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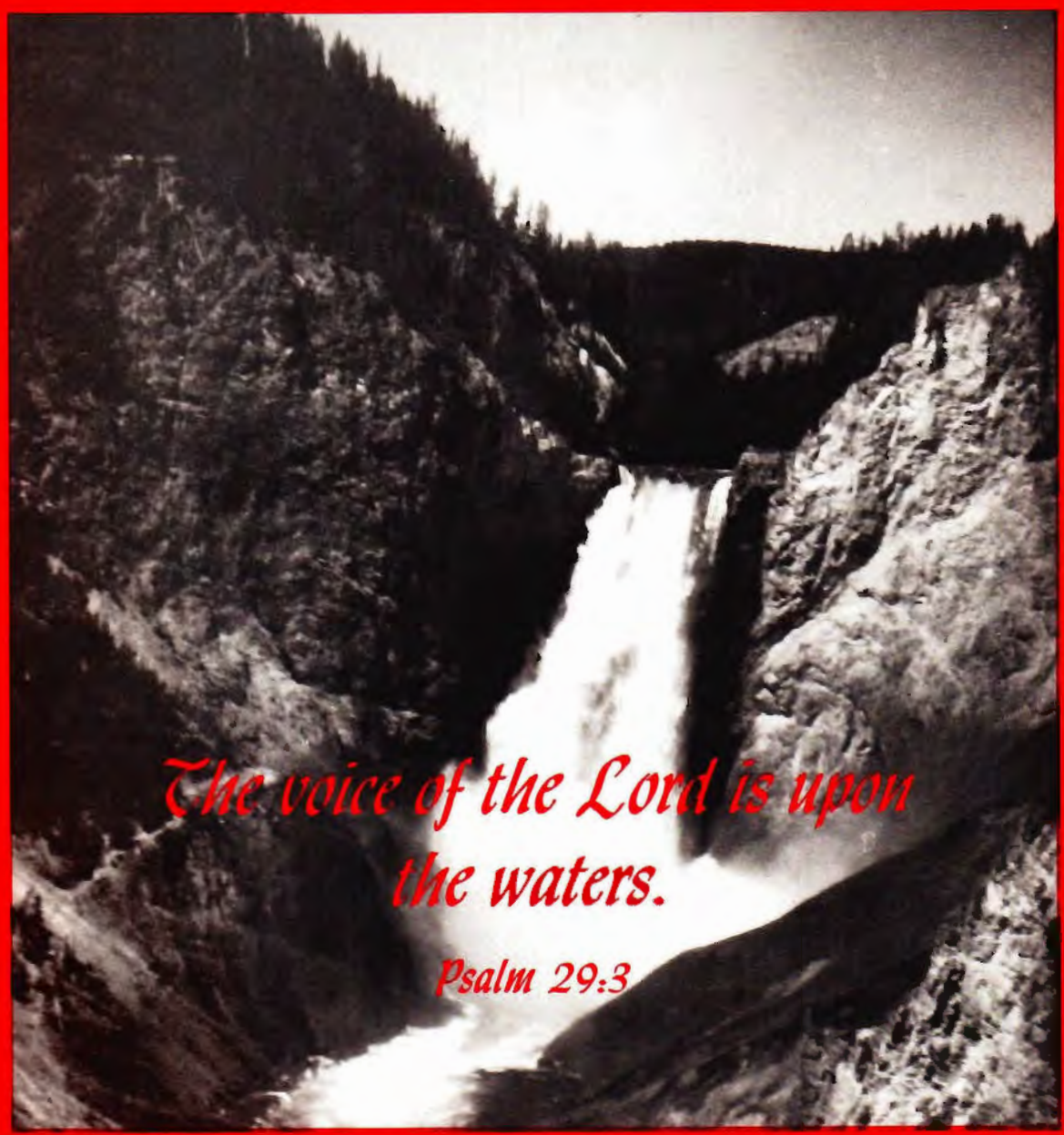

"The fear of the Lord is the beginning of Wisdom." Psalm 111:10

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Cover: Lower Falls, Yellowstone Canyon, Yellowstone National Park.

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Non-Radiometric Data Relevant to the Question of Age

DANIEL E. WONDERLY

Rt. 2, Box 9
Oakland, Maryland 21550

Within the past twenty years several useful types of age-indicating data have become available. An abundance of objective research reports on these subjects can now be easily found in scientific journals and other publications. It is time for creationists to begin to make far more use of such reports than we have in the past. We have often failed to realize that these are very helpful in making estimates of the earth's age. The record of God's work in nature is far more complete, informative, and worthy of consideration than we have usually thought.

It is our purpose here to list some of the specific types of data available, giving a few selected bibliographic references for each type. These sources have been carefully chosen with a view to their being sufficient to serve as at least a "starter" for anyone wishing to pursue a given subject. Most of the sources themselves also have good bibliographies, which will readily enable any interested person to locate numerous additional articles on the subject. An effort has been made to choose those articles and monographs which consist primarily of the objective results of research rather than of theory. However, in the references in which evolutionary theory may appear, the presence of some theoretical material need not obscure the facts which were obtained in the research. The reader should keep in mind that long periods of time do not necessarily imply evolutionary development, and that all of the types of data which are listed below appear to be in keeping with the historical account of

This paper was presented at the 1973 annual meeting of the ASA. The author was formerly Head of the Biology Department at Grace College, Winona Lake, Indiana.

creation that we find in Genesis 1 and 2.

Most of the bibliographic entries are available at the geology library of practically any large university. Other materials can be obtained from the geological societies of major oil producing states, and by means of interlibrary loan. The addresses of most of the geological societies are found in a special Directory section near the back of each issue of the *American Association of Petroleum Geologists Bulletin*. Many of the sources can be used and understood without an extensive background in geology. This paper is basically a *listing* of types of data, rather than a composite monograph. There is a separate bibliography for each section. The reader will thus be able to consider any one subject separately, and locate the bibliographic references for that subject easily.

Carbonate Deposits

Drilling records from the sedimentary carbonate deposits of the Great Bahama Bank, off the coast of Florida. This is a multilayered deposit of various forms of limestone and dolomite somewhat in excess of 14,500 feet in thickness. In the deeper parts, dolomites alternate with limestones, with evidence of erosion between four major cycles of deposition. Identifiable fossils were found to a depth of at least 10,600 ft. Alternations between limestone and dolomites in this and similar formations indicate at least a corresponding number of changes of environment during deposition and during the process of dolomite formation. (See below on dolomite formation and on limestone formation.) Also, the unconformities, at the levels where erosion is revealed, must represent significant amounts of time.[1]

Ooids

The distribution and rates of formation of the small, spheroidal bodies known as ooids, oolites, or ooliths. (The term oolite is more properly used of rocks containing the individual ooids.) Most ooids are concentrically laminated, around a core of extraneous material such as a grain of sand, a small shell fragment, or a recrystallized fecal pellet. This process of adding concrete layers (which can be readily observed with a microscope) is accomplished by a slow accretion of mineral which is extracted from the sea water on the beach where the ooids are being formed. The present-day formation of carbonate ooids is observable on numerous shores where shallow water carbonate deposition is taking place. Oolitic limestone, with ooids of various types, appears at numerous levels in the Great Bahama Bank and in many other carbonate deposits.[2]

Sediments

The similarities between the order of deposition of present-day marine sediments, and the order found in deep subsurface sedimentary deposits in oil fields. These similiarities are now being used by oil research geologists for understanding and predicting the arrangement of older deposits deep in the earth. This research also deals with paleoecological topics, such as the faunal associations and ecological succession found in ancient strata, and compares them to modern faunal associations observed in shallow-water depositional environments. Even though we cannot accept all the tenets of uniformitarianism, the close similarities between modern marine carbonate deposition and these ancient deposits demand that we recognize slow, natural deposition as accounting for many thick carbonate deposits in the oil fields.[3]

Oceanic Sedimentation

The thickness and arrangement of the layers of carbonate and siliceous skeletal remains found on the ocean floor, formed by the accumulation of the shells of Foraminifera, Radiolaria, and other planktonic organisms. A comparision of the thicknesses of such deposits with current rates of deposition of these skeletons in parts of the ocean floor where there is no evidence of rapid deposition or recent disturbance is meaningful. Of special significance are the pelagic sediments found in isolated parts of the ocean, such as on the tops of certain seamounts and abyssal hills, which are far enough from land masses that the rate of deposition is not appreciably affected by currents bringing sediments from those land masses.[4]

Plant and Invertebrate Skeletons

Present-day burial and fossilization of calcareous plant and invertebrate animal skeletons in marine coastal environments, on the sea floor, and in the subsurface of modern reefs. It has sometimes been said that processes of fossilization are not occurring today, but recent studies of marine coastal environments have revealed numerous cases of the current formation of fossils.[5]

Dolomite Formation

The rate of dolomite formation in modern marine environments, combined with a study of ancient formations which exhibit alternating dolomite (dolostone) and calcium carbonate (limestone) strata. In recent years the process of natural dolomite production has been observed and studied in several marine environments which have the proper conditions for the necessary magnesium ions to be extracted from the sea water and deposited. There are many lines of very strong evidence indicating that practically all dolomites—both ancient and modern—are formed by a process of replacement of calcium carbonate particles in lime sediment or limerock. In order for dolomitization of such sediment or rock to occur there must be a ratio of Mg and Ca ions in the water which will favor the formation of dolomite, and there must be an extensive circulation of the water over the sediment or through pores in the rock. Because dolomization proceeds by ion exchange it is of necessity a slow process, and can not occur to any appreciable degree without extensive circulation of water.[6]

Deposits of Evaporites

Multilayered deposits of the (water soluble) evaporites anhydrite and salt, which often not only alternate with each other, but also alternate with (relatively insoluble) calcium carbonate layers. The Castile Formation of west Texas and southeastern New Mexico is one such deposit, the thickness being in excess of 2,000 feet in some places, including approximately

200,000 calcium carbonate-anhydrite "couplet" layers. The nature of these thin layers of anhydrite and of calcium carbonate definitely shows that they were deposited by precipitation. It should be remembered that these two substances do not precipitate at the same degree of concentration of the sea water. Calcium carbonate begins to precipitate when the sea water has been evaporated to about half the original volume, but the precipitation of anhydrite does not begin until a volume of about 19% has been reached.

Thus it is evident that a major change in the concentration of the sea water took place 200,000 times, with the concentration coming back each time to at least very near the same value. Furthermore, each of the precipitation events had to be accompanied by quiet water, for allowing the mineral to settle to the bottom to form the thin, uniform layer that it did. (The areal extent of these layers is many miles, with almost uniform thickness of any given layer maintained over at least a distance of 18 miles.) These are processes which required very considerable amounts of time.

Another very significant evaporite formation which shows conclusive evidence that it was formed slowly is that found in the Mediterranean Sea. Beneath the Sea floor in several areas core drillings have revealed repeating layers of fossil-bearing oceanic sediments interbedded with evaporite layers, showing that the Mediterranean dried up numerous times. Also, in the Balearic abyssal plain, west of Corsica and Sardinia, a "bulls-eye pattern" of evaporite deposition was found. In this deposit, layers of $CaCo_3$, $CaSO_4$, and NaCl were found *in the normal order* of precipitation when evaporation of sea water occurs. There is good evidence that this evaporite deposit is a few thousand feet in thickness.[7]

Deposits of Sandstone and Shale

Multilayered deposits of sandstone and shale. An example is found in the Haymond Formation in the Marathon region of Texas. There are approximately 15,000 thin sandstone layers alternating with approximately the same number of contrasting shale layers in this formation. The study of such a deposit requires that we carefully consider the length of time required for the clay particles, which formed each layer of shale, to settle out of suspension. The clay particles which form uniform layers such as this are extremely small, thus settling slowly, and only when a minimum of turbulence exists.[8]

Modern Coral Reefs

The thicknesses of modern coral reefs, as related to the growth rates of reef-forming organisms. The thickest deposit of this kind measured to date is that of the Eniwetok atoll, where the test drill penetrated 4,610 ft. of coral deposit in order to reach the volcanic seamount on which the reef was built. A study of such deposits in the light of present-day coral growth rates cannot produce an exact chronology of the past, but will nevertheless be very meaningful. This is because of our recognition of the stability of God's natural laws, including the laws of nutrition, respiration, and secretion in living organisms. According to detailed and extensive studies by A. G. Mayor (1924) on the growth rates of various genera of corals in the Samoan Islands (in a tropical area where conditions are most favorable for rapid growth), the fastest rate of upward growth of the reef surfaces was only about 8 mm per year.[9]

The record of God's work in nature is far more complete, informative and worthy of consideration than we have usually thought.

Ancient Coral Reefs

Ancient coral reefs, such as the atolls found in the oil fields of Canada, together with the extensive deposits of evaporites and other minerals which frequently cover them. This is a geographic area where the process of comparing modern reefs and other modern carbonate deposits with the ancient has yielded spectacular results in predicting the best drilling sites (cf. reference 3). Some of the atoll reefs in the Rainbow Lake area of Alberta, Canada, are 800 ft. in thickness at the rim, and are strikingly similar to the crescent-atolls of the present-day Great Barrier Reef of Australia. The Rainbow Lake reefs contain abundant massive growths of colonial corals *in situ*, as well as crinoids, stromatoporoids, brachiopods, and gastropods. Thus, these were genuine, wave-resistant reefs which grew in ancient times, when most of central North America was covered by relatively shallow ocean waters. The multiple layers of evaporites and other thick mineral deposits which cover these reefs give witness of the long periods of time since that geological period (the Devonian).[10]

Coral Growth Bands

The growth bands exhibited by ancient and modern corals and mollusks, which appear to be an accurate indicator of the daily growth rates of these organisms, as well as of the number of days in the year at the time when the animal was living. It has been known since the beginning of this century that the corallites of some kinds of modern corals possess annual growth bands. Now, within the last decade, it has been learned that these corals possess two lesser orders of growth bands or ridges between the annual rings, the one marking the growth increments of synodical, lunar months, the other the increments of daily growth. When certain fossil corals from the deeper strata, e.g., from Devonian rocks of New York and Ontario, are examined, they are found to show growth bands very similar to those of modern corals, except that the number is approximately 400 instead of 365, apparently indicating that these corals lived at a time far enough back that there were 400 days in the year, and consequently slightly less than 22 hours in the day. (The calculations of astronomers have shown clearly that the rate of rotation of the earth is decreasing, but that the period of the earth's revolution around the sun has been essentially constant. Thus, in earlier times, though the absolute length of the year was the same as now, the earth's rotation was more rapid, making the days shorter, and also affecting the number of lunar—and tidal—months in a year.) The growth rings on the Devonian corals thus show that they lived and grew at a very early date; and the size of the rings shows that the growth rates of these corals

were not very different from the growth rates of modern corals. The growth bands which have been observed on certain ancient bivalve mollusk shells are in essential agreement with the findings in corals.[11]

Organic Banks

Various types of ancient carbonate organic banks, and cyclic deposits which include layers of definite, identifiable fossils. The larger of these banks are usually spoken of as reefs in geologic literature. Examples are the famous "Horseshoe atoll" (or Scurry reef) of west Texas, the numerous Silurian reefs of Indiana, and the Capitan reef of west Texas and New Mexico. Organic banks which are moundlike in shape and enclosed in rock of a contrasting type, are usually called bioherms, though the terms reef and bioherm are often applicable to the same structure.

Some of these organic banks are very large, lie at great depths, and are components of extensive, local stratigraphic columns. For example, the Capitan reef is 350 miles long, and 2,000 ft. thick in places; and the eastern half of it lies in a large oil field, at a depth of some thousands of feet. Numerous alternating layers (cyclic deposits) of evaporites make up an extensive part of the formations which cover it. This reef has numerous bryozoan colonies and other fossils still in growth position (*in situ*). Beneath the Capitan reef there are, in some localities, more than 15,000 feet of sedimentary rock. This rock consists of numerous distinct layers of limestone, dolomite, sandstone, shale, etc., alternating with each other. Most of these deep layers underlying the reef possess identifiable fossils.

Often an ancient organic bank will be associated with, or a part of, a group of repeating depositional units called cyclothems. A cyclothem is a series of sedimentary layers which repeats itself in the stratigraphic record in a particular locality. Each cyclothem represents the depositional results of a series of changing environments in the ancient locality involved. The fact that several very similar cyclothems sometimes exist in a local stratigraphic column, and that evaporite layers and other environmental indicators frequently make up a part of each cyclothem, is conclusive evidence that these are naturally formed series representing rather large units of time. It is also significant that cyclothems contain sub-cycles.

Calcareous algal, limestone banks and mounds are often found lying deep in the strata of oil fields. These are of course a type of organic bank, having been produced by calcium-secreting algae which are similar to the many species of calcareous algae which we have today. The fossilized remains of the algae in these banks give every evidence of being *in situ*, and of having accumulated in a manner similar to the formation of algal deposits in modern tropical marine environments.

Recent extensive research has shed much light on the true nature of limestones such as those found in the organic banks. The study of the various types of organic banks, together with a comparison of the carbonate depositional processes in modern marine environments, has shown that a very high percentage of the limestone deposits of the earth was formed by the gradual accumulations of calcareous animals and plants rather than by inorganic processes. Even though diagenetic change obliterates many of the skeletons of these organisms, sufficient parts usually remain (with some of the substrate material on which they were growing) so that we can be sure, in at least many cases, that they were preserved either at or near the place where they grew. Since most limerocks have large amounts of microscopically identifiable particles, it has been observed that the layers of major limestone deposits are usually composed of normal assemblages of grains and other characteristic particles. These are frequently very similar to the assemblages found in modern carbonate rock-forming environments such as those of the Caribbean area and other parts of the world.

Often the fossils found so abundantly in a given bed of limestone make up a typical marine faunal and floral community, and a significant percentage of the delicately articulated skeletons will be intact, showing that they were not transported any long distance. Also, the lack of signs of abrasion of certain carbonate grains, such as fecal pellets, in the rock, and the lack of size sorting of the various types of grains are further evidence that the limestone was formed *in situ* without extensive transport of the materials of which it is composed. One of the most spectacular examples of evidence for the *in situ* formation of limestones, as a result of the growth of organisms, is the rounded, laminated masses of limestone which are called stromatolites. Extensive study of very similar structures being formed today in some carbonate depositional environments has made possible a detailed analysis of the ancient stromatolites. (Each stromatolite is formed by a large mass of algae growing in the water, and collecting layers of carbonate grains on its gelatinous surface as the water sweeps over it.)

The presence of layers of shale between the layers of limestone in many formations has usually aided in the preservation of the skeletal material, and in the identification of the environments in which the limestone layers were accumulated.[12]

Stratigraphic Columns

Well logs and drilling cores from oil fields, which provide us with the structure and composition of entire, *local* stratigraphic columns. In the past we have too often neglected to study the deeper parts of the local stratigraphic columns in areas where we have focused attention upon a single geologic formation. There are now available very complete records of the local columns in many geographic areas in the literature of petroleum geology. For example, Hughes (1954) gives the 16,705 ft. column of the Richardson and Bass No. 1 Harrison-Federal well, in the Delaware Basin of southeast New Mexico, as a 167 inch printed column. By devoting one inch to each 100 feet of well core he was able to show the lithology of the entire well in considerable detail. Also included are the generic names of some of the fossils, to a depth of 16,000 ft. Such records as this help make possible a study of both the chemical and physical nature of the contrasting layers in the column, as well as of some of the types of animals and plants present at the times of deposition. The availability of these well logs and drilling cores makes it possible for interested persons to study the geologic record directly, without having to depend on composite columns or abbreviated summaries.[13]

Distribution of Marine Fossils

The unequal distribution of marine fossils in limestone and other formations. An example of this is the abundance of certain kinds of very dense, thick-shelled mollusks of Class Pelecypoda in the upper strata, but an absence of the same types in lower layers. Conversely, some of the less dense animals, e. g., numerous species of arthropods of Class Trilobita, are abundant in lower strata but are not found in upper layers. Recent electron microscope studies of the chitin of trilobite skeletons give evidence for a low density for these animals. Similarly, many species of the cephalopods, of Phylum Mollusca, though very buoyant due to the air chambers of their shells, are found only in the deeper strata of the earth, indicating that they were buried before the formation of the Mesozoic and Cenozoic strata, and that they became extinct before the Mesozoic and Cenozoic strata were laid down. Thus, the unequal distribution of marine fossils is another indication of the long history which these organisms have, and the theory of some of the proponents of "flood geology" which says that the unequal distribution is largely due to densities is shown to be erroneous.

