where the properties of heme have been modified[4].
Reference not listed in ref. 4; Hb Brigham[5].

(positions 92 and 87 of beta and alpha chains, respectively) or the distal histidine (positions 63 and 58 of the beta and alpha chains, respectively) is involved. In many cases, histidine is replaced by tyrosine. In Hb Milwaukee, however, replacement of valine by glutamic acid at position 67 in the beta chain permits the bonding of the carboxyl group of glutamic acid to the heme-iron. Methemoglobinemia is also a consequence of this mutation. In all of these Hb M mutants, the function of the hemoglobin as an oxygen carrier is totally lost for the particular subunit of the hemoglobin molecule that is involved. The hemoglobin of a beta chain mutant would have two normal alpha chains and two abnormal beta chains. Hence, the functional ability of the tetrameric molecule would be 50% or less of normal. Since these mutants are very rare, the heterozygous state is almost always the only condition that is encountered. Consequently, the abnormal hemoglobin is always accompanied by normal hemoglobin A. Hence the overall functional impairment (i.e., loss of ability to transport oxygen) to the individual may be of the order of 15 to 35%. With most mutants causing this degree of functional impairment, the individual will compensate by an increased production of red cells, so that there is a slightly elevated hematocrit (percent of packed red cells in the blood), and a slightly more viscous blood. Clinically this is described as polycythemia. The presence in the blood of hemoglobin with iron in the ferric state (methemoglobin) imparts an unusual coloration to the skin that the clinician refers to as cyanosis. It should be noted that cyanosis may also be due to deoxyhemoglobin in the blood. Consequently, hemoglobin mutants with decreased oxygen affinity (e.g., Hb Kansas) may also have cyanosis.[e] In Hb Kansas, the amino acid modification (threonine for asparagine in position 102 of the beta chain) in the heme pocket region also involves a contact point between alpha and beta chains. This mutant hemoglobin, as a consequence, has a number of abnormal properties. It has decreased oxygen affinity, the chains tend to dissociate into dimers and the hemoglobin is unstable. Clinically, the subject has cyanosis due to the increased level of deoxyhemoglobin in the erythrocytes.

There are various mutants listed in Table I in which hemoglobin has an increased oxygen affinity as a consequence of an amino acid modification in a region spatially near the heme group. In each of these cases, the R-group of the amino acid is involved in a contact between unlike subunits (a_1b_2 contact) of the polypeptide chains. Although there would be adequate oxygen in the blood under these circumstances, the high oxygen affinity of the hemoglobin tends to produce an oxygen deficit in the tissues. The physiologic response to this type of mutation is increased red cell production and mild polycythemia (i.e., an increased number of red cells). It is of interest to note that the beta chain mutant, Hb Ranier, with an amino acid modification at position 145 also is characterized by an increased oxygen affinity and polycythemia. The tyrosine in position 145 in the beta chain, although far removed from the heme-binding site in terms of amino acid sequence, lies relatively close to the heme pocket as a consequence of chain folding. The tyrosine fits into a small pocket between the F and H helices in the deoxygenated hemoglobin molecule; on oxygenation, the tyrosine is forced out of this pocket. This snapping of the tyrosine into and out of a pocket near the heme as oxygen is released or taken up, appears to be essential for proper hemoglobin function.

In Part II (June), the relation of these studies to theories for the biogenesis of life will be considered.

Hemoglobin Mutants Causing Instability of the Hemoglobin Molecule

During the past eight years, a new group of hemoglobin mutants have been discovered (Table II). In these, the mutation has caused instability of the molecule so that it tends to precipitate both *in vivo* and *in vitro*. In the intact circulating erythrocyte the precipitating hemoglobin tends to bind to the interior of the red cell membrane. These inclusion bodies (or Heinz bodies) are readily evident to the hematologist by utilizing appropriate staining techniques. Individuals with this type of hemoglobin mutant have, in most cases, chronic hemolytic anemia. The severity of the hemolytic disease is variable. With some mutants of this type, e.g., Hb Sogn, the hemoglobin instability causes no evident clinical abnormality. In others, e.g., Hb Hammersmith and Hb Sabine, the hemolytic anemia is severe. The subject with Hb Sabine[12, 13] for example, has an erythrocyte half life (by the chromium labeling technique) of only 4.5 days compared to a normal value of 28 days. In the case of the unstable hemoglobins, the functional impairment is not simply a matter of a partial deficit in the capacity to transport oxygen. In these subjects, the precipitating hemoglobin damages the cellular metabolism (possibly as a consequence of membrane damage) so that the red cell survival in the circulation is markedly shortened. The subjects with unstable hemoglobin mutants attempt to compensate for the deficit in red cells with an increased production of new red cells in the bone marrow. As a consequence, an increased percentage of immature red cells (reticulocytes) is nearly always a characteristic of the unstable hemoglobin hemolytic anemias.

In vitro, the unstable hemoglobins are readily demonstrated. When a solution of hemoglobin from the subject is warmed to 50°C for 20 minutes to an hour, the abnormal hemoglobin gradually precipitates and is readily demonstrated by centrifugation. The normal hemoglobin A does not precipitate significantly under these circumstances. The abnormal hemoglobin may sometimes be demonstrated by electrophoresis even though a neutral amino acid substitution may be involved. This is probably a consequence of a change in charge of the molecule due to a partial loss of heme. It is important to note that unstable hemoglobins may be a consequence of amino acid modifications at many different places in the hemoglobin molecule (see Table II). Substitutions involving replacement of leucine by proline often cause unstable hemoglobins. Since proline does not fit into a helix (except as noted earlier), the proline substitutions

cause a distortion of the molecule often permitting the entrance of water. When the proline substitution involves the heme pocket region, the oxygen-binding ability of the hemoglobin may also be altered. Amino acid modifications in regions of the hemoglobin molecule where the polypeptide subunits interact are also apt to cause hemoglobin instability (e.g., Hb Tacoma).

In many cases, subjects with unstable hemoglobins have been shown to have parents and siblings with normal hemoglobins. This would seem to indicate that the mutation originated with the mutant subjects. Since the hemolytic anemia is rather severe in the heterozygous state in many subjects with unstable hemoglobin hemolytic anemia, some of these mutations would be evident in only one generation (i.e., the mutant subjects are less likely to have offspring). With Hb Koln, where the anemia is not so severe, the genetic defect has been demonstrated in five unrelated family groups.

Abnormal Hemoglobins Involving Deletions, Chain Fusion and Chain Elongation

There are six hemoglobin mutants where deletions of one to five amino acids are noted. In five of these, the amino acid deletions cause a marked loss of function of the protein molecule. In the sixth mutant (Hb St. Antoine[14]), the deletion causes only a slightly increased instability. There are at least six abnormal hemoglobins where a fusion of genes for two different polypeptide chains appear to have occurred. When the chain length is not modified by the fusion and when the overall three-dimensional structure of the modified polypeptide remains the same, the properties of the hemoglobin would very likely remain unchanged. In Hb Lepore, as a result of a delta-beta fusion, positions 1-87 of the fused chain come from the delta chain and 115-146 from the beta chain. Since positions 88-114 are identical in the beta and delta chains, the precise locus of the fusion is not indicated. Other delta-beta fusion hemoglobins are known where the fusion is at a different locus. In two instances (Hb Miyada and Hb P Congo) a beta-delta fusion has occurred. In these cases, the initial portion of the fused chain comes from the beta chain and the latter portion from the delta chain. Since the delta and beta chains have the same number of amino acids and the same three-dimensional structure, gene fusion apparently occurs without significant modification of the properties of hemoglobin. In Hb Kenya[15], the fusion apparently involves segments of the gamma and beta chains. Although studies on Hb Kenya are incomplete, it appears to have relatively normal function.

There are two abnormal hemoglobins (Hb Tak and Hb Constant Spring) where one of the polypeptide chains is lengthened. This presumably occurs as a consequence of a mutation or a deletion affecting the termination codon for that particular gene. Hb Tak with eight additional amino acid residues at the N-terminal end of the beta chain appears to have normal function. Hb Constant Spring has 31 additional residues at the N-terminal end of the alpha chain. It occurs only in small amounts, but the available evidence suggests that it is deleterious to erythrocyte function.