Even the very fact that many types of fossils are abundant in only a small percent of the stratigraphic column in a given locality, but not found at all in other parts of that column, should be a cause for much serious study. In such columns a great many species which are present at the lower levels are not present in the upper strata at that site, nor in the corresponding strata at other sites. The prevalence of this condition calls for recognition of a long period of time for the formation of the larger (thicker and more extensive) stratigraphic columns.[14]

Forest Deposits

The multiple forest deposits in Yellowstone National Park. The data collected during the study made by Dorf and his associates, concerning the numerous types of fossil vegetation and preserved foliage in the strata of Specimen Ridge and Amethyst Mountain, have apparently not been used to any extent by creationist writers. Whitcomb and Morris have tried to explain these forest deposits by saying the trees were floated into place during the Flood, forming a semblance of successive forests preserved in volcanic ash. The work of Dorf makes this theory completely unacceptable.[15]

Sea-Floor Spreading

The present and past rates of sea-floor spreading as exhibited in the oceanic ridges, and the thicknesses of pelagic sediments which lie upon the ocean floor at various distances from the present mid-line of the ridges. The present rate of sea-floor spreading along the Mid-Atlantic ridge is estimated to be only a few centimeters per year. The fact that the sediments are thin near the center line of the ridge, and become gradually thicker farther away from the ridge, on each side, is an indication that the spreading has been practically continuous and gradual for a long period of time. Also, the linear strips of igneous rock which lie to the west of the ridge are practically identical to the linear strips extending along the east side. Thus, one side forms a "mirror image" of the other, with respect to the chemical and magnetic nature of the parallel trends of igneous rock. This gives us much reason to believe that each pair of corresponding strips was formed at approximately the same time, from the same mass of magna along the ridge, and that the slow spreading of the floor at the rift has resulted in their now being widely separated. The above mentioned symmetry along the Mid-Atlantic ridge has been carefully mapped, and the two sides correlated for a distance of about 125 miles out from the center of the ridge.[16]

Magnetic Reversals

The geologic records of magnetic reversals in igneous bodies of rock (both on the continents and in the ocean floors), and in sediment cores taken from the ocean floor. A great many extensive rock masses of these types, which exhibit an orderly series of reversals, have been discovered during the past ten years. For example, there is a close agreement between the series of reversals found in ancient lava flows of the Rocky Mountains and those in the Atlantic sea-floor. There are many strong evidences that most of these reversals which are "frozen" into the igneous rocks are separated from one another by at least hundreds of thousands of years.[17]

K-Ar "Clock"

Even though we are presenting here a list of types of non-radiometric data, there is one phase of radiometric dating which should be mentioned, because it has apparently gone unnoticed by a great many creationists.

The discovery that the potassium-argon "clock," in rocks which effectively retain radiogenic Ar^{40}, is restarted whenever the rocks are heated (or reheated) to a temperature of 300° C., or more. Recent writers on this type of dating state that all original argon is lost, when such heating of igneous and metamorphic rocks occurs. Thus when the amount of argon present is measured, only the amount produced in the rocks since they were last heated can be detected. This characteristic is often listed as a disadvantage, because this means that potassium-argon dates can give only the length of time since the rock mass was last cooled to a temperature below 300° C. However, this feature is an advantage for those who are interested in determining how long it has been since igneous or metamorphic rock masses were in a heated condition.

Perhaps we should also mention that Dalrymple, Moore, and others recently discovered that some of the earlier potassium-argon dates obtained for igneous rocks which had been formed in deep water were very incorrect (much too old). Their research showed that whenever lava is erupted into a deep-water environment, the hydrostatic pressure, and the rapid cooling caused by the cold water, causes excess Ar^{40} to be "frozen" into the *outer parts of* the lava mass. Earlier, when this principle was not known, numerous samples of marine volcanic basalt were wrongly dated. However, now that the scientific world has been alerted to this principle, only the potassium-argon dates from continental formations and from samples taken from

the interior of submarine masses of rock are considered reliable.[18]

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Biogenesis: Paradigm and Presupposition

J. W. HAAS, JR.

Gordon College
Wenham, Massachusetts 01984

The major experimental approaches and presuppositions employed in current biogenetic investigation are examined from a Christian perspective. Some objections in Christian thought to biogenetic studies are examined. The view is offered that these studies are worthwhile in demonstrating the plausibility of particular models posed for the Creation process. An appeal for freedom of thought in examining the question of origins is made.

Prologue

The module hovered over planet Htrae, then gracefully set down within 300 yards of the designated landing point. The voyage had taken over 9 years, but a technique for slowing life processes allowed the two astronauts to pass the time in a quiescent state with body reactions occurring at only 1/10,000 of the normal rate. As they descended from the space craft they carried with them a number of miniaturized analytical instruments—a gas chromatograph, mass spectrometer, electron and x-ray diffraction apparatus, nuclear magnetic resonance spectrometer and an electron miscoscope. These devices were put quickly to work relaying data to Mission Control in Houston from samples in the vicinity of the landing site and later from many areas on Htrae using the Htrae Rover. Htrae, a relatively young planet 200 million years old, was considered to have an environment at birth and during life very similar to that of Earth. A dozen other teams of astronaut-analysts were on planets of similar origin whose age varied from 1 million to 1 billion years. They pursued a comon task—to gain a

picture of the scope and nature of carbon containing molecules on the planet at that point in its history. When the data from all these molecular cameos were combined, a history of Earth's organo-chemistry from simple molecules to self-replicating systems was evident. President John F. Kennedy, III gave the first announcement of the results of the 77 trillion dollar project to a hushed, expectant nation.

Somewhat west of Tombstone, Arizona an opaque encompassing bubble rises some 400 feet above a 260 acre region onto which has been telescoped all the general surface conditions considered to have existed on the primitive Earth—mountains, sterile seas, reducing gases, ultraviolet radiation, cosmic radiation, lightning in infinite variation. This vast apparatus may be turned on at point zero in organic molecular history and sampled on land and sea from time to time to assess the course of molecular evolution until well after the first living form is observable. A quantum-mechanical tuning device allows the experimenters to accelerate the relative rates of chemical reaction by as much as 10^9 during uneventful periods in history and to slow reaction by a factor of 10^3 at significant points in organo-history. A complete biogenetic picture was obtained in less than three years and 3946 doctoral theses emanated from the project.

These idealized experiments characterize in part the complexity (and perhaps the absurdity) of origin of life studies, yet man in his God-ordained task to subdue the Earth continues the quest to gain insight with respect to his molecular beginnings.

Introduction

Although the concept of chemical evolution may be traced back to Lucretius in *De Rerum Natura* (about 58 B.C.), it was not until the third decade of this century that A. I. Oparin[1] and J. B. S. Haldane[2] independently proposed a model for the origin of life which was capable of scientific investigation. They suggested that carbon-containing gases present in the primordial atmosphere were transformed by natural stimuli such as heat, sunlight, and electrical discharge into more complex carbon compounds which collected as "dilute soups" in the seas, reacting to provide more complex molecules, then protobiological and ultimately, biological material—the process taking place in a time scale of millions of years.

Scientific interest in the Oparin-Haldane model was limited to a few scattered experiments over the next quarter century. It was not until the 1950's that the advent and financial support of the space age and broad interest in cell biochemistry provided impetus for the significant amount of investigation currently under way.[3]

The origin-of-life problem is atypical when compared with day-to-day chemical questions in that it focuses on a series of events thought to occur over an immense span of time in a period of limited accessibility to modern investigation. The method of attack, degree of certainty of conclusions, and presuppositions may vary from those formed in questions explored in a laboratory setting.

In this paper we consider the presuppositions and methodological approaches characteristic of workers in this field and see how they have fared in Christian thought.

One may plead that our efforts in biogenetic investigation be allowed to continue unhindered by political, philosophical or religious authoritarianism.

Paradigm

There are several general experimental approaches currently employed in biogenesis investigation. One method involves "synthesis of life" studies where the concern is to find a set of reactions that, under *controlled* laboratory conditions, convert relatively complex matter into living material. Here the concern is not "how did life originate?" but rather the demonstration that such an event can occur at all. Presumably this approach, if successful, would provide encouragement and direction for historical studies.[4]

A second direction seeks to determine general reaction conditions and types of chemical species which react *spontaneously* to form living substances. This basically theoretical approach places emphasis on finding the minimal set of conditions without concern for original earth conditions.[5]

The third approach is more comprehensive in that one works in the context of apparent primitive Earth conditions in an attempt to establish "the historic process," or better "a process" by which life may have originated. The Oparin-Haldane model is followed and experiments carried out to evaluate the plausibility of particular reaction sequences leading to the "simplest forms of life". This constructional-historical approach has provided significant insight in understanding the spontaneous formation of molecules of biological importance. The future will judge the value of efforts currently underway to establish the complex patterns of organization and cell formation from smaller molecules.

Presuppositions

Investigators in the field have been quick to recognize the tenuous nature of their efforts and have variously described the broad working assumptions on which their investigation is based. In the widest sense it is assumed that the universe is ordered, that the pattern of natural behavior observed today has operated through the Earth's history,[6] that the laws of logic and mathematics are true by definition or by axiomatization of basic principle, and that these laws are applicable to the world of experience.[7] It is also assumed that natural phenomena must be explained (at least in the context of scientific method) without recourse to the supernatural.[6]

There are at least three presuppositions which relate specifically to biogenesis studies. The first considers life on earth to have a beginning—a time of origin. Another suggests that the origin of life on the primitive Earth involved a series of relatively probable chemical and physical events and did not critically depend on the chance occurrence of very rare events. A third assumes that the compounds which occur ubiquitously in contemporary life were also essential to the origin of life.[8]

These operational assumptions require a view of "scientific truth"—how one recognizes it, arrives at it,

finds its limitations and how it shapes our choices. At one level truth may appear to be objective and impersonal, to have meaning only where capable of verification. This view however overlooks the role of man's mind in the knowledge process. Man constantly invokes his personal judgment and acts on the basis of things he holds to be true. He is influenced by educational background and cultural setting and well may be motivated in his efforts by a heuristic search for rational beauty. While truth for the scientist is not that of the poet, there is a little of the poet in all scientists.

Most scientists take their theories to represent real events in the world. They have little patience for the intense and often contradictory philosophical analysis of language and methodology which would limit the scope and meaning of their effort. Barbour has drawn together many elements of the discussion into a helpful statement.[9]

> The scientific enterprise is a many-faceted phenomenon. Its genius has been precisely the interaction of components which oversimplified accounts have portrayed in isolation. It involves both experiment and theory, neither of which taken alone constitutes science. It requires both logical processes and a creative imagination transcending logic. Its theories are evaluated at once by empirical agreement, rational coherence, and comprehensiveness. Individual activity and originality are significant but occur within the tradition of a scientific community and under the influence of its paradigms. Scientific language does refer to the world, but only symbolically and partially, sometimes using analogies or models of limited scope.
>
> The resulting theories are not guranteed to be the truth; any of them may in the future be amended, modified, or in rare cases, overthrown in a major "revolution." Yet scientific theories do have a reliability, and the scientific community does eventually achieve a consensus, seldom found in other types of inquiry. Although some aspects of scientific knowledge change, many aspects are preserved, contributing to an over-all cumulative advance that differs from that of other disciplines.

Christian Perspectives

Although specific comment on the topic of biogenesis has been limited, the topic of origins has dominated the science-Christianity dialogue for over a century. The complexity of the subject and the diversity of response continue to provide frustration and division in the Christian community.

From a Christian view the assumptions of origin, order and uniformity are derivable from the broad sweep of Scripture encompassing the doctrines of Creation and Providence. Indeed some would attribute the rise of modern science in the 16th and 17th century to the theistic convictions prominent in the lives and culture of many of those active in science at that time.[10]

The presupposition that eliminates the supernatural from intervention in the biogenetic process is no doubt offensive to some, yet reflects more the limitation of scientific methodology in describing the role of God in Creation than an apparently atheistic mind–set on the part of the investigator. Science does not deny "providence" or "miracle"; it is just blind to them.

Evangelical objection to the "possibility" of abiogenic molecular evolution follows two general lines of argument. One is based on the biblical text and theological formulations which stress the "rapidity" of creation, the inability of scientific models to explain "Adam and Eve" or the "image of God" and an apparent scriptural limitation on man's ability to understand his beginnings. This thread of Christian thought places the epic of origin either entirely in the realm of miracle or so interwoven with the miraculous as to be inaccessible to scientifc study.[11] Both Scripture and scientific data are used to support this view.

One scriptural argument is based on parallels between Christ's miracles and the Genesis account of creation and the language of Scripture which implies a short time span for God's creative activity in contrast to that (presumably) required for the Haldane-Oparin Model. Clearly the Bible is critical to those who profess it to be the authority for their lives. Yet, not all commentators draw these same conclusions from Scripture, but consider that science can contribute to man's quest for understanding in this domain.

Further, it is eminently unclear just which criteria may be used to decide where Providence (capable of scientific study) and Miracle (incapable of study) intersect, especially at the time of origin.

In this respect Kline has suggested

> . . . the avoidance of unnecessary supernaturalism in providence during the "six days" accords well with the analogy of subsequent divine providence for the latter is characterized by a remarkable economy in its resort to the supernatural.[12]

Kline develops this principle on exegetical grounds in demonstrating the inadequacy of traditional scriptural interpretations that hold the 24 hour-day theory or any strictly chronological interpretation of Genesis 1.[12]

The scientific argument is used to draw attention to defects in the work and conclusions of biogenesis investigators or to expose the complexity of the problem and the paucity of results.[13] Surely, scientific effort requires constant critical scrutiny to maintain integrity in the context of the current state of knowledge, yet a strategy involving a biogenesis "truth squad" seems unproductive in the long run. One must react (presumably negatively) to each paper that appears (a never-ending task) if a successful defense against biogenesis is to be maintained. One has the problem of what to do when work cannot be discounted. Again there may be no basis for deciding whether scientific arguments against biogenesis have any more validity than those proposed in support. For example, there is considerable interest in the possibility that oscillating reactions exhibited by a variety of biological systems may provide mechanisms by which a chemical reaction could have been induced.[14] One must now rush to the task of demonstrating the implausibility if not the impossibility of this approach even though an understanding of the phenomena in "simple" chemical systems is still in an early stage.

Another objection to biogenetic investigation concerns the assumption of the principle of uniformity. It is felt that the forces and laws operating during that period were different in some respects from those we see today, thus rendering invalid any attempt to extend present molecular behavior to the time of origin. However, significant scientific and scriptural evidence to support this view is lacking.[6]

An alternative approach currently being advanced by some Christians involves the attempt to demon-

strate that scientific data fit a "modern creationism" view more closely than "modern evolutionism." While this approach is preferable to one which simply attacks the other side, it suffers from the problem of attempting to prove something incapable of direct proof. One can only construct a model and then demonstrate the extent to which the data provide support. The danger that *a model* will become *the model* for orthodoxy is all too clear from church history.[15]

Toward Complexity

Some attention has been given to the nature of the "driving force" which culminated in living forms. Is there an innate molecular direction, or did life arise as the result of a long series of random, improbable molecular events?

The first view is receiving increasing attention. Kenyon and Steinman have described the driving force as *Biochemical Predestination.*

> . . . by this I mean that the association of units toward the ultimate development of the living cell is determined by the physiochemical properties possessed by the simplest starting compounds from which these systems evolved. . . . the ultimate characteristics of the living cell can be traced back to the nature of the starting compounds from which it was produced . . . we should not look on the appearance and development of the living cell as an improbable phenomenon but rather as one which followed a definite course governed and promoted by the properties of the simple compounds from which the process began.[16]

Paleontologist Pierre Teilhard de Chardin incorporated this view in developing his encompassing "cosmogenesis" view.

> Teilhard feels that at some point, which he calls Alpha, primordial matter came into being that has within it (through the creative act of God) the propensity to become complex and unified. Electrons and protrons have as it were, a built-in affinity for each other and in time form more complex atoms. Atoms in turn form increasingly complex molecules and macromolecules. Molecules coacervate to form pre-cells and these entities eventually form living cells—and so on up the evolutionary scale.[17]

Needham has commented

> Laboratory work therefore has in general strengthened the view that biological reactions are the innate spontaneous properties of materials which are synthesized spontaneously under natural conditions and that life originated and evolved for this reason. . . . Applied to the eobiological systems the contention is that life has always been precisely the most probable, opportunist exploitation of the most spontaneous pathways.[18]

While these formulations are not without problems, they may well represent the limit of man's ability to characterize God's creative direction. The concept of Biological Predestination should receive serious consideration by the Christian philosopher and theologian as well as the scientist.

Epilog

One feature that distinguishes chemical evolution from its Darwinian counterpart is that there is a strong likelihood that a plausible process can be demonstrated in the finite future using the historical-constructionistic approach, while considerably less confidence is exhibited in the ability to view major transitons in life forms after the Darwinian model. Perhaps in this generation, as the landmark efforts of the Spiegelman group on self-replicating RNA are expanded, we shall see if the current optimism is more than wishful thinking.[19]

Three presuppositions of biogenesis studies: (1) life on earth had a beginning, (2) the origin of life on earth involved a series of relatively probable chemical and physical events and were not critically dependent on chance occurrences of rare events, and (3) present-day compounds were also essential to the origin of life.

As Scientist-Christians we should follow and engage in these efforts with critical, but open minds. We have in Scripture *the* basis for understanding the fullness of reality; it is here that creation is described in terms of purpose, meaning and direction. As Christians we gain deepening insights at this level as we mature in our faith. As scientists we attempt to extend our understanding of the process of creation by viewing nature in the context of scientific method. One may plead that our efforts in biogenetic investigation be allowed to continue unhindered by political, philosophical or religious authoritarianism. In the words of Carpenter:

> I am free, I am bound to nobody's word, except to those inspired by God; if I oppose these in the least degree, I beseech God to forgive me my audacity of judgment, as I have been moved not so much by longing for some opinion of my own as by my love for the freedom of science.[20]

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Implications of Molecular Biology for Creation and Evolution

ROBERT L. HERRMANN

Boston University School of Medicine
Boston, Massachusetts 02118

Survey of Molecular Biology

In 1953 Watson and Crick[1] proposed the double-helical structure of DNA, the polynucleotide molecule carrying the cell's genetic informaton. Four types of heterocyclic nitrogenous substances (bases) were bound into its structure by means of the sugar 2-deoxyribose, and phosphoric acid. The combination of a given base, a sugar and phosphoric acid is called a nucleotide (See Figure 1). The crucial feature of the proposed model (Figure 2) was that the two chains of nucleotide building blocks were complementary. Every time an adenine nucleotide (A) is present in one chain, the opposite chain bears a thymine nucleotide (T). Likewise, every time a guanine nucleotide (G) appears in one chain, the other chain bears a cytosine nucleotide (C). The unique pairing is the basis of precise duplication of the genes which is so necessary for the hereditary mechanism. Gene duplication occurs by separation of these two chains and the synthesis of a new matching strand for each, so that there are then two double-stranded structures where before there had been only one. Each "daughter" molecule now carries the exact arrangement of nucleotide units as the "parent" molecule, because the unique pairing of the nucleotide units prescribes that this be so. This is of utmost importance because the linear sequences of nucleotide units are eventually translated into linear sequences of amino acid units for all of the protein molecules which make up the living cell.

By 1960, experiments in many laboratories indicated that the cell's protein molecules were synthesized by a process involving transcription of the DNA sequence into a second polynucleotide, messenger RNA, which, in conjunction with various elements of cell sap including complex structures called ribosomes, could cause incorporation of radio-active amino acids into protein-like polypeptide material (See Figure 3).

The great breakthrough in understanding this process came about when Nirenberg and Matthaei found that synthetic RNA molecules could catalyze the protein synthetic process in these simple cell-free systems derived from bacteria.[2] The synthetic polynucleotides, produced with an enzyme called polynucleotide phosphorylase, could be made with various combinations of the component building blocks of natural RNA and then the protein synthesized subsequently from these compounds in the cell-free system could be analyzed. In this way it was discovered that the code signal for the insertion of a given amino acid into a protein structure was a sequence of three nucleotide units of the polynucleotide. For example, three uridine nucleotides (a trinucleotide) in a sequence of the RNA specifies the positioning of one molecule of the amino acid phenylalanine in the sequence of the protein.

Later a more precise method of determining the coding sequence (the "codon") corresponding to a given amino acid was discovered, based upon the

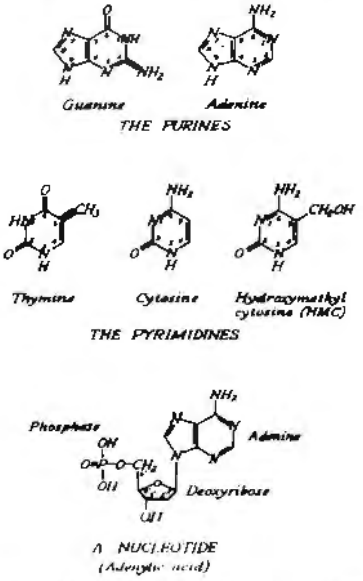


Figure 1. The combination of a heterocyclic nitrogenous base with the sugar 2-deoxyribose and phosphoric acid forms one of the nucleotide building blocks of deoxyribonucleic acid (DNA)

Figure 2. A representation of the double-helical model of DNA, illustrating the complementary base-pairing of adenine (A) with thymine (T) and quanine (G) with cytosine (C).

known involvement of a second type of RNA, transfer RNA (t-RNA) in protein synthesis (See Figure 3). This molecule was shown to occur in many forms—at least one for each amino acid found in proteins—and to function by adapting its amino acid to the codon through a complementary sequence of nucleotides in its own structure. It was found that even in the absence of protein synthesis, the specific t-RNA molecules bind to complexes of ribosomes and messenger RNA. Furthermore the messenger RNA could be replaced not only by the synthetic polynucleotides used in the earlier experiments, but also by simple trinucleotides of precise structure. In this method a given trinucleotide representing a single codon could be examined for its ability to cause binding of various t-RNA molecules with their attached amino acids to the ribosome structure. Those t-RNA molecules which bound must have have been able to recognize that codon as the position for insertion of their particular amino acid. In this way it was possible to assign each codon to a specific amino acid.

The Genetic Code

Figure 4 represents the genetic code as worked out for the bacterium *E. coli*. Several interesting features are apparent with respect to evolution. The first is the phenomenon called degeneracy. Note that for most of the amino acids there is more than one codon, e.g., phenylalanine is coded for by both UUU and UUC. The third position can vary and specificity still be retained. Because of this variation, it has been suggested that the original code was a doublet instead of a triplet code. Variation in the 3rd position would also allow for the cell to undergo mutational change without that change being necessarily lethal. CT stands for codons which cause termination of a peptide chain (chain termination) and CI stands for chain initiation. Here the amino acid methionine serves as the initiating amino acid and in this case the methionine is first formylated before initiating peptide synthesis. There are also some interesting relationships between amino acids and their codons. Similar amino acids (similar side chains) have similarities in their code words, e.g., all non-polar amino acids (phenylalanine, leucine, isoleucine, valine) have U as the second code letter. Also, aspartic acid and glutamic acid, closely related structurally, both have GA as their first two letters. This suggests another evolutionary possibility: the specific code words for the various amino acids

The implications of a universal genetic code are interesting, fascinating or threatening, depending on your viewpoint.

arose because of some physicochemical relationship between the codon's nucleotides and the amino acid which it specifies. This possibility has been explored by several workers.[3,4]

A Universal Code

Extension of these experiments to other bacteria, to intermediate forms and to mammals has led to the general conclusion that the genetic code is universal—that the same code words are used in both lower and higher organisms. For example, with rabbit reticulocytes, 22 codons have thus far been shown to be translated into amino acids identical to those in the *E. coli* bacterial system. The data, though incomplete, point to a universal code.[5]

Likewise, the protein-synthetic mechanisms in prokaryotic and eukaryotic systems appear to be quite similar. For example, the chain initiating codon which in the bacterium *E. coli* involves a special form of transfer RNA, which places the amino acid methionine in the chain at that point, is also utilized by yeast, by wheat germ, by mouse liver and rabbit reticulocytes. Other features of the mechanism also appear similar.

The implications of such a mechanism are interesting, fascinating, or threatening, depending on your viewpoint. The existence of a universal code would imply that there was indeed a single precursor of all living things, a primitive system capable of replication and information transfer from which all the present living forms developed.

A Specific Model

In fact, mechanisms have been proposed for the origin of such a system given the necessary building blocks which appear to have been present on the primitive earth. Quastler, in his *Emergence of Biological Organization*[6] suggests one such mechanism. As we have indicated, the genetic material, DNA, is made up of two polynucleotide chains whose most unique feature is the complementary pairing of the nucleotide building blocks, A to T and G to C.

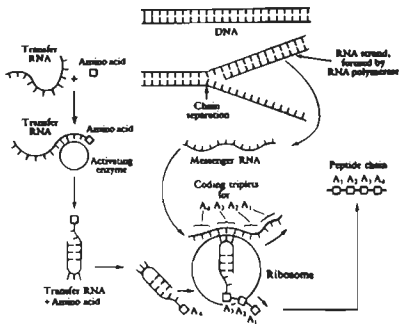


Figure 3. The scheme for protein synthesis. DNA is "read out" in the form of messenger RNA, which travels to the cytoplasm and binds to structures called ribosomes. Here, a series of transfer RNA molecules, at least one type for each protein amino acid, carry their appropriate amino acid to the ribosome and align with a specific coding sequence on the messenger to form the proper sequence of the protein chain.

Even the informational content of a living system may have arisen from the apparently random way in which the nucleotide building blocks of the first successful system were incorporated into a polynucleotide polymer.

In Quastler's proposal for the origin of the nucleic acid system (Figure 5), nucleotide building blocks react with each other to form single polynucleotide chains. This process would be very slow in the absence of enzymes, but Quastler estimates that there would still be 400 periods during geological time available for this reaction. The single chains thus formed may then react further with additional nucleotide units, by the nucleotide pairing principle, to form intermediate structures which are partly single-chained and partly double-chained. This reaction is much more favorable than is the original reaction to form the single polynucleotide chain. Completion of this reaction leads to fully double-chained structures which may then reversibly separate to form single chains.

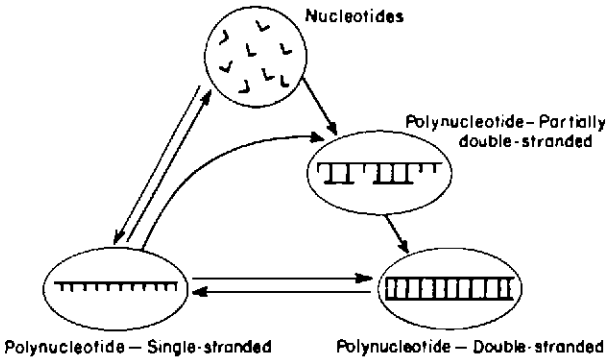
The unique feature of such a system is that it gives rise to a kind of "information," in the sense that the first polynucleotide chain to be formed has a far greater chance for survival than any later arrivals. Thus it is able to compete more favorably for nucleotide units, since the reaction of the polynucleotide chain with nucleotides is favored over the original synthesis of the polynucleotide. The first chain thus becomes the progenitor of a unique polynucleotide system made up of itself and its "sister" chain, in which each nucleotide unit is the opposite pairing partner for the other chain—i.e., A opposite T and G opposite C. The information content of the system, as Quastler sees it, is of the nature of an "accidental thought remembered." The original arrangement of nucleotide units in the polynucleotide chain might have been arrived at by purely random interaction, but once the chain is formed, that particular arrangement and that of its sister strand are the only allowable structures. A good analogy would be the numbers of a combination lock. Prior to their choice for the combination, the numbers are of no consequence. But after being introduced as the numbers of the combination they are now information.

The importance of Quastler's argument lies in its demonstration of the way in which the evolutionary

	First position	Second position				Third position
		U	C	A	G	
Amino acid codons	U	Phe	Ser	Tyr	Cys	U
		Phe	Ser	Tyr	Cys	C
		Leu	Ser	(CT)	(CT)	A
		Leu	Ser	(CT)	Trp	G
	C	Leu	Pro	His	Arg	U
		Leu	Pro	His	Arg	C
		Leu	Pro	Gln	Arg	A
		Leu	Pro	Gln	Arg	G
	A	Ile	Thr	Asn	Ser	U
		Ile	Thr	Asn	Ser	C
		Ile	Thr	Lys	Arg	A
		Met (CT)	Thr	Lys	Arg	G
	G	Val	Ala	Asp	Gly	U
		Val	Ala	Asp	Gly	C
		Val	Ala	Glu	Gly	A
		Val (CT)	Ala	Glu	Gly	G

Figure 4. The genetic code as worked out for the bacterium *E. coli*.

ORIGIN OF A PRIMITIVE NUCLEIC ACID SYSTEM



Adopted from: Quastler, "Emergence of Biological Organization"

Figure 5. Quastler's model for the origin of a nucleic acid system. Nucleotides react to form single-stranded polynucleotides. The latter can undergo a more favorable reaction to form partially double-stranded structures which eventually give rise to a double helical polynucleotide with a complementary base-paired structure.

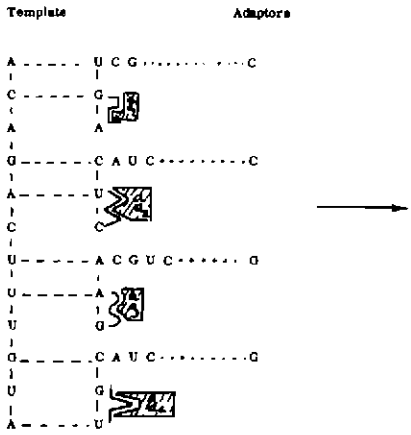


Figure 6. A proposal for the attachment of primitive counterparts of amino acid transfer RNA molecules to the template of a polynucleotide system, with the eventuality of the synthesis of amino acid polymers.

principles of selection and competition can be applied at the chemical level. For here, from apparently random events, a system may be seen to arise that is capable of reproducing and propagating itself and hence acting as a kind of primitive genetic information.

Explanation of Protein Synthesis

The extrapolation of this scheme to an explanation for present mechanisms of protein synthesis may be made on the same principles of chemical evolution (Figure 6). Polynucleotides could react with amino acids with some degree of specificity[3,4] to give adapter molecules similar to the amino acyl, t-RNA's of present protein synthesis. Complementary base pairing of these molecules to the original polynucleotide system would provide the opportunity for the system to couple amino acids in a variety of different arrangements, depending upon the sequence of the original polynucleotide, and, if one or more amino acid sequences proved to have enzymatic activity, there would be the tremendous

advantage, by virtue of the self-duplicating property of polynucleotides, for this system to "remember" it.

Thus even the informational content of a living system may have arisen, in its simplest form, from the apparently random way in which the nucleotide building blocks of the first successful system were incorporated into a polynucleotide polymer. Considering the available data on the universality of the code and a theoretical framework for its origin, the description of life's origins in a purely mechanistic sense would appear to lie within the grasp of modern molecular biology.

Other Explanations

However, this should not lead to any feeling on the part of the scientist that his explanation of origins excludes other explanations—e.g., a theological one. Jacques Monod may object in his *Chance and Necessity*[8] to the idea of a "necessity rooted in the very beginning of things," but there is certainly no valid reason to exclude such a possibility. The Scriptural view of origins in fact places its primary emphasis on this very idea of purpose and meaning in the creation; life was made with precision and order, with quite precise ends in view.

Part of the concern of many Christians about evolutionary theory is that they fear that a mechanistic explanation negates God. But this problem has been dealt with in an excellent fashion by Donald MacKay in his booklet *Science and Christian Faith Today*.[9] God's activity includes not only his originating activity (Genesis) but also his sustaining activity. The Apostle Paul writes in Colossians 1, speaking of Jesus Christ, "in Him all things hold together" (Col. 1:17) and the writer to the Hebrews speaks of Christ "upholding all things by His Word and power." (Heb. 1:3) MacKay points out that the phrase "upholding all things" might better be translated "holds in being all things" emphasizing God's immanent activity, without which the universe would not just stop but rather without which it would *cease to exist*.

The picture of God as a kind of machine tender seems completely inadequate in light of this verse. Rather, God's activity is more like that of a master artist, who paints—in a dynamic fashion—a constantly changing picture. Something like this is suggested by the picture that a television receiver presents. The analogy is especially useful because it emphasizes the dynamic aspect of God's activity—"holding in being" the universe. For by simply ceasing his activity, it would be obliterated much as the television picture may be totally altered by simply flipping a switch. By bringing the focus to God's immanent activity, we see also the inapplicability of such arguments as "evolution leaves no room for the God of action, precluding his function except in areas of fast-disappearing links." The true picture is that God acts in *all* of Reality, not just where we cannot apply a scientific explanation. It is all His! As MacKay says "the whole multi-patterned drama of the universe is His." Also, the emphasis of Scripture is that God has ordered his Creation not by virtue of producing a perfect mechanism but rather because of His complete faithfulness. It is the ultimate basis for things, the *raison d'etre*, with which the Bible is dealing in its consideration of origins, and the character of the Creator is therefore its primary concern.

Science gives us the view of *how* life may have come about. Its view is descriptive, and does not in any ultimate sense *account* for what it describes. The most we can say based on present data is that God may have used an evolutionary mechanism to achieve the purposes delineated in Scripture.

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The Christian cannot be satisfied as long as any human activity is either opposed to Christianity or out of all connection with Christianity. Christianity must pervade not merely all nations but all of human thought. The Christian, therefore, cannot be indifferent to any branch of earnest endeavor. It must all be brought somehow into some *relation to the gospel. It must be studied either to be demonstrated as false or in order to be made useful in advancing the Kingdom of God. The Kingdom must be advanced not merely extensively but also intensively. The church must seek to conquer not merely man for Christ but also the whole of man.*

J. Gresham Machen

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Random Processes and Evolution

ALDERT VAN DER ZIEL

Department of Electrical Engineering

University of Minnesota
Minneapolis, Minnesota 55455

Introduction

In 1827 the British biologist Robert Brown looked with his microscope at pollen particles immersed in water and found that they executed a zig-zag random motion. This motion generally became known as *Brownian motion*. At first it was thought to be a property of "living particles", but it soon turned out that all small particles exhibited the effect. Gradually the idea was accepted that the zig-zag motion of the particles was caused by the random collisions between the particles and the water molecules, but it was 1905 before Einstein was able to give the theory that is now accepted. Einstein generalized his ideas and showed that such a "Brownian motion" should occur in other systems, e.g., that there should be a "Brownian motion of electricity" in electrical circuits.

With the advent of electronics it became clear that this "Brownian motion of electricity", and the companion phenomenon of current fluctuations in amplifying devices, such as vacuum tubes, transistors, etc., set a serious limit to the amplification of electrical signals; these signals simply "drowned" in the fluctuating signals generated in the circuits and in the amplifying devices. Since the fluctuations, when amplified and fed into a loudspeaker, produced a hissing sound, the electrical engineers introduced the name *noise*. This name has stuck ever since.

Noise occurs in many different instances and it always sets a lower limit to sensitive measurements or to the electrical signals that can be processed electronically. It determines the smallest TV signals that can be received without excessive "snow" on the TV screen, it determines how far radar can see, etc.

It has been my privilege to study these random noise processes for more than 30 years. Gradually it became clear to me that what we have learned about random processes in physics and engineering should be applicable to biology. For in biology, mutations and genetic drift are random processes that play a role in the various theories of evolution. This paper is a first attempt at such an application.

There is, however, one difference between noise processes in physics and engineering, and random processes in biology. The first are *stationary* random processes in that the systems do not change when time goes on. The latter, however, are strictly speaking *non-stationary* in that the systems gradually change with time because of evolution. However, the changes are very slow, and they have little or no effect on the conclusions we are going to make.

What Are Random Processes and How Do They Occur?

A random process is a process that cannot be predicted in advance, except on a statistical basis. Why do such processes occur? There are two important possibilities:

> (1) The systems that we are investigating are so complex that it is impossible to give a complete description of them. There is no reason to assume that such a complete description could not be possible in *principle;* it is sufficient that it cannot be performed in *practice*. For that reason one has to be satisfied with statistical considerations.
>
> (2) The system is simple enough, but it is impossible to know the initial conditions of the system with absolute accuracy. Since there is a fundamental uncertainty in the initial conditions there is also uncertainty in the predictions we can make. For that reason one has again to be satisfied with statistical considerations.

As an example of the first case we consider a small mirror suspended in air on a thin quartz fiber. Due to the irregular bombardment of the mirror by the air molecules, the mirror shows a fluctuating rotation around an equilibrium position. Statistical considerations show that the deviation in angle from the equilibrium position has a mean square value equal to kT/D, where k is Boltzmann's constant, T the absolute temperature and D the force constant describing the retarding torque exerted on the suspended mirror when it suffers an angular deviation. One may thus determine the atomic constant k from careful measurements on such mirrors. The same relation also describes the deviation from equilibrium in sensitive galvanometers.

As a simpler example consider the number of air molecules in a room. This number is so huge that one cannot possibly give a complete description of the motion of all the molecules, but one has to be satisfied with statistical considerations.

The same situation applies to the prediction of traffic accidents on holidays. The number of cars on the road on those days is so huge that one cannot predict except on a statistical basis. One cannot predict in advance where a certain traffic accident will occur, however.

The second case, where the initial conditions cannot be fully known, is especially acute in the molecular and atomic domain and it comes about because of the wave character of the atomic particles involved. It is easily shown on the basis of this wave character that one cannot simultaneously measure the position and the velocity of a small particle with arbitrary accuracy. Rather one finds that the product of the uncertainty in position and the uncertainty in the velocity must always exceed a quantity of the order of h/m, where h is Planck's constant and m is the mass of the particle. This relationship is known as *Heisenberg's Uncertainty Principle*. The quantity h is a very small number, but so is the mass of an electron; the distances of electrons in an atom are also quite small, so the uncertainty in velocity is quite large.

Let me illustrate this with an example. Suppose you go deer hunting; you see a deer, shoot at it and you miss. Don't blame Heisenberg's Uncertainty Principle for your failure, for the mass of your bullet is so huge in comparison to the mass of an electron that the uncertainties are negligible. The only reason for your lack of success was bad shooting.

Let me give another example. The nucleus K^{40} can transform into the nucleus Ca^{40} under emission of an electron. The process must be described by wave mechanics, and all that the theory can predict is the average rate of emission. This calculated rate agrees with the experimental rate. While this *rate of decay* can be predicted, we cannot predict the moment of decay of an individual nucleus. Such an event is called an *elementary event* that is not further explainable. It is one of the characteristics of wave mechanics that it predicts only on a statistical basis.

Let us consider another event in a somewhat larger aggregate. Mutations are caused by rearrangements of molecules in the genes. A rearrangement in a particular gene is an elementary event that cannot be predicted in advance. What can be predicted by the theory is the average *rate* of rearrangements for a large assembly of identical genes. When one investigates this rate as a function of temperature, one finds that it increases exponentically with temperature in a way describable by an activation energy E; this means that a rearrangement occurs if the energy of the molecules is larger than E. This equation gladdens the heart of any theoretical physicist, for the same law holds for a host of other molecular processes. This is an indication that, at least as far as molecular rearrangements are concerned, there is no difference between "living" and "dead" molecules, but that both will show mutations.

One should not say that this has consequences for the molecular domain only. For a mutation gives rise to a different plant or animal. The mutation occurs at the *molecular* level but its end result shows up at the *macroscopic* level.

What Can Random Processes Do?

In the first place random processes are instrumental in reestablishing equilibrium after a disturbance

What we have learned about random processes in physics and engineering should be applicable to biology.

from equilibrium has occurred. Let me illustrate this with an example:

I am in the kitchen and the pilot light of the kitchen stove is off. I turn on the gas for 5 seconds and then turn it off. At that time there is a concentration of gas near the burners. If the system is now left to itself, the gas will distribute itself evenly throughout the kitchen. Such an equilibrium occurs, even though the motion of individual molecules is completely random, because there are more molecules going from an area of high to an area of low concentration than there are going from an area of low to an area of high concentration. The random motion of molecules thus has the tendency of evening out concentration differences. After equilibrium conditions have been established, local fluctuations around the equilibrium situation occur, but they are so small that it takes very careful measurements to detect them.

If we now apply the theory to the past, which means that the system has been left to itself in the past, this would imply that the system would have come from an equilibrium situation in the past. This means that the initial disturbance must have been a spontaneous fluctuation. If the disturbance at $t = 0$. is far too large for that, and it usually is, there is a very high probability tht somebody must have *set* the initial condition at $t = 0$.

We can also express things as follows. A system out of equilibrium is in a very improbable state, but it tends to an equilibrium state of much greater probability in the future. The tendency is thus to go from a state of lower to a state of higher probability. This phenomenon can also be described with the help of the concept of *entropy*. If this highly improbable initial state has come from a previous equilibrium situation, it would have come about by a huge spontaneous fluctuation. If that is ruled out, the highly improbable state must have come from a situation that was "set" at some time in the past. This argument is sometimes used in favor of a creation.

I have no quarrel with the argument itself but I do not like the conclusion for theological reasons. In this argument "creation" is equated to "setting initial conditions". To me creation is a religious concept that is much richer than "setting initial conditions". By equating the two, the concept of creation has been greatly impoverished, and to this I object.