Table II. *Beta chain mutants with unstable hemoglobin.*

Mutant designation	Residue No.	Residue Position	Replacement From	Replacement To	Location in molecule	Degree of hemolytic anemia
Sogn	14	A11	leu	arg	internal	none
Riverdale-Bronx	24	B6	gly	arg	internal	moderate
Savannah	24	B6	gly	val	internal	severe
Saint Louis	28	B10	leu	gln	internal	moderate
Genova	28	B10	leu	pro	internal	moderate
Tacoma	30	B12	arg	ser	a_1b_1 contact	mild
Abraham Lincoln	32	B14	leu	pro	near E7 heme contact	severe
Philly	35	C1	tyr	phe	a_1b_1 contact	mild
Hammersmith	42	CD1	phe	ser	heme contact	severe
Louisville (Bucuresti)	42	CD1	phe	leu	heme contact	moderate
Zurich	63	E7	his	arg	heme contact	moderate
I Toulouse	66	E10	lys	glu	heme contact	very mild
Sydney	67	E11	val	ala	heme contact	moderate
Bristol	67	E11	val	asp	heme contact	severe
Seattle	70	E14	ala	asp	heme contact	mild
Christ Church	71	E15	phe	ser	heme contact	moderate
Shepherd's Bush	74	E18	gly	asp	internal	moderate
Santa Ana	88	F4	leu	pro	heme contact	moderate
Boras	88	F4	leu	arg	heme contact	moderate
Sabine	91	F7	leu	pro	heme contact	severe
Saint Etienne (Istanbul)	92	F8	his	gln	heme contact	mild
Koln	98	FG5	val	met	heme contact a_1b_2 contact	moderate
Nottingham	98	FG5	val	gly	heme contact a_1b_2 contact	severe
Southampton	106	G8	leu	pro	heme contact	severe
Khartoum	124	H2	pro	arg	a_1b_1 contact	none
Wien	130	H8	tyr	asp	internal	moderate
Olmstead	141	H19	leu	arg	heme contact	severe

Hb Kansas and Hb M Hyde Park (Table I) also are unstable. The six beta chain mutants with amino acid deletions are unstable and there are seven unstable alpha chain mutants.
References not listed in ref. 4; Hb St. Louis[6]; Hb Abraham Lincoln[7]; Hb Seattle[8]; Hb St. Etienne[9]; Hb Nottingham[10]; Hb Southampton[11].

Abnormal Hemoglobins with Other Unusual Properties

The most common hemoglobin mutant is hemoglobin S (sickle cell-hemoglobin). In this beta chain mutant, the glutamic acid in position 6 is replaced by valine. The presence of valine in this position permits intramolecular hydrophobic bonding of deoxyhemoglobin S. The molecules are aligned into rigid filaments in such a manner that the erythrocytes are distorted into a sickle shape[16]. Oxyhemoglobin S does not undergo the molecular stacking that leads to formation of sickle cells; it is only after the oxygen is released that sickling occurs. This sickling of the erythrocytes in capillaries causes obstruction of the small blood vessels. The oxygen deprivation in the tissue may then lead to tissue degeneration (necrosis). It is important to note that in the heterozygous state (sickle cell trait), hemoglobin S is only slightly deleterious to the individual. It is only in homozygotes (sickle cell disease), that sickling occurs to an extent that is markedly deleterious. Hemoglobin S is an abnormal hemoglobin with decreased solubility. There are other examples of hemoglobin mutants where the solubility of the hemoglobin is also altered. In Hb C, lysine has replaced glutamic acid at position 6 of the beta chain. A decreased solubility of the oxyhemoglobin causes a mild hemolytic anemia in individuals who are homozygous for this hemoglobin mutant. Hemoglobin C Harlem appears to be a consequence of a mutation of the gene for Hb S. It has two amino acid replacements in the beta chain, valine for glutamic acid in position 6, and asparagine for aspartic acid position 73. The properties of Hb C Harlem are similar to those of Hb S and the physiologic consequences in the heterozygous state are the same as those found in sickle cell trait.

There are two hemoglobins that tend to undergo polymerization during starch gel electrophoresis. In Hb TaLi (b83 gly – cys) and Hb Port Alegre (b9 ser – cys), cysteine residues have been introduced as a consequence of the mutation. Both of these positions are external and there is a tendency for intramolecular disulfide bridge formation to occur with an increase in the molecular weight of the molecule. As a consequence, its electrophoretic properties are altered. This polymerization does not occur under physiologic conditions, so individuals with these mutations have no clinical abnormalities.

(To be continued)

FOOTNOTES

[a] The terms "neutral" and "charged" are used in referring to the nature of the R-group of the amino acid. The a-amino group and C_1-carboxyl group of amino acids are utilized for peptide bond formation and are not charged in the protein molecule, unless they are at the end of peptide chains.

[b] The epsilon and zeta polypeptide chains have not been characterized; consequently, they will not be considered further in the discussion to follow.

[c] Recent studies have provided evidence that there are two genes for the gamma chain, designated Gg and Ag. The gamma polypeptide chains produced from these genes differ by one amino acid (glycine or alanine) at position 136. The significance of having two genes for the gamma chain is not clear.

[d] Hemoglobin mutants, including the original literature references, have been reviewed recently by Stamatoyannopoulos[4]. References will be given in the present paper only for those mutants not listed by him.

[e] It should be emphasized that other conditions, e.g., impairment of the circulation, may also cause cyanosis.

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Scientific laws do not prescribe *what* must *happen; they* describe *what* has *happened. The earth does not go around the sun because Newton's (or Einstein's) law makes it, or tells it to. The earth goes its way, and the scientific laws are our generalized way of describing how it goes. All that they prescribe are our expectations . . . . our description of the pattern God normally follows.*

Donald M. MacKay

The Clockwork Image,
InterVarsity Press, 1974, p. 31, 32

Comments on an Article

"EVANGELICALS AND EVOLUTION"

In the Summer 1974 issue of the *Journal of the Evangelical Theological Society*, William Lane Craig (M.A. in Philosophy of Religion at Trinity Evangelical Divinity School, Deerfield, Illinois) discusses an important topic in "Evangelicals and Evolution: An Analysis of the Debate between the Creation Research Society and the American Scientific Affiliation." It is perhaps the most complete attempt at this comparison yet to appear in print. For his source material, Craig limits himself to papers published in the *Creation Research Society Quarterly* and the *Journal of the American Scientific Affiliation;* it might have been preferable if he had expanded his base to include books written by prominent members of both the CRS and the ASA. Craig's generally accurate overall conclusion is that

> . . . these two organizations are healthy counterparts in the evolutionary debate. The CRS calls Christians to examine their Bible more closely, while the ASA prevents a fundamentalist obscurantism by its persistent demand for scientific respectability. Any view of evolution that will demand our attention and respect, they tell us, must accord with both God's Word and scientific fact. (p. 148)

In terms of a sociological study, however, Craig's approach has serious drawbacks that seem sufficiently significant to deserve a few words of comment, which might be of some value to others following in Craig's footsteps. Interestingly, Craig is well aware of one drawback.

> The task (of the ASA) is made all the more difficult by the fact that the ASA does not have a party platform on evolution as does the CRS and thus cannot speak decisively as a body to the issue, though a *de facto* position, somewhat nebulous, does arise. (p. 134)

Realization of the drawback, however, does not prevent Craig from going ahead and attempting to construct an "ASA party platform" where none exists. The result is unfortunate, for in spite of Craig's *caveat*, the reader is swept along to believe by the end of the article that he has been successful in describing *the* ASA position on evolution. Almost any article from the *CRS Quarterly* can be used to define the CRS position, because no article is tolerated in the *CRS Quarterly* except those that follow the CRS position; as Craig, himself, points out, "The CRS will not tolerate any compromise on these principles and openly rebukes the ASA for having capitulated to modern science." (p. 132) But no article in the *Journal ASA* can be used to define a position for the ASA, and only the most careful of studies would be adequate to come up with even an approximation of an ASA consensus. The difference is not simply that the ASA does not have a "party platform" whereas the CRS does, but that the CRS is an organization with a single message to present whereas the ASA is an organization dedicated to the integrity of scientific and theological research. The "party platform" of the ASA is that it is a mistake to have a "party platform" on controversial issues on which committed Christians disagree. The failure to appreciate sufficiently this critical difference in presuppositional stance between the ASA and the CRS leads Craig to some questionable judgments as we discuss below.