The next question is: Can random events lead to non-random results? We shall show from two examples that this is indeed possible. For the first example we again turn to mutations. In a mutation a gene goes from one stable state to another stable state. The transition is an elementary event that cannot be predicted in advance, but the end result is fully determined by the final state. While the final state is different for different mutations, each mutation leads to a well-defined plant or animal. There is randomness only in the *transitions*.

As the next example we consider an electronic oscillator. Suppose I have an amplifier tuned at 1000 Hz internally and the gain of the amplifier, defined

as the output voltage over the input voltage, decreases monotonically with increasing input voltage and is 100 at an input voltage of 1 volt. I now feed 1/100 of the output signal back to the input and remove the external input signal. Then the amplifier will generate a 100 volt, 1000 Hz output signal all by itself; it has become an oscillator.

How does the oscillator start? If I turn the oscillator on at time zero, there is at first nothing but the spontaneous fluctuations of voltage in the circuits and the spontaneous fluctuations of current of the amplifying devices. But at these small signals the ratio of output voltage over input voltage is in excess of 100 and as a consequence the output voltage builds up until a 100 V, 1000 Hz output voltage is reached. Here the feedback produces just enough voltage to maintain the oscillations, and the buildup stops. The combined effects of the feedback, the tuning at 1000 Hz and the non-linearity of the amplifier produce a stable sinusoidal signal.

If one looks very carefully, one finds that the output amplitude is not absolutely constant but varies very slightly and slowly in a random fashion. That slight fluctuation in amplitude is all that is left of the fluctuations initiating the oscillations. Apart from that small effect, the output is non-random but sinusoidal.

Random Processes and Evolution

In the various theories of evolution one deals with random processes like mutation and genetic drift, and selective processes like natural selection. What is the role of each? Do the random processes predominate or do the selective processes predominate? That depends on the situation.

Let me illustrate that first with a non-biological example. I have a noise signal that I want to study. To that end I amplify the signal in a wide-band amplifier that gives an enlarged replica of my noise signal. Now I put the signal through a sharply tuned electronic filter that cuts out most of the frequencies into which the random signal can be decomposed. What is left of the signal now reflects more of the properties of the electronic filter than of the randomness of the input signal; while there is some randomness left, the effect of the filter predominates.

If instead I had put the signal through a very broad electronic filter that cuts out few of the frequencies into which the random signal can be decomposed, then the signal coming out of the filter reflects more the properties of the incoming signal than the properties of the filter; now the randomness predominates.

If we now equate the selective processes in biology to the filter action in my electronic example, we see that there is a wide range of possibilities for the selective processes. The two extremes are

(a) A selective process with a very broad response that admits most of the random processes initiating evolution.
(b) A selective process with a very sharp response that admits very few of the random processes initiating evolution.

What happens in these extreme cases? In the first case, given a sufficiently long time, the random processes present all the various possibilities that exist and the natural selection process admits most of them. One then obtains an extreme variety of life forms. This seems to occur in the plant kingdom and in the insect world. We have omitted here the important effect of local conditions on evolution. In each locale the development of plant forms is severely restricted by soil conditions, climate etc. It is only when we consider the development *at large* that the great variety of life forms occurs. But the contrast between the development of man and the development of plant forms remains.

The objection is often made that the transition from non-living to living matter had an extremely small probability. But that is no valid objection, for all unique events share this extremely small probability.

In the second case, however, given a sufficiently long time, the random processes again present all the various possibilities that exist. But now the selective processes admit only those few that are compatible with it. In that case one obtains a development with a very strong *directivity*. For example, in mammals the development of a better brain carries such a high premium that it presents the dominating feature that culminates in the development of man.

We come here to the point where we can understand some of Teilhard de Chardin's ideas, expressed in his book, *The Phenomenon of Man*. According to him the development of mammals is very strongly directive and leads directly to the development of man. This agrees with what we just said. But it should be understood that it is more the exception than the rule; the rule seems to be a rather broad response resulting in a great wealth of life forms.

This interplay between random processes and selectivity also occurs in our thinking. The individual steps in our thought processes are random, in that they have the same a priori likelihood. But when we concentrate on solving a particular problem, this imposes such a selectivity on these random steps that our thinking will be strongly directed toward solving that problem. It is therefore no surprise that we are so often successful in finding the solution. If, on the other hand, we had been unselective in what thoughts we would admit, we might have come up with very interesting ideas about a wide variety of topics, but we would not have succeeded in solving the problem in question.

In the case of man, we must consider cultural evolution in addition to biological evolution. The development of man during the last few hundred thousand years has been due mostly to cultural evolution, i.e., to exchange of ideas, inventions and transmission of information. The time needed to generate a new species is about 1 million years; the time needed to generate new cultural tools is many orders of magnitude smaller. Moreover, each change opens up the possibility for new changes. Therefore cultural development seems to grow so explosively, especially during the last few hundred years.

This explosive growth has been used by Teilhard de Chardin's followers as an illustration of what Teilhard de Chardin means by development towards an *Omega point*. The objection to this idea is that Teilhard de Chardin's ideas about the Omega point have a strongly religious flavor, culminating in the expectation that "God will be all and in all." This religious emphasis is missing in the discussion about explosive growth in cultural development.

The Origins of Life, of Cells, and of Multicellular Forms

How did life as we now know it originate? We don't know. But there are some hard facts, and we can speculate. We list these hard facts as follows.

(a) There is sound evidence that electrical discharges, such as lightning, in the primaeval atmosphere of the earth would have produced all the important amino acids, the building blocks of all living matter. These should have combined to more complex protein structures. Could it have resulted in living matter? Apparently it did somehow, but from complex protein structures to a living cell is a very huge step.

How should one define life? Perhaps an acceptable definition is a biological entity that has the ability to reproduce itself. Arguments are sometimes presented that viruses are an intermediate step between living and dead matter. They do not reproduce themselves, but they are reproduced by a *living host*. Moreover, mutations are possible in viruses. However, as we saw before, rearrangements of molecules are possible in all kinds of complex structures, so that mutations are no sign of rudimentary life!

How should one visualize the hypothetical first living structures? This is not certain, but it seems safe to say that they must have been much simpler than present-day cells.

(b) If amino acids are made in the laboratory, they come in two structures that are each other's mirror image; we shall call them "lefthanded" and "right-handed" structures. It seems obvious that left-handed building blocks lead to left-handed structures and right-handed building blocks to right-handed structures. A priori these two kinds of structures would be equally likely. Now the peculiar property of all living matter is that they contain only left-handed building blocks. Schrödinger, the father of wave mechanics, has therefore proposed that this must have come about because the first protein structure that acquired the possibility of reproduction happened to be built of left-handed building blocks and that all present living structures must have descended from that first one. But since it was an operation at the molecular level, it must be described by wave mechanics, and therefore the transition from non-living to living matter must have been a *unique elementary event* that cannot be further described scientifically.

God is Creator because He is God. He would still be Creator if I knew everything there is to know.

The objection is often made that such an event had an extremely small probability. But that is no valid objection, for all *unique* events share this extremely small probability. For example, if I have to figure out what the probability is that I am what I am, and take into account all the events that produced me and all the ancestors that preceded me. I come to an extremely small probability. Nevertheless, I *do* exist.

(c) If the first primitive forms of life were much simpler than the present cells, then a large *accumulation* of genetic material must have taken place in the transformation of primitive to cellular forms of life. The details of this transformation are unknown, but somehow it must have taken place.

(d) In the transition from cellular forms of life to the much more complex forms of present plant and animal life the combined effects of mutations, genetic drift and selection must have played an important role in establishing new species, genera and probably further down the line. How far can these processes bring us? We don't know.

(e) It is now very tempting to insist, as the neo-Darwinists do, that the processes of mutations, genetic drift and natural selection are *sufficient* to explain *all* the changes that have taken place. To me that is too sweeping a proposal. If our argument under (c) is adopted, the accumulation of genetic material took place when going from primitive to cellular forms of life, then it is hard to see why this accumulation must have stopped at the cellular level. It might thus be possible that at certain stages of the development new genetic material has accumulated.

The argument used against this proposal is that this means "invoking miracles". The argument is invalid, for postulating unknown processes is not invoking miracles, but means turning our attention to other possibilities. I do not believe that all the evidence is already in, and many others share this view with me.

One of the biologists from whom I have learned this is the Swiss biologist Adolf Portmann. He likes to state that we are more surrounded by mystery than by well established fact, that what we know is small in comparison to what we don't know. That instills a sense of modesty about our knowledge and a sense of urgency to work quietly but persistently on extending our knowledge.

Portmann takes a rather cautious view about evolution, especially of its neo-Darwinian form. In his opinion much more evidence should be gathered. And this evidence should not be put in a neo-Darwinian framework, for in that case all that does not fit into the framework tends to be disregarded. Rather it should be left standing *as is*, so that it becomes clear *what* the theory of evolution must explain. Portmann has worked this out in detail for the development of man. (A. Portmann, *Biologische Fragmente zu einer Lehre von Menschen*, Schwabe Verlag, Basel, 1957.)

When one looks at the huge amount of information stored in the genes, the question arises: "How did it get there?" Could it have gotten there by random processes followed by selection? Of course it could, but did it? And if so, how did it come about?

Those who at this point invoke an all-powerful designer or creator behind it all have the simplest approach to this question. I know that the principle of design has been badly misused by 19th century apologetics, so that it is no surprise that many scientists shy away from such a conclusion. But can one get

around the problem of information storage without the word "design"? Those who do not think so have in my opinion a strong position.

I would like to add a scientific word of caution, however. When the properties of the chemical elements were discovered, it looked at first sight as if all these elements had been carefully designed. But when the structure of the atom and of the atomic nucleus was unraveled, it became clear that the properties of the elements were actually a necessary consequence of the properties of the protons and neutrons constituting the atomic nucleus and of the electrons surrounding the nucleus. There is therefore no design *in fact*, even though it looks like design at *first sight*. So it may be with the huge amount of information stored in the genetic code. Maybe its structure will also become obvious when the genetic code has been fully unravelled.

I would also like to add a theological word of caution in order to emphasize that my attitude toward evolution is not motivated by theological bias. I cannot be overly enthusiastic about this "proof" of the existence of a Divine Creator. God is not Creator because I know so little about nature. God is not Creator because His actions fill the gaps in my knowledge. God is not Creator because there is so much design in nature. But God is Creator because He is *God*. He would still be Creator if I knew everything there is to know. He would still be Creator if I had a satisfactory scientific interpretation of what I now call "design".

The problems of the origin of life, of the development of cellular forms of life, and of the complex multicellular forms of life will be with us for a long time to come. It will be necessary to keep an open mind about all the options available. It will be exciting to work on these problems quietly but persistently. While the application of our knowledge of random phenomena may not solve these problems, it may give new insights. My effort is a first step in this direction.

The Doctrine of Special Creation

Part IV. Evolution and Christianity

RICHARD P. AULIE

Department of Natural Sciences

Loyola University of Chicago
Chicago, Illinois 60611

Epigenesis

There is a striking parallel between the present reluctance to accept evolution and the resistance to the idea of epigenesis in the 18th century. Both ideas involve change in the organic world. In the introduction to a 1785 French edition of the works of Lazzaro Spallanzani (1729-99) on embryology, the Swiss naturalist and clergyman Jean Senebier (1742-1809) based the concept of preformation on *Genesis*. He claimed that God had created, in the beginning, all the organisms, fully formed and alive, that ever would inhabit the Earth. Preformation therefore meant, for him, the preexistence of the organism prior to its parent. With impressive microscopic evidence at his disposal, be it noted, he could then argue that during development there was no differentiation, for none was needed: no production *de novo* of tissues and organs, but a gradual unfolding of what was already there.

Senebier let it be known what he thought of those who argued otherwise: they were atheists, the lot of them. He went on to explain (1785, p. xxxi):

> As for the moment of creation of these fetuses which must people the earth with man, animals, animalcules, and plants through its duration, I can only fix it at the moment of creation. The sacred historian informs us that God ceased from creating at the end of the sixth day. The experience of all the centuries informs us that God has created nothing anew [*de nouveau*].

Epigenesis, with its emphasis on internal transformations by a sequential, orderly differentiation, was, for Senebier, clearly a threat to theism. It meant that all living organisms had not, after all, been created *ex nihilo* in the beginning. Logically, it meant a series of encapsulated creatures in miniature. An acorn contained a diminutive oak—with yet other acorns, enough for a whole forest. Encapsulation ("ovism," as described here) was indeed the most elaborate and complex of the various versions of preformation extant in the 18th century. The devout were assured that

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Mother Eve carried tucked away in her ovaries all the members of the human race who were predestined to walk the earth—one egg inside the other, so to speak. Presumably the world would end when they were used up (Adelmann, 1966, II, p. 894 *passim*).

Epigenesis (including, of course, chemical preformation) has become so deeply embedded in biology since Senebier's time that no one today questions the idea that organisms develop gradually from an ovum, even though this can scarcely be observed with ease. Not even the authors see a threat to theism in their epigenetic treatment of development (p. 126-137).

It is therefore appropriate to wonder whether the authors are not inconsistent in denying evolution, on the one hand, while fully accepting epigenesis, on the other. If the basic kinds of organisms "were placed on the earth by direct action of the Creator" (p. 398), why not all organisms, also in the beginning? Inasmuch as the special-creation doctrine denies evolution-were right: development is due to efficacious changes

Perhaps the processes in development we now regard as epigenetic are really only apparent—a beguiling thought. Perhaps, then, the preformationists were right: development is due to effacious changes in opacity, to the shifting of position, and to unequal growth rates, by enlargements and extensions, of tissues and organs that are already there—incidentally, a not-unreasonable explanation before epigenetic mechanisms were identified (Haller, 1758, II, p. 172-190, translated in Adelmann, 1966, II, p. 878-884).

Happily, Senebier is remembered today for his meticulous experiments on photosynthesis during the 1780s, not for his dismay over what happens in an egg. The resistance to epigenesis, like the earlier resistance to gravity and the later resistance to evolution, was only a temporary step, albeit a retrogressive one. But it could be no more than a delaying action. It is as though science could not return to a former position.

Notwithstanding the continuities we must discern in the history of biology, I can think of no instance where a new conceptual view, once embraced, was rejected for a return to that of a previous age. This is the second reason why I cannot see how the authors, however sincere they may be, can expect much success in their efforts to return biology to the early part of the 19th century. Science, like time, is a forward movement.

Plato, Aristotle, and Darwin

We have seen that, historically, the special-creation doctrine views nature primarily in Platonic and Aristotelian terms. Animals are arranged on an ascending order of distinct taxonomic entities. There are variations on each level, to be sure, but each "type" of organism has an independent existence with no hereditary relationship with its neighbors. The levels represented by these animals are viewed as increasing upward in structural complexity and moral worth, toward man, who enjoyed an exalted position at the pinnacle of creation.

It was this vision of nature during the 18th and 19th centuries and now in the text under review that to a large extent was equated with the account of divine creation in *Genesis*. This vision was congenial to the superficially pious, but the meaning of divine creation was thereby obscured. For this hierarchic view of organic nature was really an expression of the Greek tradition, particularly Plato's *Timaeus* and Aristotle's *History of Animals*; it could have perforce little in common with the Biblical doctrine of divine creation. Those who failed to recognize the Greek component in the doctrine of special creation, falsely based on *Genesis*, therefore thought erroneously that Darwin's theory of evolution was an assault on the Bible. Thus we may understand the dismay evoked by the introduction of new ideas. For those who thought the Lord had created the animals all at once, instead of at successive intervals, even the idea of a series of catastrophes could jar their sense of stability. The discovery of fossils of animals now extinct raised the disturbing question of why the Lord, having once created such handsome creatures, should find it necessary to get rid of them. (Some thought they had been created to confound the horrid geologists.)

It is ironic that the possibility of progressive change was advanced by the Judaeo-Christian tradition, and that the authors would now uphold a return to Greek doctrine.

Darwin broke this static view of nature. By focusing on populations that interact in space and time he made unnecessary the Platonic types and Aristotelian hierarchies. Moreover, man could no longer occupy an exalted perch on Aristotle's "scale of nature." Darwin introduced a dynamism never before known: modern ecology became possible, and there were even implications for biology-teaching. The arbitrary division today of an introductory biology course into the two segments of botany and zoology represents a survival of this older, hierarchic view in which every living thing is fixed in its place.

As we have also seen, "special creation" has been falsely equated with the Biblical tradition. As an interpretation of organic nature with roots in Plato and Aristotle, it should be distinguished from the doctrine of "Creation," which is a Judaeo-Christian affirmation of *creatio ex nihilo*: the world came from nothing, not from a preexistent something. Creation implies the religious mystery of divine sovereignty and transcendent holiness, which thereby assure that nature is coherent, knowable, predictable, and good. A careful reading of Darwin indicates that he was aware of the difference. In fact, he allowed for (I do not say he asserted) "Creation" on p. 188, 189, 484, and 490 of the first edition of the *Origin*, and this allowance was retained in all other editions as well (for example, in the last few paragraphs of each edition).

The doctrine of Creation carried three important ideas: (i) ultimate origin *ex nihilo;* (ii) linear time; and (iii) future fulfillment. (See *Genesis* 1, 2; *Psalms* 19, 90; *Isaiah* 44:24; *John* 1:1-3; *Romans* 8:18-23; *Colossians* 1:15-20; *1 Thessalonians* 4:13-18; *2 Peter* 3; and *Revelation* 10:6, 22:13.) This doctrine assumed new importance during the 16th and 17th

centuries, when natural philosophy began to recognize a clear distinction between the created and the Creator. Natural philosophy banished the ancient gods, goddesses, and "spirit" from nature, which thereupon lost its animistic components yet remained sacred because of its divine origin. Nature could then become an object of scientific study in the modern sense, for it could be viewed as a system of matter in *motion*, controlled by natural law, and separate from the Deity. This meant a radical shift from the Greeks' unvarying, cyclic, and finalistic view of nature (Burtt, 1954; Collingwood, 1960).

The doctrine of creation contributed to the idea of progress—which implies that nature has a history and a goal. This also means that nature can experience novelty, and with it the possibility of change for the better in time (Gilkey, 1965). We perceive a linear, progressive sequence in the fossil record, and we identify adaptation as a biologic fulfillment of change in linear time. The idea of progress—necessary for the theory of evolution—was strengthened by the secularization of an attitude toward nature that was drawn initially from the Judaeo-Christian tradition (Wagar, 1967). It is therefore no accident that the theory of evolution arose in the West.

Galileo Galilei (1564-1642) saw nature as a created object, and he recognized the significance of change in time—evidenced by comets, sunspots, novae—for the possibility of scientific progress. He was also clear on the "use of Biblical quotations in matters of science" (1651) in what still remains a useful discussion of the relationship between science and religion. As Alfred North Whitehead (1861-1947) remarked, "the faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative of medieval theology" (1925, p. 19).

It is the prospect of progressive change in time that haunts the authors of this book. This is the same view of change that caused alarm in the time of Galileo and Newton and that caused Senebier to take fright at an egg. It is ironic that the possibility of progressive change was advanced by the Judaeo-Christian tradition, and that the authors would now uphold what must be, in effect, a return to Greek doctrine. They think it may be possible to resolve the paradox of what Asa Gray once called the "designed and the contingent" (Dupree, 1963, p. 225). But theirs can only be a minority opinion, for contemporary Protestantism as a whole has long since made its peace with Darwin.

Science and Christianity Both Suffer

The interpretation of *creatio ex nihilo* I have been discussing was obscured, to some extent, by the natural theology of the 18th century, and certainly by the doctrine of special creation in the early decades of the 19th century. I fear this textbook will obscure it even more. A theologic doctrine—Creation—of high importance in the history of science has been equated with the science of a bygone age. We shall have, therefore, neither true religion nor modern biology. Christianity must now depend on the accuracy of geologic claims made more than a century ago. And biology must absorb again the main elements of Plato and Aristotle.

Evangelicals Speak Out On Human Engineering

Over 150 evangelical natural and behavioral scientists, doctors, theologians, educators and lay persons from 25 states, Canada and England concluded 4 days of meetings at Wheaton College (Illinois) July 21-24, 1975. Sponsored by nine major evangelical associations, attendees at the International Conference on Human Engineering and the Future of Man considered implications of scientific research in genetics, neuropsychology and behavior conditioning. Invited addresses were presented by noted scholars Daniel Callahan (Institute of Society, Ethics and Life Sciences), Donald MacKay (University of Keele, England), Robert Sinsheimer (California Institute of Technology), Elliot Valenstein (University of Michigan), Perry London (University of Southern California), and Senator Mark O. Hatfield (Oregon).

A 20 member Conference Commission of distinguished evangelical scientists, theologians, psychiatrists, philosophers and lawyers has prepared a landmark statement of "Evangelical Perspectives on Human Engineering". The 5 page document, intended to be a preliminary orientation, calls for a generally positive attitude toward human engineering research.* Potential abuses in research and application are clearly warned against, but continuing scientific inquiry is seen as part of human responsibility before God.

The Commission calls for extensive justification of procedures which may have drastic or irreversible effects on individuals, safeguarding of human rights, special obligations to non-prejudicially extend safeguards and benefits to the powerless, and the need to develop ethical decision-making models based on biblical principles. It recommends continuation and expansion of efforts by all sectors of science, government and the public to exchange information and focus on ethical implications. Funding for conferences and research projects aimed at developing ethical decision-making models is called for through such groups as the National Science Foundation.

Cautions are made against unnecessary public alarm, while citizen review of human engineering research and application is supported. Evangelical organizations and individuals are urged to expand efforts to integrate Christian ethics with scientific concerns.

* *For copies, write Dr. Craig W. Ellison, Westmont College, Santa Barbara CA 93108.*

The doctrine of special creation obscures the troublesome yet edifying questions of the responsibility of man to his Creator and of man's responsibility to his fellows and to nonhuman nature. As Hugh Miller warned: "The true question is, not whether or no Moses is to be believed in the matter, but whether or no we in reality understand Moses" (1857, p. 351).

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Ecstaticism as a Background for Glossolalia

WATSON E. MILLS

Department of Philosophy and Religion

Averett College
Danville, Virginia 24541

The significance of the experience of glossolalia would be much easier to grasp if some of the questions about its origin could be answered. Interpretation of tongue-speech would be greatly facilitated if examples of similar phenomena could be gleaned from the extant literature for comparison. The purpose of this study is to investigate certain materials with that goal in mind. Since there is a close correlation between ecstatic prophecy and glossolalia the study includes a treatment of ecstaticism both within and outside the Hebraic tradition.

Ecstaticism Outside the Old Testament

The earliest report of ecstaticism that included frenzied speech is found in the report of Wenamon, an Egyptian who journied through Palestine and Phoenicia about 1117 B.C. While in Byblos he wrote this account of his experiences:

> Now when he sacrificed to his gods—, the god seized one of his noble youths, making him frenzied, so that he said: "Bring [the god] hither! Bring the messenger of Amon who hath him. Send him, and let him go."
>
> Now, while the frenzied [youth] continued in frenzy during this night, I found a ship bound for Egypt, and I loaded all my belongings into it. I waited for the darkness, saying: "When it descends I will embark the god also, in order that no other eye may see him."[1]

The attention that is focused upon this frenzied youth sems to indicate that in Gebal such ecstatic utterances were thought to be of divine origin.[2] Moreover, the report indicates that he was a devout worshipper of Amon and that his speech contained some

words that were understandable.

About the end of the second millennium before Christ, there occurred a revival of the worship of Dionysus. This movement spread rapidly over Greece and Syria-Palestine.[3] The devotees experienced a kind of religious rapture or ecstasy whose closest analogy would be found in physical intoxication.[4] Such was the essence of Dionysian religion. In the service of their god the Bacchanals drank wine until they became intoxicated. The wine they drank was for them the very quintessence of the divine life.[5] Their enthusiasm was quite literally a matter of having the god within themselves, of being full of and completely possessed by their god. The Dionysiacs have been likened to the participants at revival meetings—"and these of a very emotional and exciting sort."[6]

The ecstatic nature of the Dionysiac cult is apparent in this description:

> The dances in honor of Dionysus were usually held at night time by torchlight and were preceded by fasting. They were accompanied by the weird music of wind instruments and the clashing of tambourines. Mingled with this strange music were the shouts of the Bacchanals themselves as they waved their torches in the darkness, thus giving to the scene an unearthly light. The dances were wild and irregular and were characterized by a tossing of the head and a violent whirling bodily motion. Thus by the very movements of the dance a physical frenzy was quickly induced, quite as the "dancing dervishes" of Mohammedanism lose control of themselves in the delirium of their ritual.[7]

Euripides, in the play *Bacchae*, tells how these Dionysiac worshippers longed for this ecstatic experience.

> Ah, shall my white feet in the dances gleam
> The live-long night again? Ah, shall I there
> Float through the Bacchanal's ecstatic dream,
> Tossing my neck in the dewy air;[8]

It is at this point that Israelite ecstaticism is somewhat akin to the ecstatic frenzy of the Dionysiac worshippers. In fact, W. F. Albright suggests that the legendary Bacchantic irruption into Greece of which Euripides wrote, and the prophetic movement in Israel may have a common historical source.[9] Although such an hypothesis is both sociologically and psychologically credible, it is plainly evident that Yahwistic ecstaticism followed a very different line of development after the eleventh century.

Actually, the Yahwistic movement probably arose partly as a reaction against ecstaticism.[10] Such a theory seems tenable in light of the relationship of the Dionysiac and Appollonian art forms in both religion and culture in Greece. The relationship between these two forces in art, for example, was one of tension. The Dionysiac artist was ecstatic; the Apollonian found creative expression in "dreams." These were two approaches to reality itself: that of intoxication and that of the dream.[11] It was in the Greek drama that these two forces resolved themselves into a unified whole.[12]

Ecstaticism in the Old Testament

The trail of historical appearances of ecstaticism leads directly to the Old Testament prophets; indeed, Canaanite religion may have been the medium through which the ecstatic movement filtered into Israel.[12]

The first reference to the ecstatic is found in Numbers 11:24-29. This is a clear picture of a frenzied, involuntary utterance. The occasion was the selection of the seventy elders who were to assist Moses in leadership responsibilities. Thse "seventy" elders demonstrated ecstaticism as did Moses, Miriam and Aaron.[13] It appears that Joshua did not know what to make of the experience.[14] The account indicates that the seventy became frenzied on this one occasion only.

Eldad and Medad, who were left behind at the camp, "prophesied." Moses recognized the validity of the phenomenon and suggested that others seek the same experience. The entire episode is in no wise regarded as a psychopathic situation, and the account is set in a religious context and given religious significance.

The earliest detailed examples of ecstaticism in the Hebraic tradition are to be found among the prophets. Originally the prophets went about in bands that formed a kind of separate society within society. In keeping with this societal status, the prophets were commonly designated "sons of prophets"[15] by subsequent generations. Some scholars see the existence of bands of ecstatic prophets as late as the time of David.[16] Possibly they lived together in communal dwellings, and certainly they considered themselves to be inspired by the Spirit.[17] A central passage for ascertaining the nature of this inspiration is found in I Samuel:

> . . . you will meet a band of prophets coming down from the high place with harp, tambourine, flute, and lyre before them, prophesying. Then the spirit of the Lord will come mightily upon you, and you shall prophesy with them and be turned into another man.[18]

While it appears that Saul's behavior is spontaneous, the band of prophets has employed a certain "technique for bringing on the ecstatic condition."[19] The resultant ecstasy is highly contagious, and Saul appears to be caught up in it. Music was commonly used to include this ecstasy.[20] Also, among the earlier prophets as in the case of the Baal prophets, various drugs and wines were probably employed.[21]

Some scholars maintain that the term *nabi* itself is derived from the condition of ecstatic frenzy into which the subject passes; hence, the term denotes a "raving condition" or one who is "peculiarly susceptible to ecstatic excitement."[22] W. F. Albright, however, contends that the central idea of the term is "one who is called" and concludes that

> this interpretation of the word suits its meaning exactly; the prophet was a man who felt himself called by God for a special mission, in which his will was subordinated to the will of God, which was communicated to him by direct inspiration. The prophet was thus a charismatic spiritual leader. . . .[23]

Other scholars hold that ecstatic forms of prophecy were native to Canaanite rather than Hebrew culture. Various "pagan" parallels are cited,[24] and generally it is assumed that the Hebrew people first encountered the phenomenon at the time of the conquest and during the settlement of Canaan.[25] The difficulty with this notion is that some of the earlier literary materials refer to similar phenomena in Irsael prior to the time of the conquest.[26] Moreover, succeeding generations became so suspicious of the ecstatic form of prophecy that the prophet was considered to be "mad," and the prophet of the eighth century did not hesitate to say so.[27] If the influence of the later prophetic movement is to be seen in the Numbers account of Eldad and

Medad, it is most likely the writing into it of the distrust of ecstatic prophecy of that later time and not in the account of the prophecy itself. It appears, then, that even though ecstatic experiences and states in prophecy can be more fully documented in extra-canonical literature, it does not necessarily follow that no comparable phenomena existed in pre-conquest Israel.

External patterns of behavior, such as incoherent speech, insensibility to pain, wild leaping and contortions, and abnormal expressions, were manifested in the ecstasy of both the Hebrew prophets and those of the Canaanites. It would have been easy, therefore, for the two to merge into a kind of syncretistic form in subsequent generations; and such was probably the case. There would then develop a reaction of true prophetic enthusiasm among the Hebrews against the mystical-ecstatic forms of Canaanite culture; however, this does not mean that there is a resulting, rigid distinction between the "cultic" and the "canonical" prophets. On the contrary, there were definitely ecstatic features among the writing prophets.[28] The difference lay in the fact that there was a continuous, gradual, but definite development away from ecstatic forms of prophecy toward the more ordered form of discourse.[29] By the time of the writing prophets there was evidently an intense dislike for the older form of spirit manifestation in prophecy that allowed for little, if any, intelligible communication.

Gradually, through the sheer moral force and righteous living of these great prophets, the ecstatic manifestation of possession of the deity was replaced by more moral concepts of the divine indwelling of the Spirit. That is to say, ecstasy was no longer held to be *just* fanatic behavior; on the contrary, the objective "proof" of possession issued forth in a state of spiritual exaltation for the persuasive communication of the message. This brought about the very evident and continuous resistance of the latter prophets to all abnormal demonstrations of spirit possession. Hosea notes that "the prophet is a fool, the man of the spirit is mad,"[30] while Jeremiah writes:

> The Lord has made you priest instead of Jehoiada the priest, to have charge in the house of the Lord over every madman who prophesies, to put him in stocks and a collar.[31]

Developing, then, is a higher standard by which to evaluate spirit possession—no longer are ecstatic manifestations the sole criterion.

Ecstaticism in the Inter-Biblical Period

During the years between the writing of the major portions of the two testaments, there is not much literary evidence relating to frenzied, inarticulate, ecstatic speaking among the Jews. This scarcity may be due partly to the policy of Jewish religious leaders of the period,[32] although of more influence was the attitude of suspicion concerning the validity of these phenomena.[33]

II Esdras affords one example of frenzied speech. In the account of Ezra's ecstaticism, the text reads:

> Then I opened my mouth, and behold, a full cup was offered to me; it was full of something like water, but its color was like fire. And I took it and drank; and when I had drunk it, my heart poured forth understanding, and wisdom increased in my breast, for my spirit retained its memory; and my mouth was opened, and was no longer closed.[34]

In the contemporary Graeco-Roman world frenzied speech in a religious context was not extraordinary, but rather commonplace.

In this case frenzied speech was induced through the use of drugs.

The remaining literary references to ecstatic speech are to be found outside the Hebraic tradition. In three separate instances, Plato reveals his knowledge of ecstatic speech. In *Phaedrus*[35] he discusses the question of "madness." He does this in terms of prophecy, inspiration, poetry, and love. In discussing madness as prophecy, Plato alludes to the prophetess at Delphi, the priestess at Dodona, and Sibyl, all of whom, he thinks, have conferred great benefits upon Hellas through their ecstatic speaking when out of their senses, but when not, little or none. In connection with inspiration as madness, he refers to certain families where madness has entered with holy prayers, rites, and by inspired utterances. For Plato, the contemporary poets were much akin to the prophets and priestesses; they created compositions during ecstatic trances and from ecstatic utterances. In Plato's discussion there seems to be a link between ecstatic speech and religious significance. Also it should be noted that Plato himself regarded the persons so gifted as of more value than the normal, sane persons.

In the *Ion*[36] Plato further describes the poets when he likens them to the Corybantian revellers who became ecstatic both in action and in utterance. He likewise compared them with the Bacchi maidens of the Dionysian cult.

Again, in *Timaeus*[37] he sought to draw a distinction between the diviner and the true prophet. The diviner was pictured as similar to ecstatic persons—demented, unable to evaluate the visions which he sees on the words which he utters. In describing these diviners Plato ascribed to them certain features similar to those of glossolaliacs: their speech being due to spirit possession; their being unable to discern what they said while in a given ecstatic mood; their state being unconscious. Plato recognized that many people had identified these diviners with the prophets of his own time, and so he was determined to draw a valid distinction. It is strangely similar to that distinction between prophets and glossolaliacs drawn by St. Paul in I Corinthians 14.

A final example of frenzied speech from non-Hebraic sources during the inter-biblical period is found in the *Aeneid*.[38] Virgil here refers to the Sibylline priestess on the isle of Delos. She is pictured as attaining her ecstatic speech in a haunted cave. After the priestess was "unified" with the god Apollo, she began to speak ecstatically. At times this speech was intelligible, and at others it was less coherent. The religious context and connotation of the story are apparent.

These accounts from the inter-biblical period indicate the presence of this frenzied, inarticulate speech

in the Graeco-Roman world. It appears that in at least some cases these practices were connected with religion and were given a religious interpretation and significance.

Ecstaticism in the First Century

Contrary to many modern writers,[39] the case is not so easily made for the existence of parallels to glossolalia among the "religions of the first century."[40] The sources dating from the first and second centuries of the Christian era; e. g., Strabo, Plutarch, Pausanias and Philo, indicate that the "oracles" may have been an intelligible, though difficult, language.[41] The oracle at Delphi was the most famous in the ancient world,[42] and several scholars declare that she uttered her prophecies in an ecstatic frenzy.[43] T. K. Oesterreich, however feels that no clear picture of the inspiraation at Delphi has yet been given. "Everything," he continues, "is wrapped in obscurity and contradiction. Unfortunately, there is little known about her; there exists no eyewitness's description . . ."[44]

Strabo indicates that the Pythia at Delphia received the "breath" that inspired a "divine frenzy" and then uttered oracles in both verse and prose.[45] In addition, Plutarch refers to the emotional frenzy of the mystery religions. He quotes Herodotus regarding the rites of these groups: "Frenzy and shouting of throngs in excitement with tumultuous tossing of heads in the air."[46] Strabo gives an account of the whirling of cymbals and clanging of castanets that were used in the worship of Dionysus, Cybele, and others.[47] He also describes the shouts of "ev-ah" and the stamping of feet that produced a religious frenzy.[48]

It appears that women usually played the ecstatic part in Hellenistic religion,[49] though Pausanias indictates that men once prophesied at Delphi.[50] These women who went into an ecstatic state for the purpose or oracular prophecy may well have spoken in *intelligible* language, but nevertheless they were obviously under great emotional strain. Plutarch tells of one Pythia who went berserk, frightening the people who had come to consult the oracle as well as the male interpreters.[51]

The cause of the ecstatic state in Greek religion was artificial and exterior to the person involved. Erwin Rohde has described the wild frenzy, the use of wine and drugs, and the use of dancing to induce the ecstasy.[52]

It seems that one can posit the existence of ecstatic, frenzied speech on the basis of the extant records; however, it is too hypothetical to postulate that this speech was *the same as* that in Acts and I Corinthians. It appears that the Greeks were ecstatic, but that their speech was not always unintelligible. This means that in the contemporary Graeco-Roman world frenzied speech in a religious context was not extraordinary, but rather commonplace. It means that the early Christians may well have known of a religious phenomenon not wholly different from what occurred on Pentecost.

FOOTNOTES

[1]"The Frenzied Youth" in the *Report of Wenamon* cited in James Henry Breasted, *Ancient Records of Egypt* (5 vols.; Chicago: University of Chicago Press, 1906), IV, 278.

[2]George A. Barton, *Archaeology and the Bible* (7th ed.; Philadelphia: American Sunday School Union, 1937), p. 453.

[3]W. F. Albright, *From Stone Age to Christianity* (2nd ed.; Baltimore: John Hopkins Press, 1946), pp. 304-305.

[4]Friedrich Nietzsche, *The Birth of Tragedy*, trans. Francis Golffing (Garden City, New York: Doubleday Anchor Books, 1956), p. 22.

[5]Harold R. Willoughby, *Pagan Regeneration: A Study of Mystery Initiations in the Graeco-Roman World* (Chicago: University of Chicago Press, 1929), pp. 74-75.

[6]James B. Pratt, *The Religious Consciousness* (New York: Macmillan and Company, 1937), p. 167.

[7]Willoughby, *op. cit.*, p. 79.

[8]Euripides, *Bacchae*, 862-865.

[9]Albright, *op. cit.*, p. 305. *Cf.* also E. R. Dodds, "Maenadism in the Bacchae," *The Harvard Theological Review*, XXXIII (July, 1940), 155-176.

[10]Albright, *loc. cit.*

[11]For a fuller discussion see E. R. Dodds, *The Greek and the Irrational* (Boston: Beacon Press, 1951), *passim*.

[12]Gerhard von Rad, *Old Testament Theology*, trans. D. M. G. Stalker (2 vols.; Edinburgh: Oliver and Boyd, 1965), II, 8.

[13]Numbers 11:17; 11:26; 12:1, 12:2.

[14]Numbers 11:28.

[15]2 Kings 2:3; 2:5; 2:6; 2:15; Amos 2:11; 7:14.

[16]Von Rad, *op. cit.*, p. 10. *Cf.* Amos 7:14. Alfred Guillaume, *Prophecy and Divination among the Hebrews and Other Semites* (London: Hodder and Stoughton, 1938), pp. 144-145, claims that "in 853 B.C. four hundred prophets raved in ecstasy before the gate of Samaria."

[17]*Cf.* Walter Eichrodt, *Theology of the Old Testament*, trans. J. A. Baker (2 vols.; Philadelphia: The Westminster Press, 1961), I, 315.

[18]1 Samuel 10:5b-6, RSV.

[19]Francis J. McConnell, *The Prophetic Ministry* (Nashville: Abingdon Press, 1930), p. 86. For further discussion of the relationship of glossolalia to the prophets see Emile Lombard, *De la Glossolalie chez les premiers Chrétiens* (Lausanne: Bridel, 1910), pp. 189ff.

[20]1 Samuel 10:5 refers to a "psaltry and a timbrel, and a pipe, and a harp."*Cf.* 2 Kings 3:15.

[21]Theodore H. Robinson, *Prophecy and the Prophets* (London: Gerald Duckworth and Company, 1950), p. 32.

[22]Harold Knight, *The Hebrew Prophetic Consciousness* (London: Lutterworth Press, 1947), p. 23.

[23]Albright, *op. cit.*, p. 303.

[24]Hughel Fosbroke, "The Prophetic Literature," *The Interpreter's Bible* (Nashville: Abingdon Press, 1952), I, 202.

[25]Robinson, *op. cit.*, p. 33.

[26]*Cf.* Numbers 11:25-29.

[27]Hosea 9:7; Jeremiah 29:26; *Cf.* 2 Kings 9:11.

[28]For example, Ezekiel's psychic transports (Ezekiel 3:14; 11:5; 11:13; 37:1-10); Jeremiah's emotional outbursts (Jeremiah 4:19; 8:18–9:1; 10:19-20); Isiahia's vision in the temple (Isaiah 6:1-13); and Isaiah's mention of prophetic babblings (Isaiah 28:10-13).

[29]H. Wheeler Robinson, *Inspiration and Revelation in the Old Testament* (Oxford: Clarendon Press, 1946), p. 175.

[30]Hosea 9:7b.

[31]Jeremiah 29:26.

[32]Zechariah 13:3.

[33]See Zechariah 13:3; 13:6; Psalm 74:9.

[34]2 Esdras 14:39-41.

[35]Plato, *Phaedrus*, 244.

[36]Plato, *Ion*, 533-534.

[37]Plato, *Timaeus*, 71-72.

[38]Virgil, *Aeneid*, 259-260.

[39]*Cf.* Clarence T. Craig, "Exegesis: The First Epistle to the Corinthians," *The Interpreter's Bible* (Nashville: Abingdon Press, 1953), x, 146. James Moffatt, *First Corinthians* (New York: Harper and Brothers, 1933), pp. 207-208; Jean Héring, *The First Epistle of Saint Paul to the Corinthians*, trans. A. W. Heathcote and P. J. Allcock (London: Epworth Press, 1962), p. 128; Maurice Barnett, *The Living Flame* (London: Epworth Press, 1953), pp. 79-112.

[40]Elias Andrews, "Tongues, Gift of," *The Interpreter's Dictionary of the Bible*, (4 vols.; Nashville: Abingdon Press, 1962), R-Z, 671.

[41]*Cf.* Plutarch, *The Oracles at Delphi No Longer Given in Verse*, 22.

[42]Richard Haywood, "The Delphic Oracle," *Archaeology*, V. (Summer, 1952), 110-118.