Craig's conclusions are also seriously affected by a deficient method of sampling. His sources in the *Journal ASA* are some 11 papers, all except one of which predate 1970; 9 communications or letters, all except one of which predate 1970; 4 book reviews, from 1964, 1968 and two from 1973; and one "filler" on the inside cover of the September 1973 issue which contained a quotation from a book by Herbert Morris published in 1871! A quick examination of the contents of the *Journal ASA* shows that between 1971 and 1973, 22 different authors contributed one or more papers to the *Journal ASA* dealing with the subject of evolution; not a single one of these papers is cited by Craig. Even given Craig's premise, therefore, that a consensus of ASA position can be obtained from an analysis of publication in the *Journal ASA*, his choice of source material is unlikely to lead to an adequate consensus.

His failure to appreciate adequately what is indicated on the inside front cover of every copy of the *Journal ASA*,

> The pages of the *Journal ASA* are open to any contribution dealing with the interaction between science and Christian faith in a manner consistent with scientific and theological integrity.

leads Craig to a number of distorted conclusions. When he says that, "the ASA, on the other hand, seems quite befuddled by all this," (p. 132) or "again the ASA does not seem to know just what to do with all this," (p. 139) or "but the ASA is in little better condition on this issue," (p. 148) Craig is judging differences of opinion voiced in the *Journal ASA* to be indications of dissension in the ranks, rather than the result of purposeful insistence that all sides of a question be viewed.

When Craig says, "in September of 1973, the ASA journal still found itself reviewing CRS books in its book review section," he is proceeding on the assumption that the attitude of the ASA toward CRS books should be the same as the attitude of the CRS toward ASA books. The fact that the *Journal ASA* continues to treat the subject of evolution at some length several years after the president of the ASA

called for a break away from old issues and a concentration on more pertinent issues, does not indicate, as Craig suggests, inability of the ASA to carry out a policy; when it is recognized that the same president, now your editor, is responsible for planning these continued discussions of evolution, it becomes evident that the continuation is our response to be of service to our readers who still encounter problems with the question, rather than a relaxation of deepfelt conviction that other problems may in general be more important. Craig might have pointed out that not only does the *Journal ASA* continue to review books written by CRS authors—and will continue to do so as long as such books are of interest to Christians and demonstrate minimum scientific and theological integrity, but that the *Journal ASA* both has and will continue to publish qualified papers written by CRS authors.

Craig's interpretation of *Journal ASA* policy tends to guide his conclusions. For example, he states, "In September, 1969, the ASA printed an article against the CRS position that one suspects was supposed to be the decisive blow in the evolution debate." First of all, the article dealt with flood geology and is important for evolution only because anti-evolutionists insist that it is. But second, why did not Craig conclude that the paper on "The Case for Global Catastrophism," published in the December, 1973, issue of the *Journal ASA*, or the paper on "The Relationship between Immanuel Velikovsky and Christian Catastrophists" in the same issue, represents the *Journal ASA's* decisive blow against evolution?

There is no possible way to claim as Craig does that "The ASA, in discussing philosophy of science, subscribes to what Bube calls 'Christian realism.'" (p. 136) A survey of the philosophical commitments of ASA members on this question has not been taken, but how their unanimous subscription to a particular position can be stated on the basis of a few assorted papers and book reviews is difficult to see. Again there is no possible way for Craig to claim, "The ASA accepts the double revelation theory," (p. 139) especially when his prime evidence is a "filler" from an 1871 book published on the inside cover of the *Journal*.

Many members of the ASA would feel that Craig has greatly underestimated the difference between CRS and their position when he says, "The major differences between the CRS and the ASA here are that the CRS holds that kinds were created in one week while the ASA spreads out creation progressively." (p. 147)

If the ASA were a Christian organization demanding belief in evolution as the criterion for membership, a reviewer might be somewhat better able to compare the ASA and the CRS. As it is, any comparison must begin with a full appreciation for the differences in presuppositional starting points before attempting to analyze isolated publications.

R.H.B.

Revealing - but about What and Whom?

The magazine *Christianity Applied* recently offered an interesting exercise in sociological opinion taking. The magazine, published by the Christian Freedom Foundation, set out to take a "national Evangelical public opinion poll" by sending out 65,000 questionnaires last year before President Nixon resigned. In October 1974, on the basis of a 5% return, the results of this survey were mailed out with the statement that "The results are revealing." Following are some of the more striking conclusions from this poll of "national Evangelical opinion."

One out of three is a minister.

There are twice as many ministers as housewives (the two largest occupational groups), and twelve times as many ministers as students.

Three out of four are over 40 years old; only one in twenty-five is 16-24 (the youngest age range given).

There are five men for every two women.

Five times as many would choose the Republican Party as would choose the Democratic Party.

Sixteen times as many would regard themselves as politically conservative as politically liberal.

Almost twice as many rated President Nixon's performance above average as rated it below average.

One in three agreed with the statement, "Richard Nixon is a Christian President. He has been wronged by conspiratorial forces in this country."

As many agreed with the statement, "Richard Nixon should be permitted to lead this country as its President and the Congress and the press should get off his back," as disagreed with it.

Only a few weeks before his resignation, only one in four agreed with the statement, "The President should not be impeached but he should resign." (Only one in four also agreed that "President Nixon should be impeached and removed from office as quickly as possible.")

Four out of seven would vote against Senator Mark Hatfield if he ran for the presidency (in spite of the fact that he is both a Republican and an evangelical Christian).

As many agreed with the statement, "The Evangelical Church should become politically active," as disagreed with it.

So we can't help wondering. Revealing of what? About whom?

If we take seriously what the Bible means by creation we see that it is not just a single datable event, which happened at a particular point in time; it is rather a continuing relationship of dependence between us and God, such that the whole of our drama, its past, its present and its future, owes its form and its ongoing existence, moment by moment, to his creative power.

Donald M. MacKay

The Clockwork Image,
InterVarsity Press, 1974, p. 69

BOOK  REVIEWS

THEOLOGY OF EVOLUTION by Ervin Nemesszeghy, S. J. and John Russell, S. J., Notre Dame: Fides Publishers Inc., 1971. 96 pp., $0.95.

The Catholic press during the last three or four years has printed over forty paperbacks in the Theology Today Series which sell for 95c each. The above book is No. 6 in this series. All have evidently been written to help the increasing number of laymen who are manifesting a genuine interest in the beliefs of their church to come to grips with what leading scholars and theologians consider to be a workable and wide-ranging theology for the last half of the twentieth century.

Nemesszeghy and Russell are Britishers, who at the time of the publication of their *Theology of Evolution* were lecturers at Heythrop College, London. Both have numerous articles appearing in scholarly journals in Britain. One of the first things apparent as one glances through this little book is the influence of Teilhard de Chardin (1881-1955) on their thinking. The last chapter deals almost entirely with the evolutionary vision of Teilhard.

In their introduction the authors point out that they desire to steer clear of any head-on-clash-view of science and religion. In the first chapter evolution is considered as an accepted scientific theory. The theories of natural selection and micro- and macro-evolution are discussed, and in the concluding paragraph (p. 26) it is stated,

> So long as the theory of evolution is the only available natural explanation of the biological history of the world, it will continue to be accepted as a matter of course, both by Catholic and non-Catholic biologists.