[43]For example, *cf.* Moffatt, *op. cit.*, p. 208. The same idea may be seen in "The Famous Oracle at Delphi," *National Geographic Magazine*, LXXXV (March, 1944), 304.
[44]T. K. Oesterreich, *Possession: Demonical and Other* (New York: Richard Smith, 1930), p. 312.
[45]Strabo, *Geography*, IX, iii, 5.
[46]Plutarch, *The Obsolescence of Oracles*, 14.
[47]Strabo, *Geography*, X, iii, 13, 16.
[48]*Ibid.*, X, iii, 15.
[49]Oesterreich, *op. cit.*, p. 311.
[50]Pausanias, *Description of Greece*, X, xii.
[51]Plutarch, *The Obsolescence of Oracles*, 51.
[52]Erwin Rohde, *Psyche* (New York: Harcourt, Brace and Company, 1925), pp. 257-60.

A Speculative Model—Part II

Original Sin as Natural Evil

RICHARD H. BUBE

Department of Materials Science and Engineering

Stanford University
Stanford, California 94305

This paper continues an effort begun in a previous paper to explore the possibility of integration of an evolutionary view of life with the biblical revelation. No really successful integration has been previously accomplished, and those that have been offered (e.g., by Teilhard de Chardin) tend to depart at some point or other either from the biblical revelation or from scientific understanding in a crucial way. The specific purpose of this paper is to suggest a possible interpretation of original sin within the context of an evolutionary view. The key thought is not that "man commits evil because he is an animal," as commonly maintained in non-biblical evolutionism, but that "an animal commits evil because he is a man."

Background

In a previous article (*Journal ASA* 23, 140 (1971)), "Biblical Evolutionism?" I attempted to develop a speculative model in which both biblical theology and an evolutionary view of life were integrated. This speculative model included the affirmation that (1) God created man, (2) He created him distinct from the animals, (3) He created him out of the stuff of the earth, (4) man is the participant in real moral guilt, (5) sin entered the world through man's choice to rebel against God, (6) man guilty of moral evil needs a Savior, and (7) the only way to bring man to his creation-intended position is through his acceptance of the Lord Jesus Christ for the forgiveness of his sins. In this model Christian conversion, justification and sanctification are processes in evolutionary development; all evolutionary development is a manifestation of the continuing activity of God. In the present paper I continue the development of this model in somewhat more detail, and in particular consider the significance of "original sin."

The Problem of Evil

The problem of evil is certainly one of the most central and difficult in all of Christian thought. The

Copies of this manuscript as it appears here were sent over two years ago to four distinguished scholars in biblical disciplines and in theology, history and philosophy, who would be critical of the ideas presented without being polemical. After promptly receiving their insightful responses, there was a great temptation to rewrite the entire manuscript and attempt to take advantage of their critiques. This might have led to a more unified presentation for the reader, but it would have slighted the contributions made by these scholars and would have made it unnecessary for the reader to work through some of these nuances for himself. The original manuscript and the responses are reproduced here substantially unchanged, therefore, and a few notes of response are added at the end in an effort to avoid misunderstandings. The reader is urged to read paper, critiques and response all together, before making a personal evaluation.

origin of evil remains a problem with no ultimate answer, but this does not mean that nothing significant can be said about it.

The definition of evil must take into account the definition of good. If God is the ultimate standard of good, then that which is good in the world and for man is that which is in accord with God's *creation purpose*. Anything that happens can be called evil, therefore, if it is not in accord with God's creation purpose. Several categories of evil may then be recognized.

The first category is that in which human beings are not involved at all. In the earlier paper it was suggested that such events should not be called evil, and perhaps this is still a wise decision, but they must to some extent be included if we are to abide by the above definition of evil. When rabbits are killed by falling rocks, or deer are brought down by lions, or sheep are drowned by overflowing rivers, events are taking place which are both natural and yet perhaps unnatural. We hesitate to call them "evil" because rocks, lions and rivers are not responsible moral agents, and because rabbits, deer and sheep do not bear the image of God. The question is, "Are such events in accord with the creation purpose of God?" One is hard put to answer with authority, since such events are evidently indispensable in the world as we know it. Yet from the biblical strain flowing from the Old Testament prophets through Paul one must conclude that the biblical authors were either using these events symbolically to refer to actual evil, or these events themselves are part of the reason why the creation groans and waits for redemption. In any case it is probably appropriate to include them under the category of natural evil.

The second category is the more common one of natural evil, in which human beings are caused to suffer and/or die due to forces characteristic of the natural world as we know it, e.g., earthquake, fire, flood, volcanic eruption, disease, famine etc. The biblical revelation is fairly clear that the involvement of human beings in events such as these are not in keeping with God's creation purpose, but mirrors in some indirect way perhaps the sinful state of the world.

The third category is that of moral evil, in which human beings participate to violate the image of God with which they are endowed by creation. Moral evil results when a human being causes suffering and/or death either directly or indirectly (e.g., through irresponsible stewardship of the world's resources) to other human beings.

Moral Evil

The existence of moral evil in the world (even if not its ultimate origin) can be dealt with biblically without major difficulty. Moral evil results when men place their own egos at the centers of their lives rather than God. Neglecting the fact that they are creatures, they claim the prerogatives of the Creator. Moral evil leads to the separation of man from his

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Evil and/or Sin Inherently Irrational

Bube's article, as I see it, is an attempt to make a synthesis of what Scripture says about man, sin and evil, and, of what we know of man through the sciences. Working with these two different sets of data, he attempts to illuminate what is meant by original sin.

Because evil and sin (which Bube does not sufficiently differentiate) are destructive of nature, i.e., value-destroying, they are inherently irrational. The irrational is never capable of total rational explication, but always ends up in a logical surd. That is why to date no explanation of evil and/or sin is satisfactory and that shall always be the case. A satisfactory explanation of evil and sin would be a contradiction "in the adjective." Accordingly Bube's article does not completely satisfy us, nor did we expect it to do so, but the article could have stressed the irrational and mysterious elements of the problems of sin and evil.

I think Bube has struck off in the right direction for how Genesis 1-3 is to be understood. I do not know if all readers would catch the importance of the hermeneutical stance. He says in effect that Genesis 1-3 is not giving us something strictly in historical order so that we can speak chronologically of conditions before a fall and after the fall. Rather the passage sets out the conditions of natural or created and human existence. These factors are factors always and everywhere at work. Hence they light up our present existence as well as the first man's.

This is what is meant by the best use of the word myth, and not the degenerative understanding of it by Bultmann. A myth in the good sense is a story, an historical narrative (which by definition is consequential with a "before" and "after") which sets out great, universal human themes, experiences, and conditions that illuminate our existence. The purpose of this illumination is not for contemplation but for wisdom in the manner in which we lead our lives. I would say that most Old Testament scholars today would accept the mythical understanding of Genesis (in the sense which I have stated but certainly not Bultmann's!) and not the historical-consequential interpretation.

I suppose the most critical issue in Bube's paper is whether original sin is a "fall from" or a "failure to." His paper is not quite clear at this point. If it is a "failure to" meaning that man as evolving is first natural animal, but one who must move along spiritually and morally to be fully in the image of God), then he is in the camp of Teilhard even though the paper ends with a disclaimer to this position. That is to say, redemption is the extension of, and fulfillment of, the creative-evolutionary process. However it seems to me in historical theology and in the Biblical record itself we have more a "fall from." It seems to me that the seriousness of sin, the demonic character of it, and the senseless and irrational character of it, are better explained by a "fall from" than a "failure to." Now there is some "fall from" in Bube's article, so that he could reply that he does write about a "fall from" as well as a "failure to." However the paper would have been stronger with this clarification.

Another problem is whether the completed state of man is the man saved in Christ or not. If one says this, then what do we say of the Old Testament men of faith who had no knowledge of Christ? Or, what of men who apparently are born again—the spiritually circumcised Gentiles of Romans 2:29—by responding to the light of God within them ("the things of the law," or that "which the law required")? Is Bube's statement a normative one? That is to say, is this what God bestows on all the redeemed? If so, I agree. If it implies that all the redeemed had a Christ-awareness, then I have problems!

Finally, the doctrine of original sin is very controversial. Fresh investigations of Romans 5:12-21—especially by Roman Catholics—have sparked new ideas. Studies in the concept of Adam (also in I Cor. 15) have always caused rethinking. Two or three volumes on the history of the concept have appeared in German theological literature, and an impressive two-volume work in French.

As I understand Bube's interpretation, original sin seems more the pre-condition of sin than a consequence of sin itself. At least I do not find this point sufficiently clarified. If original sin is the ultimate fountain of specific sins, then it seems to me that original sin must be a consequence of sin. Bube's interpretation seems to me to be in the Kierkegaardian vein (*The Concept of Dread*) that original sin is the existential factors which characterize man and thereby explain (only to a degree!) why all men do as a matter of fact sin, and that not by genetic heritage of something from the founder of the race.

Bernard L. Ramm
Eastern Baptist Theological Seminary
Philadelphia, Pennsylvania

Creator, the separation of man from his fellow man, the separation of man from his true calling as human being, and the separation of man from the created world in which he lives. The solution for moral evil is to be found in Jesus Christ, the Incarnate Son of God, who came to live, die and rise again, in some way to pay the penalty for the guilt that man has incurred through his moral failures, so that man can receive the forgiveness of God, enter into restored fellowship with God, and exercise the ability to do moral good and oppose moral evil.

Natural Evil

The problem of natural evil is not so easily dealt with, and probably poses one of the most severe philosophical problems for Christians to deal with. A paradox is involved. The present state of the world is obviously designed to be appropriate for sinful man, yet neither its design nor its sinfulness are part of God's creation purpose.

Consider one particular example of a natural evil: death, itself. The Bible makes quite clear that death is indeed an evil, that death is an enemy, and that death is the consequence of participation in a sinful world. The very existence of death is somehow related to the presence of sin in the world, and in the final redemption of the world death itself will be destroyed. Yet in the world in which we live, death is a necessity. Without death in the world, there could be no life. Life in the plant and animal worlds depends on the death of previous generations. We have therefore the paradox of death: a natural evil and an aberration on God's good creation, but a necessity for life in the world that we know today.

Theories dealing with the origin of natural evil are far from satisfactory. One theory proposes that natural evil is a direct consequence of moral evil. This theory starts with the creation of an actually perfect world, free of moral and natural evils, in space-time. There were no floods, fires, or disease; the lion did not eat the lamb; animals were vegetarians; death did not exist in the world until Adam and Eve sinned against God. The curse of God which followed that sin completely transformed the world, altered the basic physical laws, and produced instead a new and fallen creation out of what had previously been a good and perfect creation. Thus the natural evil we experience is caused directly by a historical curse pronounced upon nature as the result of a historical fall into sin at some time in the past. The drastic scope of this theory is sometimes softened somewhat by proposing that perfectness was limited to the Garden of Eden, and that death and other forms of natural evil existed at least potentially outside the Garden in the rest of the world.

A related theoretical formulation equates the occurrences of natural evil in the world with the activity of the Devil. This theory is based on those biblical passages that speak of the Devil as the ruler of this world, the prince of powers of the air, the one into whose hands the present power over the world has been temporarily given. Whenever we see natural evil, we recognize it as coming from the Devil.

These attempts to provide a theory for natural evil are important and practically useful; they help to

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elaborate and guide the application of the revelation of the opening chapters of Genesis. They serve to emphasize that natural evil, and its associated conditions in the plant and animal realm, are not part of God's good creation purpose, but exist as present realities corrupting and altering that intrinsic purpose. But they do not fulfill the search for an adequate description of the full significance and origin of natural evil, nor can they be considered consistent with a total biblical and scientific perspective.

However much natural evil may remain a mystery, however, the biblical revelation is quite clear about the way that a Christian should deal with it. Never is a Christian to respond to natural evil as something which in itself is the will of God, and hence is worthy of respect and submission. It is at this point that the first theory mentioned above fails to represent the total biblical revelation. It was a mistaken application of this theory that led Christians to argue against relieving woman's pain in childbirth on the ground that this pain was directly willed by God in the curse that followed the sin of Adam and Eve. The last theory mentioned avoids this pitfall, but introduces some of its own in terms of the identity of the real ruler of this world. The biblical view is that the Christian is constantly called upon to realize that natural evil, like any evil, is not part of God's good creation purpose, and to combat it whenever and wherever possible. It is the calling of the Christian not only to give first aid to those suffering from the effects of flood and disease, but also to lead in the prevention of flood and disease as God gives him the ability. Never is he in the bind of having to decide whether or not to do these things for fear that he might be fighting against God. It is the recognition that these events of natural evil are not part of the good creation that gives the Christian his mandate to work against them and stop them.

The Message of Genesis 1-3

It is precisely in Genesis 1-3 that the Christian finds the biblical basis for this approach to evil. One of the basic revelations given to us in these chapters is the emphasis upon the goodness of God's creation. The creation "as it comes from the hand of God" is good and free from evil. The evil that we see around us, real moral or natural evil, is due to man's sin or to natural causes, and is not intrinsic in the creation purpose of God. Unlike many other major religions, Christianity rejects the concept that evil finds its ultimate cause in matter, finiteness, or in individuality. It is not intrinsically necessary for matter, finiteness or individuality to result in moral and natural evil. The biblical record tells us that the evil around us is something outside of, contrary to, different from, and an aberration on that kind of world which would correspond to the creation purpose of God.

How can such a truth be set forth in a language and form acceptable and understandable to all people of all times, regardless of their cultural sophistication or their scientific knowledge? How can it be told as clearly as possible that the world's goodness derives from God, that potentially the world is good, that the destiny of the world according to God's creation purpose is for salvation, and that matter, finiteness and individuality are good aspects of God's good creation? That the real evil in the world does not have its cause and origin in matter, finiteness or individuality, but that it comes into being for other reasons—reasons that are not part of, but are contrary to God's continuing purpose in and for His creation?

One way such a revelation can be accomplished is to take what is an abstract philosophical concept and cast it into the form of a chronological account. Take the idea of goodness vs. evil as problems in ontology, and reduce them to "before" and "after" in the framework of chronology. Replace the goodness of God's creation purpose with a good creation *before* the Fall; replace the characteristic of evil as extraneous to God's creation purpose with a fallen creation *after* the Fall. Then the nature of God's good creation and the origin of evil are clearly distinguished.

If we read the opening chapters of Genesis and the closing chapters of Revelation, we see that in some ways the Bible forms a full circle. It starts with the representation of man free from suffering and in fellowship with God, living by the tree of life and the waters of life, and it closes with man free from suffering and in fellowship with God, living by the tree of life and the waters of life, yet in a new creation, not the old one recovered. In between comes the account of sin and God's plan of redemption. What is God's plan of redemption? It is to bring man to the actual state intended in God's good creation purpose, from which he deprives himself by his sin. It is as though the final pages of Revelation bring to completion what is the destiny of man set forth according to God's creation purpose in the opening chapters of Genesis. Neither moral nor natural evil are intrinsic to God's creation purpose, but they are intrinsic in the present state of that creation. Is it not possible that the biblical pre-fall and eschatological descriptions in these first and last portions of the Bible do not tell us necessarily what literally was or literally will be, but rather they tell us what is consistent with God's purpose, sometimes in symbolical language? Is it that they tell us what is and what God's purpose will bring into being?

To speak of the eternal God's relationship to events in time is always a difficult thing for the space-time mind to handle. Even Creation does not mean only creation of space, but creation of time itself as well. Just as the present is part of the eternal, so the eternal is manifest in the present. As God knows the end from the beginning, so what passes between beginning and end is eternally known. When God's activity becomes manifest in time, as He shapes the world, it is not surprising to find that the state of the world is appropriate for the state of man living in the world at that time. The present world with its various kinds of natural evil—some of them, like death, essential for life in the present—is appropriate for the sinful state of man. The Genesis account tells us that sinfulness in man goes back to his very beginning. There were not several generations of sinless man living in Eden; the first man sinned. Hardly was he created before he sinned. Hardly was he formed before the world in which he lived was a world appropriate for fallen man. Must we adopt a chronological literal-historical view of Genesis 1-3? Must we accept the account of the pre-fall world as something which actually happened in the spacetime realm in the past? Or can we instead see it as a description given right from the beginning that makes plain man's calling and destiny according to God's creation purpose? This is what man is intended to be, this is what man can become if he is fully human. Man's sinfulness prevents this, but it can be overcome by the work of God on his behalf in Jesus Christ.

If we take these chapters of Genesis as not presenting an historical account of an idyllic perfect world before the Fall, we find consistency with scientific data which informs us about the occurrences and history of the world in previous times. We no longer are confounded with such (possibly meaningless) questions as: Was there death of plants and animals before the Fall? Were animals before the Fall carnivorous? Does one distinguish between plant death and animal

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Difficult to Think of Evolution of "Image of God"

It is good to see a Christian attempting to come to grips with a scientific hypothesis that has been bothering Christians for the past century and a half. Indeed it is high time that we began to look very carefully at the whole evolutionary position since it is now dominating not only biology, but practically every other discipline. Furthermore, Christians have often been kept from any attempt to come to a possible reconciliation between the Bible and evolution not only by the scientists who would use it as a club to destroy Christianity, but also by Christians who through fear or some other motive continually and dogmatically insist that there can be no such thing as "theistic evolution." For this reason I find Bube's two articles (*Journal ASA*, Dec. 1971 and the present statement) very interesting.

He might have pointed out, however, some of the reasons for Christians' adopting the attitude which they have towards evolution. The influence of the Greek philosopher Aristotle has not been limited to the Middle Ages, for from the seventeenth century on, after the initial Reformation break with him, he returned in the form of rationalism which resulted not only in the rise of 18th century "enlightenment" and 19th century positivistic materialism, but also in a type of biblical literalism which in reality has kept many Christians tied to an Aristotelian outlook on the phenomenal world. This in turn has faced them with many problems as scientific knowledge has expanded and changed our whole outlook on both this planet and the universe in general. One has to remember only the opposition of many evangelicals to flights to the moon on what they conceived to be biblical grounds, to realize how this type of thinking still prevails in many Christian circles.

Now we are having attempts by Christians who are scientists to harmonize the biblical doctrine of creation with the scientific General Theory of Evolution, without surrendering either Christian beliefs or scientific knowledge. One cannot help wondering, however, if Maatman's comments (*Journal ASA*, Dec. 1971) on the radical differences between the two do not have some point here. The Bible speaks in terms of sudden and largely discontinuous events while evolution stresses the gradual movement of cause and effect. May it not be that we are here in a situation similar to that which exists with regard to the question of light, where under certain circumstances a particle picture holds while in others a wave picture seems to be valid? May it not be that with one side approaching from theological or biblical starting point and the other from a scientific, empirical base, they can never be brought to a point of reconciliation, although they may both be true according to their own systems from which they work? They may touch at the edges, without really becoming meshed.

My reason for saying this is primarily in relation to the

death as consequences of the Fall? Were there floods, fires, and earthquakes before the Fall? Did the lion lie down with the lamb before the Fall? We are no longer challenged without cause by the physical record that indicates that death, animal aggression, accident, fire, flood and freezing, etc. have extended back far beyond the time in which one could reasonably place the days of the first man.

Original Sin

With this as background, we finally come to the consideration from which the title of this paper is derived. The term "original sin" does not appear in the Bible, and the doctrine of original sin is a theologically developed one from biblical imputs. What is meant by the term is traditionally either one or both of the following: (1) a *predisposition* to sin, which is inherited through birth; and (2) the *guilt* which accompanies that state in which there is a predisposition to sin. "Original sin" is not *a* sin; it is a state of human nature.

One of the traditional views of original sin is that sinless Adam sinned, and that in some way—apparently necessarily genetic—the effects of his sin have been passed on to all of his descendants. We are therefore all prone to sin by that human nature which we inherit, and guilty in some sense of Adam's sin: "In Adam's fall sinned we all." An associated view is often that Adam was the federal head of the human race representing all his descendants; the guilt which he incurred by his actual sin is imputed to his descendants in analogy to the way in which the righteousness of Christ is imputed to all who put their faith in Him. Is man then condemned, judged guilty by God because of the sins of his ancestors? This kind of question has always been a difficult one. It is evident that man is guilty for his own sins. No man ever lives a life free from sin. It is also evident that each man is born with a predisposition toward sin, toward self-centeredness which is the root and source of sin. Let us settle for a practical definition of "original sin" therefore as that predisposition with which we are born, that natural inclination toward self-centeredness which can lead us to transgress the commandments of God and to exalt the commandments of self.

Genesis 1-3 *takes the idea of goodness vs evil as problems in ontology, and reduces them to "before" and "after" in the framework of chronology.*

By its very nature original sin cannot be described under the category of moral evil. Moral evil is entered into by man responsibly by choice; original sin is something that man is born with without choice. If we view original sin under the category of natural evil, however, we can see its existence in a man as a consequence of the process by which man has come into being through the activity of God.