The second chapter contains a discussion of the theological problems which come naturally from any literal interpretation of the Scriptures that the Church has usually held. A brief historical summary of the pertinent orthodox beliefs of the church from the Pelagian Controversy in 418 A.D. to the year 1950 when Pius XII published his encyclical, *Humani Generis,* is presented in the first few pages of the chapter. For the authors, the encyclical leaves the doctrine of evolution an open question as long as it confines itself to speculation about the development of the human body from other living matter already in existence, but they realize that the encyclical does not allow any speculation concerning the spiritual origin and nature of man and original sin (p. 47ff).

In chapter three the authors begin in earnest to justify what they personally, and other Catholic writers with them, consider to be a more reasonable approach to the interpretation of the Scriptures. This is an approach which would have somehow to reason around the doctrines of original sin and the creation of the soul that the Church has held for centuries; for if evolution is accepted, a new theological understanding of these two basic dogmas is called for. To do this they summarize the writings of other churchmen:

> Adam is not an individual who lived on earth at a remote period of history but the concrete, individual representation of every man. He is, therefore, not a historical figure in the sense in which, for example, Napoleon is; nor is he a figure of pure imagination for *what he represents is realized historically in every human being.* Adam's sin is the concrete, symbolic representation of *every human sin.* . . . In its origin it is a sinful personal act carrying with it personal guilt and remorse; in its consequences it brings about a *sinful situation,* a state of separation from God, and leads man to sin personally, and so to make Adam's sin his own. Once it is fully apppreciated that the doctrine of Original Sin speaks primarily of the *present* situation of man, it will become of secondary importance how this sin is 'inherited' or 'transmitted (p. 54, italics theirs.)

They thus consider the traditional concept of 'biological transmission' as being inadequate, and that:

> It seems more helpful to ground the 'inheritance' of original sin in the social character of man's life and that of his sins. The individual man in his whole biological psychological make-up is to a great extent produced by the human society in which he lives. He is born into a situation where sin and evil are a sad reality, and prior to his own choice. He 'inherits' a sinful situation simply by being a member of the human family. . . . He is utterly powerless in face of the mess of mankind's sins and cannot remain unaffected. Thus, God's grace in Christ for him is not a special free gift, a privilege, but a saving power, a redemption (p. 54ff).

To seek scriptural and scientific justification for the above views, they point out that science assumes a polygenetic origin of mankind, and the *ha-adam* of Genesis 2 and 3 can readily be translated "man," "all men," "any man," or even "human race" (p. 56). Further, there is cosmic evolution, and the Paradisal state of Adam does not yet exist; it is part of God's original plan and will that it be the final state. Man cannot fall from a Paradisal state he does not yet possess, but he can, by refusing God's will, frustrate his own completion.

In objecting to the orthodox teaching of the Catholic Church that souls are immediately created by God, they turn to a book of Karl Rahner (*Hominisation,* Burns and Oates, 1965). Rahner objects to the traditional account on the grounds that it insinuates a Platonic conception of the soul-body relationship, and it also degrades God to the level of a secondary cause or makes soul-creation a miracle (p. 65). They then summarize Rahner's suggested theory of "becoming," in order to explain the creation of a soul:

> Evolution implies a real 'becoming,' a 'self-transcendence': an agent is moving beyond and above its own limits, and produces something that is genuinely greater than itself. Hence evolution appears as a movement from a 'lower' form to a 'higher' one, from a 'less' to a 'more'. But without God a finite being can never give itself a true increase of being. God however does not destroy the real self-transcendence of a finite being. He

> should never be conceived as a 'part cause.' He is the ground of the very possibility of every becoming. Any true development, any new being, is produced not partly by finite causes and partly by God, but wholly by the finite causes in virtue of the evolutionary dynamism God endows them with. For this reason God's creative activity is not an item in our experience; it is always mediated to us through finite things. . . . God is the transcendent and immediate ground of the whole evolutionary dynamism. The creative relation between God and man is different from the relation between God and brutes . . . because the two creatures are different and different in kind. . . . Thus, the creation of man, including his spiritual capacities, should not be regarded in itself as an exceptional, extraordinary or miraculous occurrence but an event which exemplifies in an eminent way all true becoming and self-transcendence (p. 65ff).

Nemesszeghy and Russell believe that Rahner's suggestion is not only compatible with the Bible but even more so than the traditional view. Earlier it had been hinted that the Church is slowly moving towards new interpretations which would be more compatible with the findings of science—after all, did not her theologians earlier work out a theology of redemption which embraced the Immaculate Conception (p. 63)?

In the last chapter, which deals with Teilhard, it is pointed out that this man has done more to help the world see that evolution can be understood in the context of Christian faith than has any other individual. For him the entire universe is oriented around Christ, not through redemption only but through creation as well, and even within the natural order its completion is to be found in him. The historical process is, for Teilhard, a vast phenomenon of Christification. First came biogenesis, then noogenesis, with the cosmic eventualizing process culminating finally in Christogenesis. "The whole of creation is, and was from the first moment, oriented towards that participation in the divine nature which Christ brings to the human race" (p. 87).

In the last paragraph of this paperback, the authors admit that Teilhard's synthesis has its defects, for its terminology is often obscure and unsatisfactory; it tends to overemphasize certain aspects of the picture; and the final conclusions are given an air of inevitability which may not be justified. But they feel that when all legitimate criticism is in, his vision of the universe as a unity in which all things are oriented toward the final consummation in the Mystical Body of Christ is both reasonable and important.

In this work Nemesszeghy and Russell have given some logical reasons for hoping to see the Catholic Church change some of its orthodox theology so that a theology of evolution could be incorporated within the doctrines of the Church. Evangelicals would do well to read the entire book, and at the same time if they wish to strengthen their own orthodox beliefs regarding creation, monogenism and the results of the fall, they can go to at least two recent books by Francis A. Schaeffer--*Pollution and the Death of Man,* 1970; and *Genesis in Space and Time,* 1972.

No doubt this book could have value for individuals in the scientific community who are theistic and seeking for a world-view which embraces evolution. Enough Scripture is quoted to spark a scientific interest in the Bible for further information. It might also cause a thinking individual to want to read from the writings of Teilhard, where he could find some spiritual food in *The Divine Milieu,* 1960, and in numerous collections of his letters. Yet to the reviewer, after reading Sir Julian Huxley's long introduction to Teilhard's *Phenomenon of Man,* 1959, it is evident that it is easy for the scientist to see what he wants to see and to miss entirely the emphases on the things of the spirit. He highly values Teilhard's friendship and considers him to have been a great man and that his ideas regarding evolution coincide in many respects with his own; yet he states that he finds it impossible to follow Teilhard "all the way in his gallant attempt to reconcile the supernatural elements in Christianity with the facts and implications of evolution" (*Phenomenon,* p. 19).

Reviewed by Henry H. Howell, Department of Biology, Asbury College.

SCIENCE AND CREATION by Stanley L. Jaki. Science History Publications, 156 Fifth Avenue, New York, N.Y. 10010 (1974). 360 pages. $15.00.

Why did science suffer a stillbirth in so many thriving cultures which had developed some of the mathematical tools and experimental techniques necessary for an ongoing and systematic investigation of nature which is the essence of science? Why did science start and become a self-sustaining enterprise only in Western European culture at the end of the so called "Dark Ages?" These are the questions that Dr. Jaki addresses himself to in this new and stimulating book.

Before going any further, it should be stressed that Jaki is primarily concerned with the birth of science and not technology, for many ancient cultures had developed thriving technologies. Technology concerns itself with invention and utilization of devices that serve some material, economic advantage. By science is meant the seeking of greater understanding of physical reality by utilizing systematically both quantitative observation and experimental manipulation of natural phenomena coupled with systematic mathematical analysis and theory formulation. Science is primarily concerned with the discovering of those regularities and relationships that are intrinsic to a variety of natural phenomena; basic science seeks to discover those recurring patterns and relationships that are truly universal in scope.

Jaki is concerned with the question of why science as defined above was born and grew to a self-sustaining enterprise only in one culture, that of Western Europe. Jaki argues that religious presuppositions deeply embedded in the fabric of many cultures prevented the healthy birth of science after promising starts had been made. He starts by giving a detailed analysis of the ancient Hindu, Chinese, Mayan, Egyptian, Babylonian, and Greek cultures. All of these cultures, especially the Greek, could boast of a valuable start in science. Yet in all of them science suffered a stillbirth; it did not become a self-sustained enterprise. A detailed chapter is devoted to the lack of development of science as a vital enterprise in each of these cultures; the book must be read in order to appreciate

the careful documentation of the effect of a particular culture's basic presuppositions (or world view) on beginning efforts to study nature scientifically:

> Great cultures, where the scientific enterprise comes to a standstill, invariably failed to formulate the notion of physical law, or the law of nature. Theirs was a theology with no belief in a personal, rational, absolutely transcendent Lawgiver, or Creator. Their cosmology reflected a pantheistic and animistic view of nature caught in the treadmill of perennial, inexorable returns. (p. viii)

These ancient cultures, often tacitly, thought of nature and God (or the Gods) as one, in many ways like a huge world organism which by its very nature is capricious, governed by whim. Such a view of reality which was further thought of as repeating itself in endless cycles gave insufficient motivation to explore and change reality for the better. Such world views did not provide "in sufficient measure, confidence in the rationality of the universe, trust in progress, and appreciation of the quantitative method, all indispensable ingredients of the scientific quest." (p. viii)

Why did science undergo a successful birth and grow to maturity in Western Europe beginning in the late 1200's? The Medieval World's whole culture was permeated by a set of presuppositions arising from Hebrew and Christian convictions. The early Hebrews and Christians were not directly interested in scientific endeavors. A major portion of their time was spent on surviving amid antagonistic, much stronger pagan cultures; they did not have the time to develop scientific inquiry into nature, but they left a legacy to the Medieval World that eventually resulted in the birth of science. That legacy is present in both Old and New Testaments. The Old Testament resounds again and again with:

> . . . the natural echo of the theme which sets the tone of the first pages of the Bible about the ultimate characteristics of external nature; It is good. The exclusion of an evil principle of equal rank with God entails in turn that the biblical world view has no room for a concept of nature in which capricious, dark forces dominate. Again, within the context of the Covenant, the world is not an all-encompassing entity containing the source of all life, human and divine, and unfolding that life through inexorable, blind cycles. The world, being the handiwork of a supremely reasonable Person, is endowed with lawfulness and purpose. These are the direct result of the never failing and benevolent surveillance by Yahweh over the entire world. The regular return of seasons, the unfailing course of stars, the music of the spheres, the movement of the forces of nature according to fixed ordinances are all the results of the One who alone can be trusted unconditionally. Thus, the prophet Jeremiah praises the faithful recurrence of harvests as the sign of God's goodness. Moreover, he establishes a remarkable parallel between Yahweh's unfailing love and the eternal ordinances by which Yahweh sets the course of stars and tides of the sea. (p. 150)

Jesus's teachings reaffirmed the message of the Old Testament on God's creative activity. He clearly pointed out that truth must be looked for in an honest, open fashion. This attitude is essential for science, "For it is the very soul of science to call a fact a fact in all truth and honesty. Such an attitude cannot emerge in the relatively narrow field of scientific pursuit if parodies of facts, norms, and values are taken for genuine along much of the gamut of human experience." (p. 156) Only by seeking the truth and committing ourselves to this goal can we be truly free. Jesus also continued the Old Testament teaching of creation:

> The principal aim of the Master from Nazareth consisted in bringing out the basic feature, love, in the image of Father and Maker of all. If what he said about the love of God and neighbor was already extraordinary, no less astonishing was the effectiveness of his words and his matchless remarks concerning creation. He kept his own life in utter compliance with the Father's will. That will, to recall some of his inimitable remarks, governs the whole of creation, keeps clothing the lilies of the field, prevents sparrows from falling to the ground haphazard, and instituted the human race, as man and female, from the creation. Deep-seated consciousness of the unique importance of the creation sets the tone of one of his few recorded utterances of prayer that starts with the exclamation: 'I bless you, Father, Lord of Heaven and Earth!' (p. 156)

The theme that the reasonability of the Creator is coupled to the constancy of nature provides a background from which one can think of the autonomy of nature and its laws. It took centuries, however, of crises facing believers in one God, Hebrew and Christian, in order to show the enduring vitality of the biblical heritage of the Creator. Once the vitality of the trustworthiness of the biblical heritage becomes embedded in the mind set of an entire high, medieval culture it became possible for scientific exploration of the world to begin and become self-sustaining.

There was one other culture, besides the Hebrew-Christian culture, that had access to many crucial biblical presuppositions; that was the Arabic, Muslim culture. At the same time that the Medieval, Western European world was acquiring knowledge of the science of antiquity through contact with Arabic culture, the Arabic world was studying these same documents and making attempts to explore nature. Arabs made many original contributions to mathematics and to medical science; yet their efforts to improve

and build from the rudimentary science of the ancients never blossomed forth into an ongoing scientific examination of the world. Why? Jaki provides detailed documentation that their Muslim religious faith emphasized a transcendent creator of all reality, but greatly overemphasized the essentially unknowable will of God as creating and holding in moment-to-moment being of all nature. The Arabs, in turn, deemphasized the essential biblical teaching that an intrinsic part of God's nature as loving Father is rationality and trustworthiness. Such a set of religious presuppositions provided no sustained motivation to look for rational laws undergirding physical phenomena and science eventually came to a standstill among the Arabs despite many worthy accomplishments. The conflict between consistent laws of nature and the willfulness of Allah was ultimately resolved in Arabian culture by the former being sacrificed for the latter; thereby, science suffered a stillbirth in Arabian culture.

In the latter half of the book Jaki traces the beginnings and developments of science from the so-called "Dark Ages" to the present day. There were many false starts and much overreliance on Aristotle's faulty physics, but men slowly began to see that systematic observation and experimentation were necessary in order to understand nature.

Jaki traces this change of outlook to three biblical presuppositions that kept asserting themselves in late and Renaissance medieval culture. First was the affirmation that men were made in the image of a rational God who created and continually holds in being all physical reality. In those times men believed that:

> . . . nature was the work and a faithful symbol of a most reasonable Supreme Being. Therefore, nature, in analogy to her maker, could only be steady and permeated by the same law and reason everywhere. From permanence and universality of the world order followed, for instance, that the same laws of motion were postulated for the earth and the celestial bodies. It also followed that regularly occurring phenomena, such as tides, baffling as they might appear, should not be assigned a miraculous cause. The most important consequence of the permanence and universality of the world order anchored in the Christian notion of the Creator was the ability of the human mind to investigate that order. Such was an inevitable consequence if both nature and the human mind were products of one and the same Creator. . . (p. 278)

Second was the affirmation that man was given the universe to subdue and maintain as God's steward. Man was commanded to gain dominion over all physical reality. Certainly experimentation was a reasonable way to gain dominion by first seeking to understand physical processes.

Third was the affirmation that the universe is a created universe; it is contingent in every respect of its existence on the creative act of God. Many ancient cultures including the Arabs thought of the universe as necessary, not contingent. If it were necessary, *a priori* reasoning could perhaps determine the basic nature of physical reality. If, however, physical reality is contingent, then the only way that man could seek to understand it is by observation and experiment.