A somewhat enigmatic formulation may help at this point to demonstrate the differences between competing views. The traditional Christian view is that "man commits evil *because* he is man." The sin of man is something wholly unique to man and his relationship to the animals is only coincidental due to the fact that both have the same Creator. The non-Christian evolutionary view is that "man commits evil *because* he is an animal." The reality of sin is downgraded to that of incompleteness in the evolutionary process; this same process will carry man beyond the point where he no longer commits evil. What I am suggesting is that "an animal commits *evil* because he is a man." By this perhaps unnecessarily paradoxical phrase, I mean that the characteristics which were natural, acceptable and intrinsic to the animal *become* sin when that animal *becomes* a human being.

There is an undeniable continuity of man with the other animals, as well as an undeniable uniqueness about man which separates him from other animals. As Schaeffer has pointed out, man is one with the other animals as to his creaturehood, but uniquely separate as to his manhood. When man stops being human, he sinks to the level of the animal. The animal is characterized by self-centeredness and by the instinct for self-preservation as the very basis for its existence, although in the higher animals even this basic instinct can be overruled by love, loyalty or habit as one cares to describe it. The driving force for animal life is to preserve the self. Thus self-centeredness and self-pres-

question of man becoming man. I would be willing to go along with Bube in his interpretation of the meaning of man being made from the dust of the earth. On the other hand, I find it a little difficult to think in terms of the evolution of the "image of God in man." According to the biblical position it would seem that man became "the image of God" in an instant. Dr. Stephen Leaky with whom I had some discussions on this matter some years ago spoke of man, or rather a hominid, becoming *homo habilis,* i.e., learning how to think and to use implements. Then he believed man became *homo sapiens,* and although I cannot remember that he believed that this was the time when man became the "image of God", it seems to me that this was his view. Is not this possible? Anyhow, how could such a matter be determined by purely biological investigation, unless we were prepared to accept a materialistic philosophy?

It would appear that we might learn something from biblical teaching concerning the Christian's regeneration. We are told in Colossians 1 that Christ is the "express image of God", and we are also told that we are made conformable to Christ as new creatures. Christ's use of the term "born again" or "born from above" would seem to indicate that the new birth takes place at a definite time, even instant, but that the Christian then grows into the likeness of Christ. May this not be the way in which the original formation of man in the image of God took place, but that the growth stopped short when man turned aside to worship the creature instead of the Creator. (Rom. 1:19ff)? Of course man's rebirth is ultimately mysterious and beyond man's comprehension (John. 3:8), so will not his original creation in the image of God also remain a secret into which man cannot pry? Perhaps we should leave the matter there.

It seems to me that Christians must get over their fear of science by recognizing that the development of scientific knowledge is as a result of the Common Grace of God to all men. They must also realize, of course, that much of their biblical interpretation as well as scientific theorizing is purely human rationalization which overlays the fact. Thus they must seek to strip both away if they are to gain true knowledge. At the same time, they have to realize that ultimately the providential action of God is not subject to human understanding. Consequently they cannot bring about a rational coherence between all biblical and scientific ideas or theories. They are to do their best, but after that they have to admit that the "ways of God are past finding out." Bube has presented a model as a starter. It is now up to others to see what they can do to improve it.

W. Stanford Reid
Department of History
University of Guelph
Guelph, Ont., Canada

ervation are appropriate attributes for the animal. In the course of God's working as seen in the evolutionary process, however, animals were transformed into men; or, if you prefer, men came into being as unique animals, creatures with many attributes similar to the other animals, but with unique attributes which describe man as made in the image of God. These include such attributes as God-consciousness, responsible choice, use of language, being able to live before God and have personal fellowship with Him in prayer and in life. Man shares the attributes of the animals, self-centeredness and self-preservation, but what was for the animals a matter of natural instinct becomes for a human being, with his new dimensions and potentialities, the source of sin *if* it continues to hold the same position in his life as it holds in that of the animal. When a man acts in such a way that self-centeredness and self-preservaton are the dominant factors of his life, then he has denied the humanity with which he was created, denied the position to which God has destined him by His good creation purpose, and sunk indeed to being only an animal.

Recapitulation

Consider God's purpose in shaping a perfect world in Jesus Christ. We see God's work in history, forming from nothing the energy from which this world exists, and maintaining that energy in existence moment by moment by His continuing activity. We see the shaping of that energy into matter, of matter into living organisms, the development of living organisms into plants and animals, and the appearance of that unique creature man bearing the image of God. But man, as he comes into being, is also in the process of becoming. Natural man is not a fully human being. The answer to the question, "What does it mean to be fully human?" is "To be like Jesus Christ." If a man does not live as Jesus Christ, he cannot be said to be fully human. Thus man is in the process of becoming, either more human or less human. As he is touched by God, accepts and receives Jesus Christ, commits his life and himself to Him, the characteristics of the animal—appropriate for the animal but inappropriate for him—are transformed into the fully human. On the other hand, when a man turns his back on God and sinks in his actions and attitudes to the level of only animal-like emotions, then although potentially still made in the image of God, in actuality he becomes little more than an animal.

Sexual relations provide a graphic example. Animals partake of sex as a purely biological function. Men can choose to treat sex as a purely biological function and engage in sex indiscriminately for fun, but a man cannot act in this way without forsaking his humanity. It is his humanity which adds the dimensions to the sexual act which transcend the biological, which make it an act of a lifelong commitment of love before God, rather than just the carrying out of an instinctual biological animal urge.

The man in Jesus Christ is continuing along in God's purpose for the forming of a perfect world. In Him the effects of natural and moral evil are being overcome, and in Him are the firstfruits of what is to be a completed creation. The world as it exists today is not the world intended in God's good creation purpose. We are living in a transition time, between the time when God brought man into being and made it possible to enter into fellowship with Himself, and the time when God's work for the world will be completed. Now is the time for us to begin to deal with some of the moral and natural evils of this world through the strength of God's Holy Spirit and through a committed walk after Jesus Christ. This work of perfecting will be completed only in the final redemption, when the creation will no longer groan, when every tear will be wiped away, when suffering will end, when moral and natural evil will be done away with, when death will be cast out, and when the promise made in Christ's resurrection will be realized not just in hope but in full actuality.

Objections to this Approach

Objections to this approach may be anticipated. I would like to consider just two which are based on a misunderstanding. One objection is that this approach treats sin as if it were not real. This is not the case. Rather we recognize that from the earliest days of the unique human being, brought into existence by God

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Really Makes No Sense

In a previous article (*Journal ASA*, Dec. 1971) Bube suggested that the scientific model of progressive development (evolution) with which the biologist works is not incompatible with Christian theology, since the doctrine of creation does not rule out God's acting in and through a process of development and change at the empirical level. In this second article he attempts to go on and show how such a developmental or evolutionary model is compatible with a Christian view of evil, including moral evil. His argument, in this case, is not as plausible to me as in the first instance. I shall simply indicate how I think as a theologian in these areas to focus some facets of the problem.

1. By "natural" evil I understand all those events that occur according to the laws of "nature", which bring suffering and death to living creatures. The factor of evil in such events is more evidenced as one approaches the human realm: the death of a deer from starvation caused by a famine is less, the death of a child is more, "evil" in this sense of "natural" evil.

2. By "moral" evil I understand all those events, whether inward attitudes or overt acts, which are a part of man's life, in so far as that life is opposed to God's will revealed in his law and in Jesus' life.

3. Moral evil I believe to be the result of a free and responsible act of disobedience on man's part, which act I call the fall. Having its root in pride and unbelief it results in the alienation of man from God and his neighbor.

4. Man was not created fallen and sinful, but upright in communion with God. He did not fall *into* history (Greek Idealism) but *in* history. The fall, then, is an historical event, chronologically in the past. I cannot be more specific than to say it was an act of the first Adam, hence in the primal history of the race, in contrast to the saving act of Jesus, the second Adam, in the relatively recent history of the race. A date on the calendar, a location in a geography book, as describing this event, is not possible to us in the case of the first Adam, as it is in the case of the second Adam.

5. As a result of Adam's sin, all men are born sinners, that is, born disposed to sin, incapable of loving God and neighbor apart from God's grace in Christ renewing their hearts.

6. When God's gracious work of redemption in Christ is complete in the world to come, all evil, natural and moral, will be done away. Since there will be no more sin, there will be no more death.

7. This final order of life which is free from sin and death, is a new creation of God, not the result of the upward movement of human history. To say that natural evil is a curse or judgment of God upon man for his sin is not to say that sin *causes* natural evil, as scientists speak of cause and effect. (A man's congenital blindness is not caused by his parents sin. John 9:2.) A *cause* is always prior in time to an *effect*, whereas we know that death was in the world as a universal law, long before man was

with the potential to be in fellowship with God and to be free from sin, he has failed to realize this potential and has instead been subject to self-centeredness and the neglect of the claims of God upon him as a human being. These claims call him to transcend the instincts, the animal emotions, that he has because of his animal heritage. The non-Christian evolutionist is not totally wrong in arguing that man commits evil because of his animal heritage; he is wrong in arguing that such a situation denies the reality of sin, guilt and human responsibility. But the traditionalist Christian is also wrong in arguing that man's sinfulness has nothing to do with any animal heritage. (It may be noted here that it is logically possible to divest the term "heritage" of its historical evolutionary connotations, and replace them with existential physical and psychological characteristics, thus making it possible to continue our present argument even under circumstances where the evolutionary process is not completely accepted.) It is also a grave error to argue, as is sometimes done, that the animal state represents a pure state of being which has been corrupted by the human, so that the solution of evil is sought in returning to the primitive pre-civilization modes of life; such a course can lead only to the final realization that the truly animal is truly bestial.

Man chooses to do evil, and in choosing to do evil, he uses one of the human abilities given to him. He does not commit evil because he is an animal, but he chooses responsibly as a human being made in the image of God. Therefore he is responsible for the choices he makes. Yet also undeniable is the fact that every man comes into the world with a predisposition to self-centeredness, to sinning. This predisposition does not determine that he must sin or make it impossible for him to do otherwise in an ultimate sense, but it is a condition that he cannot overcome by himself and that only the grace of God active in his life can free him from into what it means to be fully human. We are certainly not saying at all that sin is not real. We are saying that sin, rebellion against God and self-centeredness are conditions of man as he is developing, but that sinfulness, man's separation from God, and his participation in moral evil are the results of his responsible choice as a human being through which he becomes guilty of sin indeed and in need of a Savior.

What was for the animals a matter of natural instinct becomes for a human being, with his new dimensions and potentialities, the source of sin if it continues to hold the same position in his life as it holds in that of the animal.

A second objection is that this point of view is very much like that of optimistic evolutionism which describes not the fall of man, but the rise of man—how man, once an animal, now has risen to be a human being and will pass on to higher and higher states until finally he becomes like God Himself. The critical difference here, of course, is that the common position of optimistic evolutionism is a man-centered humanistic view of life. It says that all this is going to happen as man pulls himself up by his psychological bootstraps. The Christian position is radically different in essence if not necessarily in form. It speaks about man becoming perfect, as becoming fully human, as being made like Jesus Christ Himself, as seeing Him as He is. But all of this is not somehow because of some basic capability or potentiality of man himself alone, but all of this is only because of the work of God who brought man into being through a process and continues to make it possible for him to fulfill his creation-intended destiny of being fully human through a process. In past days man's ancestors were wholly animal, indeed, and yet God brought out of this stock a creature made in His image, a unique creature, destined to live in fellowship with Him. By His grace God calls this unique creature and says, "Turn from the self-centeredness which characterizes the animal aspect of your ancestry, and recognize that to which you are called and created, namely to be a child of God living in the image of God." It is only by the grace of God that man is able to progress along this way.

created, much less fell. Man's fall into sin is the *reason*, not the *cause*, of natural evil, including death.

8. The point I have just made (among others) makes me incline to a position which the theologians have called supralapsarianism. (Barthians also call it Christocentricity.) According to this view, the final end or *telos* of creation is salvation. In other words, the fall of man and his sin are a part of God's larger purpose of redemption in Christ. (Eph. 3:8-12). God, then, created this world as the theater of fallen human history, a world marked by death from the beginning, a world, to use scientific terms, in which there is a universal reign of entropy.

In light of the above affirmations I have difficulty with Bube's thesis in the following areas:

1. I do not see how he can say that evil in all its forms is no part of what he calls God's "creation purpose". The world, he says, is destined, according to God's creation purpose, for salvation. Since "salvation" presupposes salvation from sin and evil, I do not see how evil can be no part of God's creation purpose.

2. I do not see how one can understand such matters as man's fall, his original sin and actual sins, in terms of his animal ancestry. This really makes no sense to me. For me, sin in its origin, nature and expression, has to do with man's being in the image and likeness of God, not in his being like the animals. Jesus, who was as much like the animals as we are, did not sin, whereas angels, who are not like the animals, did sin. I get the impression that Bube is trying to think of the fall in terms of evolutionary development from animal to humanlife, whereas I think of it as a revolt against God, something which man is capable of because he is like the angels, not because he is like the animals.

3. I do not see how one can say that something that is "natural", "acceptable", and "intrinsic" to an animal can "become sin" when that animal "becomes a human being." Take sex, for example. I have always supposed it was "natural", "acceptable", and "intrinsic" to human beings as well as animals. It becomes sinful, not when an animal becomes a human being, but when a human being becomes a sinner.

4. I do not see how one can say such things as: (a) "Original sin cannot be described as moral evil." (b) "The traditional Christian view is that man commits evil because he is a man." I should rather suppose that (a) original sin is the primary form of moral evil and that (b) man commits evil because he is a sinner, not because he is a man.

5. I guess I could sum up my response to Bube as far as this article is concerned, by saying that I appreciate his awareness of how the modern scientific picture of man and the world impinge on a Christian view of man and the world; but I do not see that it is possible to harmonize the two, in these areas, as he does.

Paul K. Jewett
Fuller Theological Seminary
Pasadena, California 91101

Summary

The point of view sketched in this paper seems to enable us to integrate a scientific understanding of man and the world with a theological and biblical understanding, in such a way that violence is done to neither. We see them not as exclusive competing worldviews, but as complementary worldviews that tell us what man is in different ways, both of which are needed if we are to have a full perspective of what man is truly like. It provides us with a tie between the real world of geology, paleontology and anthropology, and the real world of biblical theology. It is consistent with our observations in the biblical record that man can sink to the level of an animal (and lower, since he is intended to be a man), that he can act through motives which are not truly human, not characteristic of the image of God—motives which are like and perhaps even baser than those of the animals to which he becomes similar. Yet from the very beginning of the fulfillment of God's purpose in creation to the final completion of His redemption, He calls men and draws them to Him in Jesus Christ by His sovereign grace. To live like an animal is not man's destiny; it is submission to "original sin" and rejection of God's continuing work. Man is called to be fully human in and through Jesus Christ.

Makes God Responsible for Sin

Given that God is morally perfect, omnipotent, omniscient etc., how does it happen that evil exists? If we take the question, "Why does God permit evil?" perhaps the proper answer is, "We don't know." God hasn't told us why He permits it. This seems to be the aspect of the problem of evil that Bube speaks of in this paper.

Throughout the paper there is ambiguity about the meaning of the phrase, "God's good creation purpose." On the one hand, one might mean God's long-run or ultimate purpose: the state of affairs that He proposes to bring about in the end, what we might call His eschatological purpose. On the other hand, one might mean God's purpose for the creation as it is presently constituted, what He wishes to see happen right now, for example. In Bube's view, events like rabbits being killed by falling rocks, deer brought down by lions, or sheep drowned by overflowing rivers are cases of evil, and are therefore not in keeping with God's creation purpose. But if one supposes that they are not brought about by any other beings (as apparently Bube does suppose), then presumably these events are due to God's activities, to the way He has constructed the world. It becomes very difficult to see how they could fail to be in accord with God's creation purpose, at least with His purpose for the creation as presently constituted.

Does God wish to see rocks falling right now? Did He wish to see rocks falling before the creation of man? Did He wish to see animals killing one another or rivers overflowing? Apparently He did; otherwise it is difficult to imagine how or why those things happened. A particular event, e.g., the drowning of animals in floods, could be in accord with God's proximate creation purpose applying to now or before men were created, but not in accord with His ultimate or eschatological purpose applying to the state of affairs He proposes to bring about in the future. Bube's ambiguous use of the phrase "God's good creation purpose" causes him to be ambiguous about whether or not these events such as rabbits being killed by falling rocks are or are not in accord with God's creation purpose. He is unable to decide whether to call them evil or not. They are in accord with God's proximate purpose, but perhaps not with His eschatological purpose. How could the answer be anything other than Yes to the question, "Are these events in accord with the creation purpose of God?" if what we have in mind is God's purpose for the world as it is now, for present events. If God didn't want these events to happen, presumably they would not happen. Why would they happen if they were not in accord with His purpose? If He didn't want them to take place now or before the Fall of man, leaving aside the effects of man's sin, they would not have happened. They did happen, so they are in accord with His purpose then, His proximate purpose. When the Bible speaks about these events as being one of the causes of the groaning of the creation, one must conclude that they are not in accord with God's ultimate or eschatological creation purpose. This kind of distinction between God's proximate and God's ultimate creation purpose needs to be made throughout Bube's paper.

Bube's definition for moral evil seems too utilitarian. Moral evil results from disobedience to God, even if no suffering or death to other human beings is involved. Failure to treat oneself properly is an example. Putting something else in God's place is another.

Bube's ambiguity concerning God's creation purpose arises again when he says that the present world is designed to be appropriate for sinful man, but that neither its design nor its sinfulness are part of God's creation purpose. In what sense is the present world appropriate for sinful man? In terms of punishment? But suffering doesn't seem to be very carefully tuned to what people deserve: good men are stricken and evil men are not. It is not clear what Bube means to say here. As for the rest of Bube's statement, the design of the present world may not be part of God's ultimate creation purpose, but it is certainly part of God's proximate creation purpose.

The Bible does clearly teach that human death is an evil and a consequence of sin, but it is not at all clear that the Bible teaches this about plant death or even animal death. It is not at all clear that death in the non-human world is an aberration on a good creation. Maybe yes, maybe no; the Bible doesn't tell us. The theory that the world was created free of moral and natural evil surely does not intrinsically contain the assumption that there were no fires, floods or disease. Floods and fires certainly need not be considered as evil. Maybe animals were vegetarians; maybe not. All that the Bible teaches is that human death is unnatural and contrary to the nature of man.

The second theory - that ascribing the existence of natural evil to the devil and his cohorts - is really a special case of the first theory, since it involves evil resulting from the free will choice of the devil. If what this theory implies about the real ruler of this world is a problem for it, the same implication should be a problem for Bube's account of moral evil. But in fact it does not seem to pose such a problem for him. The fact that God allows the devil to bring about natural evil doesn't pose a problem as to the identity of the real ruler of this world.

Bube says that one of the basic revelations given to us in Genesis 1-3 is the emphasis upon the goodness of God's creation purpose. The creation as it comes from the hand of God is good and free from evil. That presumably means that when creation did come from the hand of God at some time in the past, there wasn't any natural evil. But this conclusion does not appear consistent with Bube's view that creation as it comes from the hand of God did include death and natural evil.

What does Bube mean when he says that the evil we see all around us is due to man's sin and natural causes? The role of man's sin is easily understood, but how are natural causes involved? Whatever is due to a natural cause is due to God's creation purpose for the world at present. If it's due to natural causes, it's due to God; it must be intrinsic to God's creation purpose for the world at present, although not to God's ultimate creation purpose.

How could natural evil come into being for reasons that are not part of but are contrary to God's continuing purpose for His creation? If natural evil is not due to man's sin or to the sin of any other creatures, what is it due to? The virtue of the other theories is that they do give an answer to this question; Bube's view gives no answer.

Part of the point of the story of the Fall is to give an account of the origin of evil. Two Falls really are involved: the Fall of the Serpent, the devil, and the Fall of Adam and Eve. Part of the purpose of these accounts is to give a description of the origin of evil, both moral and natural evil. But on Bube's view such an account is not possible. The story becomes the symbol for some other view which does not have an account for the origin of natural evil.

In Bube's view the world apparently was appropriate for fallen man long before man was formed. This is certainly not very clearly in accord with the Genesis account. If we take it at all literally, it seems to suggest that God looked at His creation and said it is good - there was no evil in it. *Then* something happened. Other creatures introduced sin into it. After that it was appropriate for fallen man, but not before. My point is not

An attempt at clarification . . .

When one attempts to deal with as difficult a subject as this, the limitations of communication become startlingly evident. Jewett provides a clear theological base for a portion of the position I am trying to advance.