The men, Copernicus, Galileo, Kepler, Newton, who today's science textbooks state first studied motion (on earth and in space), thereby starting modern science, were an unusual group. They relied on the insights into motion of their medieval successors such as Buridan, often not acknowledging their indebtedness to this earlier work. (Jaki clearly documents the first steps that were made toward an experimental study of motion, divorced of many of Aristotle's tenets. These steps were made, in the so-called "Dark Ages" by men with Christian mindsets that made them open to attempt experiments and consider concepts other than those of the ancients.) They often did not even acknowledge work by others of their own time. Both Kepler and Galileo saw nothing inconsistent in casting horoscopes for kings and patrons while pursuing serious scientific study of motion on earth and in space. Yet these early founders of modern science had a firm conviction that the universe was structured rationally and that structure could be determined by observation, experiment, and mathematical description. Copernicus was typical as Jaki points out:

> The simplest ordering of the planets according to Copernicus was 'the sure scheme for the movements of the machinery of the world.' This had to be as the machinery in question 'has been built for us by the Best and most Orderly Workman of all.' (p. 260)

Jaki presents the Renaissance as an attempt to deviate from the linear world view implied in the belief of creation to the pagan idea of eternal recurrences. Such efforts stifled science's growth in all pagan cultures in Greek and Arabian efforts toward scientific understanding. Jaki also shows in confirmation of this thesis that the anti-scientific trends of the 19th century, largely derived from German idealism, instinctively went back to the pagan notion of eternal returns.

Human Engineering and the Future of Man

The *American Scientific Affiliation,* along with eight other major evangelical organizations*, is cosponsoring the International Conference on Human Engineering and the Future of Man (ICHEFM), July 21-23, 1975 at North Park College, Chicago, Illinois.

This highly significant conference will formulate a preliminary value framework to address specific control issues raised by research in genetics, electro-chemical intervention and behavior conditioning. In addition to several addresses by nationally respected experts from both the evangelical and non-evangelical communities, there will be substantial small group dialogue between conference participants. A special 20 member ICHEFM Commission made up of technical specialists, theologians, lawyers, sociologists, philosophers and ethicists is also being developed to provide dialogue direction and post-conference output.

Registration will be $60 (deadline: May 1, 1975). Room and board at the college for two nights and three days is expected to be approximately $25. For further information, contact:

Dr. Craig W. Ellison
Director, ICHEFM
955 La Paz Road
Santa Barbara, Cal. 93108

*Center for the Study of the Future, Christian Association for Psychological Studies, Christian College Consortium, Christian Legal Society, Christian Medical Society, Evangelical Theological Society, Insitute for Advanced Christian Studies, Institute for Christian Studies (Toronto).

Jaki then traces the growth of modern science, with particular emphasis on cosmological questions, to the present day. This reviewer has attempted to give the reader a brief introduction to some of the major themes in the book. The book must be read in its entirety to appreciate the wealth of detail it contains on both pre-scientific cultures and Western culture where science has grown to maturity. It is an exciting and stimulating book. It should be read by all Christians and non-Christians who have scientific interests and want to see how religious convictions have had a healthy impact on world history by aiding in the birth and growth of modern science.

Modern scientists of our age have been looked upon as "religious" prophets by a large percentage of the lay public. Yet the scientific community has become increasingly appalled as they observe the knowledge gained of nature in nuclear physics and in biology being used to create weapons of mass-destruction and techniques to manipulate and alter the human personality. Some sincere young people (and some elders) have turned away from science as a profession, seeing it as lacking in emotional, moral, or religious content. These people could benefit much from reading *Science and Creation* concerning the true nature of science as a human activity with its own pecular strengths and limitations. Indeed the history contained therein as to how science gave birth and grew in only one culture should clearly indicate to all sincere persons how science is intimately linked to human presuppositions embedded deeply in the fabric of a particular cultural climate. As Jaki points out, today there is a:

> . . . steadily growing realization that the man of science, no less than his counterpart in religion, lives ultimately by faith. With the mirage of positivism now being unmasked, it is easier to recognize that the scientific enterprise rests on a conviction which pre-supposes far more on man's part than the mere juxtaposition and correlation of the data observation. The conviction in question is nothing short of a faith which, like religious faith, consists in the readiness of going beyond the immediately obvious. The step is not a glib conjection about a deeper layer. It is rather a recognition of the indispensible need of such a layer if the scientific enterprise is to make any lasting sense. It is in that deeper layer that notions like the intelligibility, simplicity, and lawfulness of nature are taking on a meaning which demands absolute, unconditional respect and acceptance. It is that deeper meaning which science must command if its laws should be considered not merely lesser manipulations of terminology and data, but a concrete encounter with the real structure of nature.
>
> That real structure is not an *a priori* construct. Efforts, ancient and recent, aimed at deriving the shape and structure of the cosmos from preconceived considerations have one thing in common: their miserable failure. The universe is an entity which is given, in the most ontological sense of this word. This feature of the universe . . . is again imposing itself on the enquiring mind with elemental force due to the rather recent but inevitable acceptance of the finiteness of world in matter and space. There will, of course, be many who keep trying to show up their Spinozean pantheism and immanentism by desperately claiming infinity for the universe along the perimeter of time. Neither science nor scientific history will be their ready allies . . . science owes its only viable birth to a faith, according to which the world is a created entity, that is contingent in every respect of its existence on the creative act of God, that its existence has an absolute origin in time, majestically called 'in the beginning' . . . The presence and past of scientific history tell the very same lesson. It is the indispensibility of a firm faith in the only lasting source of rationality and confidence, the Maker of heaven and earth, of all things visible and invisible. (pp. 356, 357)

Dr. Jaki is to be highly comended for his sensitivity, graciousness and fairness in analyzing the religious presuppositions of cultures other than the Judaic-Christian culture of the Western world. His book is a most original synthesis carefully documented in every detail. Science and religion are seen as allies in a new, broader perspective.

Reviewed by W. Jim Neidhardt, Dept. of Physics, Newark College of Engineering, Newark, N.J. 07102

Books Received and Available for Review

(Please contact the Book Review Editor if you would like to review one of these books.)

Maguire, Daniel C., *Death by Choice*, Doubleday, 1974.

Morey, Robert A., *The Bible and Drug Abuse*, Baker Book House, 1973.

Schaeffer, Francis A., *No Litle People*, IVP, 1974
Introduction to Francis Schaeffer, IVP, 1974.

Steffenson, Dave, W. J. Herscher and R. S. Cook, *Ethics for Encironment: Three Religious Strategies*, University of Wisconsin at Green Bay Ecumenical Center, 1973.

Williams, Robert H., *To Live and To Die: When, Why and How*, Springer-Verlag, 1974.

Williams, Rheinallt W., *Faith/Facts/History/Science and How They Fit Together*, Tyndale House, 1973.

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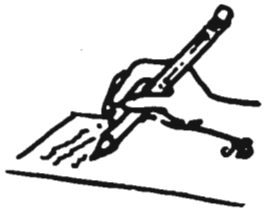

We regret that the number of manuscripts awaiting publication and the increasing number of Communications make it impossible for us to publish all of the Communications received, as we have in the past. We will do our best to publish representative Communications as space permits. We continue to urge you to write to us, however, and promise that we will respond as best we can to your comments and suggestions.

Responses to "Is There a Christian Basis for a Sexual Revolution?" (*Journal ASA*, June 1974)

The best perspective on proper hermeneutics lies somewhere between Bube and Roy. On the one hand, there are biblical and extra-biblical criteria for determining what is a just or loving or gracious action. These criteria are quite inter-subjective and knowable and their systematization results in biblical and extra-biblical laws. This is very close to the emphasis of Bube. But some of the criteria can and do change with time and space and conditions, and therefore the form and content of the laws based upon them change, too. This is why many of the prescriptions of the Old Testament have lapsed into desuetude. There is no theological or any other kind of objection to this type of irrelevance. This, I take it, is very close to what Roy says.

Allen Harder
Department of Philosophy
Iowa State University
Ames, Iowa 50010

Rustum Roy's pitch for sexual liberty and situation ethics shows how clever the human mind can be in rationalizing its desires when its tether is loosed from the Word of God. His questioning of the interpretation or revelance of certain passages can be summarized in the words of his mentor, "Yea, hath God said?" He apparently has read the book of Galations: I suggest that he read Jude next.

The window opening to the left – the enmeshing dialog with the apostates – will blind us to the handwriting on the wall.

Frank Vosler
8011 Morse Rd.
New Albany, Ohio 43054

What a brave attempt in "Is there a Christian Basis for a Sexual Revolution?" and what a pathetic waste of space.

In Roy's words, "Is not the pre-occupation with sex instead of love wholly a waste of time and energy for Christians today?" But why then does he occupy himself with questionable analogies, twisted injunctions, and pure self-contradictions to establish his position on SEX? Isn't this just the plain centuries-old process of self-justification we all like to find for ourselves when out of tune with God?

And as for Bube, what he writes is for the most part excellent, except it has that quality - rather like pulling one's punches - so that when he has finished he has seemed to have not done justice to his arguments, and the remarks rather fall flat. Is this perhaps because the entire subject ought not to have been "How a Christian sex life should appear" - but "How, really, does a Christian meet God's desires of LOVE, and of what does a life IN Christ really consist?"

Joseph F. Paydon
Department of Mathematics
U.S. Naval Academy
Annapolis, Md 21401

I as a Christian believer was appalled that we are even permitting such a dialogue in our Christian journals such as Dr. Roy proposed. I am sure that he and others who believe with him in his proposals have many arguments that they would throw at me to validate their position. I am not capable of going into all the sociologic arguments that the proponents of liberation in sexuality put forward. However as a practicing physician and a Christian I can testify clearly to the wisdom of God regarding the sanctity of marriage and conversely to the terrible results of people who will not accept God's direction for human beings in the area of marriage and sexuality.

I would hope that the A.S.A. would not pursue obvious anti and un-Christian avenues of discussion. There is much more that should be done in this field without seemingly accepting un-Christian ethics.

Floyd L. Rheinheimer, M.D.
Box 128
Milford, Indiana 46542

I believe it is extremely significant, and I trust more than coincidental, that the June 1974 issue of the *Journal* began with an article which at least touched on the large subject of biblical interpretation, while the last article consisted of your dialogue with Rustum Roy on the issue of the sexual revolution.

My reaction to the dialogue was that Roy is almost totally illiterate in the field of hermeneutics. In my ministry I have discovered that most people–including good church-goers–are caught in the same difficulty. Either conscious or unconscious blind rejection of the simple and clear meaning of a Scripture passage in favor of what I want it to say is called "my interpretation." This is the only way in which such absurd propositions as Roy's can even be considered in the context of the Christian faith today.

Thomas R. Teply
First Presbyterian Church
Anchorage, Alaska 99501

I appreciated Roy's willingness to air his views in response to Bube's critique, and that appreciation increased as I saw the diversity of their positions. Nevertheless, I found myself, reacting negatively to Roy's views on very basic issues.

Rustum Roy's "highly selected quotations" on law vs. grace distort the nature of grace. Even in Gal. 5 the works of the flesh are described as *evident*, not shrouded in subjective ambiguities. Sexual sins are held in sorry contrast to the love-fruit of the Spirit.

To regard fulfillment of sexual desire a necessity goes beyond the teaching of our Lord. Food and clothing are the only physical basics that Jesus accepts as needs in his Sermon on the Mount.

"Sexual affluence". Roy's favorite catch-term, is also misleading, technological accessories not with-standing, since the Creator has supplied the same basic equipment to every generation. Stolen sex is as old as the thief but *Honest Sex* is a deductive rip-off. And squandered sex is never affluence, just inflation.

That large segments of the church of Jesus Christ will be increasingly conformed to the world in sexual mores is a saddening probability. That it should intentionally be led this way of Balaam is nonsense. The last state would be worse than the first.

Is there a Christian basis for a sexual revolution? No, but it would take a Balaam's cure to restrain the madness of these prophets.

Mark Peterson
328 N. Palm St.
Janesville, Wisconsin 53545

A Micro-Dialogue on Micro-Evolution

The question keeps coming up: Is it proper for a creationist who believes God made the world in six days to say he believes in "micro-evolution"?

Changes which can come about through breeding programs, such as increasing the milk production in cattle, have been called "micro-evolution."

Another kind of example of "micro-evolution" is the case of the environmentally related change in the relative population of light and dark moths in England. The light and dark moths are merely different color phases of the same kinds of moths, and they are not becoming anything different. In spite of this, scientists write of these moths as representing an unusually good illustration of evolution.

The blue goose and the lesser snow goose were long considered to be different species, but recently it has been found that they are merely different color phases of the same species. But because some environments favor one and other environments favor the other, the relationship between them is called evolution.

Although these examples of environmentally related changes are true, they are *not* examples of *any* kind of evolution. It is as though someone said, "When there is lightning Jupiter is throwing thunderbolts," and then Christians would say, "It is true that there really is lightning, so it is all right for us to say we believe in Jupiter." The observed facts called "micro-evolution" are no more evolution than lightning is Jupiter throwing thunderbolts.

Why is there an issue over this matter of "micro-evolution"?

1. The evolutionists must and do assume that "micro-evolution" is real evolution. Although it has not been demonstrated that it has any connection with real evolution (such as molecule to man, or worm to walrus, or fish to frog), if real evolution did occur there seems to be no alternative but that it came about through the kinds of changes which are called "micro-evolution."

2. "Micro-evolution" is a "brainwashing" term. Because the phenomena referred to as "micro-evolution" are factual, some creationists say, "We believe in 'micro-evolution.'" The Christian laity gets the idea that it is all right to accept *some* evolution. Although this may be done innocently, the effect is the same as though done intentionally to deceive. It is similar to the case where men say that driving on the freeway is gambling. Driving on the freeway is *not* gambling and it does not lead to real gambling. Those who say driving on the freeway is gambling are the professional gamblers and others who expect to profit from gambling.

There is a natural trend for creationists who compromise with evolution to become more and more evolutionary in their outlook. This has happened repeatedly in Christian schools where compromising with evolution accompanied the trend toward liberalism in theology. An instructive illustration of this trend occurred in an organization founded by Christian men of science to defend the Bible against the attacks of non-Christians in the area of science.[1] As its leadership began to compromise with evolution it also vigorously denied that it was doing so. But at last it went so far that a prominent spokesman for the group[2] wrote favorably of the "Christian evolutionist" in one of his books.[3]

The matter revolves around accepting or rejecting a definition of what evolution is. If someone defines a buzzard as a coffeepot, then it is true that coffeepots lay eggs and gorge themselves on rotting flesh. However, discerning people will endeavor to keep the issue straight and not be deceived, especially when it is a matter of such importance as evolution.

1 The American Scientific Affiliation.
2 The Editor of the *Journal ASA*.
3 *The Human Quest*, Word (1971), p. 184.

Bolton Davidheiser
Box 22
La Mirada, California 90637

A Christian evolutionist is no more nor less than a person who is committed to Jesus Christ as Lord and Savior, who believes that the biological theory of organic evolution is the best currently available scientific description of the development of life.

Little is usually served by attempting to use words in a way inconsistent with commonly accepted usage. As what I take to be an accepted usage of the term evolution, I quote from a draft of a statement prepared by the Science Committee Curriculum Development and Supplemental Materials Commission of California:

> "The process of change through time is termed evolution. . . . The concepts which are the basic foundation for this theory are: (1) that inheritable variations exist among members of a population of like organisms; and (2) that differential successful reproduction (i.e., survival) is occasioned by the composite of environmental factors impinging generation after generation upon the population."

Given this universally-accepted definition of evolution, it follows that the changes referred to may be minor, easily observable in contemporary experimentation, or major, postulatable on the basis of geological and paleontological evidence but by their very nature not directly observable. To call the former "micro-evolution" and the latter "macro-evolution" does not commit one to some kind of philosophical position: one can consistently accept "micro-evolution" as self-evident and reject "macro-evolution" as not sufficiently established, or even as essentially contradicted by the data. Davidheiser may object to the use of these terms because of his personal convictions, but his dialogue with the rest of the scientific world is not going to benefit from the invention of a private vocabulary.

Such a private vocabulary is evident again when Davidheiser appropriates the term "creationist" to refer only to those who believe that "God made the world in six days." I maintain that biblically and historically, a creationist is one who believes in divine creation: that God brought forth all there is in the universe with all the biblical implications that such a position entails. Within Davidheiser's private vocabulary system, it is indeed true that a "creationist" cannot believe in "micro-evolution," but what Davidheiser means by this assertion is that since he believes that there was never any process of evolution, it is improper to call any existing process a process of evolution. If some portion of the world strives to gather emotional support for macro-evolution by referring to observable genetic variation as micro-evolution, Davidheiser uses the same technique in striving to gather emotional support against macro-evolution by referring to creationism as a belief in a six-day *fiat* event. Is it not better simply to agree on the meaning of words and then decide whether or not the positions symbolized deserve support rather than attempting in either way to achieve a purely semantic victory?

In making the statement, "If evolution is true, we are becoming better," Davidheiser is attempting to establish an ethical or theological conclusion as if it necessarily followed from a biological theory. As a matter of fact, the biological theory of organic evolution can say absolutely nothing about conditions such as "better," nor about man's need for a Savior, nor about the Person and work of Jesus Christ, our Lord and Savior. Davidheiser may quote men who mistakenly have thought that biological evolution permitted them to generalize in this philosophical and non-scientific way, but it should be well established by this time that no scientific position can provide an ethical foundation by itself, quite independently of whether the ethical position being considered is consistent with or inconsistent with Christian ethics. Davidheiser does not contribute to the growth of the maturity of the Body of Christ by arbitrarily branding those who might be willing to contemplate the organic theory of evolution as a description of God's creative mode of activity, as though they were in fact deniers of Christ.

Richard H. Bube

Bube desires words to be used in a way consistent with commonly accepted usage. Reference to any typical college textbook which treats the matter of evolution will reveal that total evolution from something very simple to all forms of life on earth, including human beings, is what is taught. Bube cites a definition of evolution "universally accepted" which defines the phenomena of "micro-evolution" as real evolution. This is exactly what I said: "The evolutionists must and do assume that 'micro-evolution' is real evolution."

Bube further says that "one can consistently accept 'micro-evolution' as self evident and reject 'macro-evolution' as not sufficiently established, or even as essentially contradicted by the data." This is not the issue. I emphasize that the data of so-called "micro-evolution" are factual. The question is: Is it really evolution? To this I say NO, it is not any kind of evolution.

He attributes my objection to the term as due to my personal convictions and accuses me of inventing a "private vocabulary." On the contrary, I have treated facts. My personal convictions have nothing to do with it except to emphasize the importance of the issue. I use terms the same way that everyone else does and no private vocabulary is involved.

I am accused of having a private vocabulary again by using the term "creationist" "to refer only to those who believe that 'God made the world in six days.' " I am doing nothing of the sort. I am merely distinguishing such creationists from other kinds of creationists. As far as I am aware, those who consider themselves creationists and do not believe God made the world in six days do not feel they have a problem with the so-called "micro-evolution" because they are willing to go along with the evolutionists in accepting it as a part of creation through a certain amount of evolution.

Bube says that according to my private vocabulary system a creationist cannot believe in "micro-evolution" because there never was a process of evolution and so it is improper to call any existing process a process of evolution. What I said was that it has not been demonstrated that the phenomena of the so-called "micro-evolution" have any connection with alleged real evolution, the so-called "macro-evolution."

I desire no "semantic victory," as he implies and I said that "discerning people will endeavor to keep the issue straight." I am a biologist and not a theologian and I believe it is not necessary to be a theologian to see that according to evolutionary theory we *did* become better, by the commonly-accepted meaning of the term, as we evolved from the lower animals, in contrast to having fallen from a state of perfection in creation. The questions involved related to redemption *are* of vital importance. One does not need to be a trained theologian to understand this. In fact, at present in our country the majority of trained theologians are on the side of the evolutionists!

From a "scientific" point of view the question is whether or not to accept "micro-evolution" as real evolution in spite of lack of evidence for it and because evolutionists with an ax to grind *define* it as real evolution.

Bolton Davidheiser

On one notable occasion when a great discussion was going on among the Jews about his credentials and authority Jesus replied, "Whoever has the will to do the will of God shall know whether my teaching comes from him or is merely my own." (John 7: 17) Here I suggest, we have basically an appeal to all that is true and honest in the scientific *attitude: an appeal to test for yourself, to allow your experience an opportunity to bear out the truth of what he claims.*

Donald M. MacKay
The Clockwork Image,
InterVarsity Press, 1974, p. 101

Pseudoscience

During the last few years elements of the public and particularly of university students have turned increasingly to mysticism and to what I would call pseudoscience. The top sellers at campus bookstores have included such books as *Chariots of the Gods?, Gods from Outer Space, Limbo of the Lost, The Secret Life of Plants,* and others like them.

The recent pseudoscience books are in part a form of science fiction, but they have characteristics that make them different. The readers of earlier works generally understood that they were scanning fictional material, but the new books seek to create the impression of scholarship and verity. *Chariot of the Gods?* does this in several ways. It has a bibliography. In an introduction it acknowledges help from personnel of the National Aeronautics and Space Administration, including Werner von Braun. The book also contains some respectable scientific material. But the author moves quickly and without warning from fairly solid facts to unsubstantiated speculations.

Another tendency of the pseudoscience books is to evangelize in behalf of fantasies and in the process to denigrate science. For example, in the best-selling *The Secret Life of Plants,* the authors state "what makes plants live, or why, does not appear to be the purview of science." They describe botany as being "reduced to a dull taxonomy."

This is, of course, untrue. One of the great scientific frontiers today is research in plant biology.

The scientists of the so-called establishment are berated because they did not accept the suggestion that plants were capable of emotions which "might originate in a supramaterial world of cosmic beings which, as fairies, elves, gnomes, sylphs, and a host of other creatures, were a matter of direct vision and experience to clairvoyants among the Celts and other sensitives."

In *Limbo of the Lost* the author devotes most of the book to an enumeration of disappearances of ships and planes in the general area of the Bermuda Triangle. In a concluding statement, the author gives his explanation for the information he has produced. He ties the disappearances to unidentified flying objects and concludes that a large ocean vessel and commercial airlines were "actually being taken away from our planet for a variety of reasons."

Much of the appeal of the new pseudoscience seems to relate to a deep-seated quirk of human nature--a predisposition to believe in the supernatural. Part of the appeal of these books is that they are entertaining, interesting, and even exciting. The danger from them is that uncritical and undiscriminating minds may accept imaginative speculation as fact. An optimist might take the view that the current craze for this new form of science fiction will go away, just as streaking departed. But already these types of books have been in demand for several years.

The popularity of pseudoscience books at universities should be a source of concern to academic people, particularly scientists. The new trend comes at a time when many universities have abandoned requirements that students be exposed to as little as one science course. It is not pleasant to contemplate a situation in which our future leaders are being steeped in fantasy and are exposed to a put-down of science without effective response. The university community has a special obligation which it has not been meeting very well. It should move toward providing antidotes to the new intellectual poisons. In meeting these challenges to rationality, we should all remember that although humanity is eager to accept mysticism, it is also capable of yearning for truth.

Philip H. Abelson *Reprinted from* Science *184, No. 4143, June 21, 1974.*

Founded in 1941 out of a concern for the relationship between science and Christian faith, the **American Scientific Affiliation** is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. The *Journal ASA* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

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PUBLICATIONS include the *ASA News* (sent to all members four to six times each year); three symposia: *Modern Science and Christian Faith*, F. Alton Everest, Editor, Van Kampen, Wheaton, Illinois (1950) (out of print), *Evolution and Christian Thought Today*, Russell L. Mixter, Editor, Eerdmans, Grand Rapids, Michigan (1960), and *Our Society in Turmoil*, G. Collins, Editor, Creation House, Carol Stream, Illinois (1970). Individual authors are also encouraged to publish independently.

LOCAL SECTIONS of the American Scientific Affiliation have been organized to hold meetings and provide an interchange of ideas at the regional level. Membership application forms, ASA publications and other information may be obtained by writing to: AMERICAN SCIENTIFIC AFFILIATION, Suite 450, 5 Douglas Ave., Elgin, Illinois 60120.

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