> *Jewett*: "To say that natural evil is a curse or judgment of God upon man for his sin is not to say that sin *causes* natural evil, as scientists speak of cause and effect. . . . A *cause* is always prior in time to an *effect*, whereas we know that death in the world is a universal law, long before man was created, much less fell. Man's fall into sin is the *reason*, not the *cause*, of natural evil, including death. . . . . the fall of man and his sin are a part of God's larger purpose of redemption in Christ. (Eph. 3:8-12). God, then, created this world as the theater of fallen human history, a world marked by death from the beginning, a world, to use scientific terms, in which there is a universal reign of entrophy."

As one interprets what I have written, I urge that it be interpreted in terms of this position of Jewett, which is probably for many a more effective description. Plantinga, on the other hand, appears to see my acceptance of this position, but rejects it.

> *Plantinga*: "In Bube's view the world apparently was appropriate for fallen man long before man was formed. This is certainly not very clearly in accord with the Genesis account."

Another example of the difficulty in communication involves the question of whether original sin is to be considered moral evil. Jewett disagrees,

> *Jewett*: "I should rather suppose that original sin is the primary form of moral evil."

but Plantinga appears to agree,

> *Plantinga*: "Bube says that original sin cannot be described under the category of moral evil. That seems to be right, at least as far as my original sin is concerned."

In the following I attempt brief clarification of some of the problems raised with the argument presented in my paper.

> *Ramm*: "It seems to me that the seriousness of sin, the demonic character of it, and the senseless and irrational character of it, are better explained by a "fall from" than a "failure to."

I am not able to make a sharp distinction between these two terms. There is definitely a "fall form" involved, for man fell from the possibility of serving God fully with the newly developed human qualities he possessed. Yet there is also a "failure to" involved, for man fell from this possibility when he failed to choose for his human personhood in relation with God.

> *Ramm*: "Is Bube's statement a normative one? That is to say, is this (a completed state in Christ) what God bestows on all the redeemed? If so, I agree."

Yes, this is my intention.

> *Ramm*: "As I understand Bube's interpretation, original sin seems more the pre-condition of sin than a consequence of sin itself."

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that the Genesis account must be taken literally, but merely that the Genesis account cannot be very naturally taken in the way that Bube means to take it, i.e., as a kind of symbolic account. It does seem to suggest strongly that first of all the world didn't contain any evil at all, or that whatever evil there is in the world is the result of sin. On Bube's view all evil cannot be the result of sin, since what is called natural evil existed long before man's fall into sin.

The view Bube contraverts is not one that is found only among theologians outside the Bible. It is also found within the Bible: "as through one man all sinned, so through one shall all be made alive." That view strongly suggests that human sin somehow begins with one man, with Adam, just as all shall be made alive through one man, through Christ. I fail to see how Bube can understand or interpret such a text on his view. Bube's view seems to run contrary to the New Testament as well as to literal interpretations of Genesis.

Bube says that original sin cannot be described under the category of moral evil. That seems to be right, at least as far as my original sin is concerned. On the traditional view, it is the result of Adam's moral evil, but it is not the result of my free choice. If original sin is seen to be a natural evil present in man because of the process by which man has come into being through the activity of God, then isn't God responsible for it? How can we understand evil in such a way that we do not see God responsible for it? On Bube's view it looks as if God is responsible: He created man in a certain way using certain means that involve men in a predisposition to selfishness which is sinful. Apparently then God is responsible for my having this original sin. Nobody else is. I'm not. Adam isn't. It's just the way I've been created; it has to be attributed to God. This is the point of Bube's view with which I disagree most strongly. We must understand sin in such a way that it is not attributable to God. We can't maintain that God is morally perfect, omnipotent and omniscient - and that He is responsible for sin, when there is some other way in which He could have accomplished His purpose. Presumably there is some other way in which God could have created man free from original sin. On the traditional view, God creates man free and then man misuses that freedom. This is the source of both moral and natural evil. This makes sense in a way that Bube's view does not.

Bube says that when man stops being human, he has the capability of sinking to the level of only an animal. But man can sink much lower than that: he can rebel against God. Animals don't rebel against God. Putting anything else in the place of God is sin. Selfishness is one kind of sin, but it is not the essence of all sin. There are other kinds of sin. Likewise it is not totally true that animals are governed by the instinct for self-preservation. In many cases preservation of the group or hive takes precedence over preservation of the individual.

Finally let me summarize my principal objections to Bube's view. Man doesn't choose to have self-centeredness according to Bube; that's just part of his animal heritage with which he was created. He isn't responsible; God is. God could have made him differently. He could have arranged it so that man was not produced with animal ancestry at all, but could have been created directly as in the traditional view. On Bube's view God chose to create man in an evolutionary fashion and the result is that man suffers from original sin. Then original sin must be laid to God's door. God is responsible. He chose the means that result in original sin. Bube's view simply does not answer the question he started with. Part of the ground rules of such a discussion are that one doesn't say that God thought it would be nice to have some sin. Or that just as God brought about natural laws, He brought about man's sin. The task is to find an expression for the origin of sin that is consistent with the holy character of God. Bube doesn't give such an account.

Alvin Plantinga
Department of Philosophy
Calvin College
Grand Rapids, Michigan

In the sense that "freedom of choice" is the pre-condition of sin, so the "predisposition toward self-centeredness" that I have called "original sin" is also a pre-condition of sin.

Jewett: "Man . . did not fall *into* history (Greek idealism) but *in* history."

This is in accord with the model suggested.

Jewett: "As a result of Adam's sin, all men are born sinners."

This is more difficult; what does it mean to say that all men are born sinners *as a result of* Adam's sin? Is this a scientific cause and effect relationship? Is the biochemistry of the human gene such that sin is transmitted with genetic material? Did Adam's sin result in a change in biology? Is the human body then inherently sinful today? If the questioning of Jewett's contention raises profound theological problems, and I do not deny that it may, the affirmation of the contention raises problems as to what corresponds to the affirmation in the biological world. Perhaps a representative view of Adam is more compatible, leaning toward passages like I Corinthians 15:22 and Galatians 3:7 as analogues.

Both Jewett and Plantinga point out that I have been ambiguous in speaking of God's "good creation purpose." I must plead guilty to the charge on a number of counts. In most of my paper I am speaking primarily of God's ultimate creation purpose; this defines God's intention for the final state of his creation, and it also establishes certain basic principles, as, for example, that sin is not inherent in created matter per se.

Jewett: "I get the impression that Bube is trying to think of the fall in terms of evolutionary development from animal to human life, whereas I think of it as a revolt against God, something which man is capable of because he is like the angels, not because he is like the animals."

There need be nothing contradictory in the two ways of looking at the question. When man arrived on the scene via the evolutionary process (i.e., a creature came into existence like the angels), he faced the choice of living in the fullness of this nature or of subverting it by choosing to follow the self-centered aspects of his biological animal heritage; when he chose himself over God, he revolted and the fall was the consequence.

Jewett: "I do not see how one can say that something that is 'natural,' 'acceptable,' and 'intrinsic' to an animal can 'become sin' when that animal 'becomes a human being.' "

Self-centeredness is the prime example; when an animal is self-centered it is living in accord with God's intention for its animal nature. When a human being lives a self-centered life, he is not living in accord with God's intentions for his human nature; what for the animal was good, has for the human become sin. An animalistic approach to sex *does* become sinful when a human being chooses it; it is not *sex* that becomes sinful, but the indulgence by human beings in sex practices commensurate with animals but not with beings made in the image of God.

Some of the criticisms given by Plantinga are similar to those discussed above. His major devastating criticism, however, appears to be fundamental.

Plantinga: "If original sin is seen to be a natural evil present in man because of the process by which man has come into being through the activity of God, then isn't God responsible for it? . . This is the point of Bube's view with which I disagree most strongly."

On the classical view, God made man with the ability to make a free choice for or against God. What does it mean to have the ability to make a free choice against God? Does the existence of this possibility make God responsible for its exercise? Normally we answer that it does not; God makes the opportunity available, but since he does not compel the choice, man remains responsible. In my model, the "first man" again has a choice. He can choose to follow the predisposition of his nature as inherited from his animal ancestors, or he can choose to follow the higher calling of his new nature as one made in the image of God. It is his choice and it is his responsibility, not God's. The very fact that Adam can be spoken of as making a free choice against God means that Adam had the wherewithal in his nature to make such a choice; my model attempts to indicate a possible way in which Adam came into possession of this nature. Whether by evolution from animal ancestors, or by *fiat* creation with a genuine free will, man faces a choice and man is responsible, not God. In either case the *possibility* of Adam's sinning is provided by God.

Perhaps it is an error to speak of original sin as natural evil, since this leads to the apparent conclusion that God is the author of evil. Yet, in the view of Jewett, natural evil can be integrated with God's overall plan for the world, and even Plantinga is able to view natural evil as within the proximate purpose of God.

Plantinga: "Man doesn't choose to have self-centeredness according to Bube; that's just part of his animal heritage with which he was created."

Man doesn't choose to *have* self-centeredness (just as man doesn't choose to be able to choose against God), but man does choose to *be* self-centered in thought and life.

The reader will see now my great temptation to rewrite the paper to include these excellent comments; I am greatly indebted to the reviewers.

BOOK REVIEWS

THE SCIENTIST AND ETHICAL DECISION edited by Charles Hatfield, Intervarsity Press (1973) $2.95 (paper).

This is the second book based on contributions to an invitational scholars' conference sponsored by the Institute for Advanced Christian Studies, in this case at the U. of Michigan in October, 1972. (The previous book and conference were concerned with *Christianity and the Counter Culture*.) The book has four major sections, the first two being more general in scope, I Ethical Principle and II Ethical Practice, and the next two dealing with specific areas, III Ethics in Genetics and IV Ethics in Psychology. The book concludes with a brief contribution by Carl Henry, "The New Image of Man."

The tone of this book is well expressed in introductory comments by the editor:

> Thus what the scientist who is a Christian thinks about scientific work and ethical decision should be both significant and instructive . . . The use and abuse of technologies make it clear that the problem is unavoidably man himself: His value, his meaning and how he conceives his role in the world . . . Thus the information generated by the sciences and technologies is necessary but not sufficient for an optimal decision on what is best for man. If man is really in God's image -- and that is a moral image if it is any image at all -- then the biblical view of man is quite pertinent to the problem.

In the first paper, Stob states his purpose as exposing "scientific control", the exploitation and pollution of external nature and the chemical, biological and psychological manipulation of man, to the scrutiny of Christian ethics. He does this by

> (1) depicting the rise of Western science and technology; (2) setting forth a Christian understanding of man's relation to nature; (3) by commenting on selected features of the current scientific engagement with man; and (4) by remarking on the role and use of the Bible in moral decision making.

In interacting to Stob's paper, Ronald Nash amplifies the question of how Christian ethics can aid the scientist in determining his moral duty. In his own words, "I am trying to throw some light on why it is sometimes so difficult for Christians to determine their duty." Nash makes a strong distinction between doing the right thing and doing the good thing.

In a second interaction to Stob's paper, Stanley Obitts takes a further look at the development of science, particularly the roles of Descartes and Kant. Obitts traces to Kant, "this separation of scientific judgments about facts from moral judgments about valnes which lies behind the imposition of man's selfish values upon the world controlled by science which concerns us today."

The second section contains papers by Hanley Abramson, John McIntyre, Kenneth Pike and Walter Hearn, and each has merit. I found of particular interest McIntyre's, "Is the Scientist for Hire?", in which the legal ethics of the scientist as a professional are compared to those of a lawyer and a medical doctor. He concludes, "The same ethic guides all professions . . . The scientist's primary responsibility is to his client or employer. Thus, classified work, (e.g., for the department of defense) is proper for a scientist." Further, "the scientist is not responsible for the actions of his client or employer." However, scientists do have responsibilities to society when not serving in their professional capacites. McIntyre argues from a Biblical perspective that the obligations of a scientist when serving in a professional capacity may be quite different from those when he acts as an individual.

I also found most refreshing the paper by Walter Hearn, "Whole People and Half Truths", which is an honest examination of personal ethics in science. I recommend this for all science students.

The third section is composed of well thought out papers by V. Elving Anderson, "Genetic Control and Human Values" and by J. Frank Cassel, "The Ethics of Genetics", The fourth section primarily deals with the reaction of Ralph Underwager, Lawrence Crabb and David Busby to the psychology of B. F. Skinner. For example, from Underwager,

> I rather expect that the more people hear clearly what he is saying, the more openness and readiness there will be to hear the word of God's grace. Go to it, Skinner! The clear and forthright proclamation of the law in which Skinner is engaged makes it possible for the Christian to witness and to proclaim the good news of the Gospel.

This feeling for Skinner is obviously not shared by all.

I found a number of new concepts (for me) in the book and found my time reading it well spent. I highly recommend it to other A.S.A. members.

Reviewed by Bernard J. Piersma, Professor of Physical Chemistry, Houghton College, Houghton, New York.

Books Received and Available for Review

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

Adams, J. E. *Your Place in the Counseling Revolution*, Presbyterian & Reformed Publ. Co., 1975

Corliss, W. R., *Strange Artifacts: A Sourcebook on Ancient Man*

Corliss, W. R., *Strange Phenomena: A Sourcebook of Unusual Natural Phenomena*

Corliss, W. R., *Strange Planet: A Sourcebook of Unusual Geological Facts*

Greenhouse, H. B., *The Astral Journey: Evidence for Out-of-Body Experiences from Socrates to the ESP Laboratory*, Doubleday, 1975

Hall, M. & S., *The Truth: God or Evolution*, Craig Press, 1974

Morey, R. A., *The Dooyeweerdian Concept of the Word of God*, Presby. & Reformed Publ. Co.

VIOLENCE by Os Guinness. Downers Grove, Illinois: InterVarsity Press, 1974, 52 pp., Paperback, $1.25.

Os Guinness is an Englishman born in China and educated at the University of London. He has been associated with Francis Schaeffer at L'Abri Fellowship in Switzerland.

This pamphlet contains a revised and updated version of Chapter 5 of Guinness' book, *The Dust of Death.* According to the publisher, this publication is the result of readers' requests. It concentrates on the problem of violence and its meaning.

It is pretty heavy reading, not something you would turn to for relaxation. Liberally peppered with quotations, it requires a good deal of concentration to follow the development of thought.

THE AUTHORITY OF THE BIBLE by John R. W. Stott. Downers Grove, Illinois: InterVarsity Press, 1974, 44 pp., Paperback, $.25.

Has John R. W. Stott ever written anything dull? He certainly ranks with the most readable Christian writers of our time. His logic is always clear and easy to follow.

This pamphlet, while not presenting any original ideas about the Bible's authority, gives a concise formula for arriving at the evangelical view of Scripture. Stott's argument is that we first are lead to faith in Christ via the Scriptures. Then we accept the doctrine of the Bible that was espoused by Christ. In other words, "historical documents evoke our faith in Jesus, who then gives us a doctrine of Scripture."

Stott has two books which discuss this issue in more detail: *Understanding the Bible* and *Christ the Controversialist.* This present booklet is based on an address given at Urbana 73 InterVarsity Missionary Convention.

SEXUAL FREEDOM by V. Mary Stewart. Downers Grove, Illinois: InterVarsity Press, 1974, 20 pp., Paperback, $.25.

V. Mary Stewart identifies herself "as a sinner redeemed by Christ," a psychologist, and a single woman. She was coverted two years ago at the age of 27.

She writes about sex, "the most hotly debated functions of human existence," and she seeks to reflect biblical truth in doing so. The three sexual functions she discusses are fornication, masturbation and sexual fantasizing. Experienced in all three, she comes to the conclusion that the Christian knows more fully the "joy of life" by abandoning them.

An abridged form of this booklet appeared in *His* magazine, the student publication of InterVarsity. This article was ostensibly intended to dissuade college students from engaging in the sexual behavior described. Hopefully the reader will have the insight to realize that Stewart's experience should not be considered normative nor her logic irrefutable. For example, her argument that masturbation restricts the stimulus for sexual arousal is not very good psychology. The concept of stimulus generalization allows for stimuli other than the conditioned one to elicit the response. As a matter of fact, behavior therapists have employed masturbation and erotic materials for some time in seeking to correct the sexual maladjustments of clients.

SPIRITUAL GIFTS AND THE CHURCH, by Donald Bridge and David Phypers. Downers Grove, Illinois: InterVarsity Press, 1973, 160 pp., $1.75.

The authors have written this book for the lay Christian who might be excited or puzzled by the present charismatic movement, and not for the academician or theologian. The book is the result of the authors' interactions as church officers with Christians both in church and school. It was originally published in London by InterVarsity Press in 1973.

The book has a preface and 13 chapters that are divided into three main sections: spiritual gifts: their place in the church; the baptism of the spirit and spiritual gifts; and appropriating spiritual gifts.

In the book many questions about spirtual gifts are discussed: what are they; are they supernatural or natural; what was their function in the early church; and do they have a place in the church today? The authors feel that these questions have unnecessarily divided the church. They desire that Christians approach this subject with open minds and teachable hearts. In their writing they exemplify the humility that they encourage readers to display in areas of difficulty.

The authors write in a conciliatory, diffident, nondogmatic tone but not at the expense of stating their view on controversial issues. They argue persuasively that all the gifts of the Holy Spirit are extant and available to the church today. More specifically, they contend that the distinction between temporary and permanent gifts cannot be sustained. Therefore, the gifts of prophecy, healing, miracles, tongues, and apostles continue today. The gift of apostleship for example, cannot be regarded as having been withdrawn with the death of the twelve apostles. While the qualifications for the original twelve apostles cannot be met by any Christian today, there were other disciples (James, Barnabas, Andronicus, Junias, Timothy, Silas) described in the New Testament who did not meet them either and yet they are called apostles.

Demon possession occurs today according to the authors. It is different from a spiritual attack and mental illness, although the distinction between them is unclear. If opposition to the gospel and the servants of God are symptoms of demon possession, it is difficult to understand how the authors can argue that the Western nations are largely free from it.

Dispensationalists will disagree with the authors contention that the baptism of the Holy Spirit was anticipated in the Old Testament. They confuse the indwelling of the Holy Spirit and His baptism. Since the church was a mystery in the Old Testament, it can be deduced that the baptism of the Holy Spirit which formulates that church was also unknown and unanticipated.

Reviewed by Richard Lee Ruble, Professor of Psychology, John Brown University, Siloam Springs, Arkansas 72761.

SCIENCE, MAN AND SOCIETY 2nd Ed., by Robert B. Fischer, W. B. Saunders Company, Philadelphia, 1975 208 pages, Paper.

In *Science, Man and Society,* former ASA president Robert Fischer has designed a text to help students to gain some perspective on the nature of science and to illustrate the diverse roles that science plays in shaping modern society. Chemist-college administrator Fischer begins by developing a working definition of science that he contrasts with a variety of other descriptive statements about science. In elaborating his definition through the early chapters Fischer carefully develops his theme of the humanness of scientific endeavor. Brief vignettes or comments drawn from the lives of scientists are effectively used in examining such elements as personal motivation, cycles and facts in research, the problem of communication, and the international scope of science. Some popular misconceptions are buried in the process.

Chapter 3 covers ground often placed under the umbrella of philosophy of science by considering individual authority, collective judgment, presuppositions, limitations and "truth". The difference between science and scientism is clearly drawn.

The relationship between science and technology is examined in Chapter 4. An historical approach is used to support Fischer's contention that "science and technology are distinct from each other, and that there are cross-links between the two". Along the same line, areas of interaction with the arts and humanities are brought into focus. The theme of Science and Higher Education is developed in Chapter 5. In perhaps the best section of the book Fischer sketches the development of the early American college and university, noting the curricular ties to Cambridge and Oxford and the unity of purpose (educate persons for the professions), curriculum (classical studies), and conviction (a Christian perspective) running through these colonial institutions. This unity is seen as lost in the development of the typical modern institution. Such topics as the place of science in liberal education, interdisciplinary study, problem of specialization, and financing are appropriately placed here. Chapter 6 deals with the relation between science and government. An historical sketch provides some picture of an unfolding pattern which has seen the Federal Government change "from a position of aiding science and technology to a position in which government guides science and technology." Some problems related to the present state of affairs are considered.

The concluding chapter looks again at man — his rationality, creativity, humanness — in a world increasingly affected by science and technology. For Fisher an approach involving an "ecology of understanding" is needed if the many serious issues involving individual man and society are to find solutions.

In considering man and society Fischer does not neglect the religious side of man or the cultural role played by religion. The subject is introduced naturally without resorting to preaching or artificial appeal. The tone is set in the preface "This book is not intended, however, to be a partisan plea for my own *Weltanschauung.* I am very willing to identify and make such a plea, but to do so would not be in keeping with the purpose of this book."

In less than 200 pages Fischer has superbly accomplished his task. Students in science courses for nonmajors at an introductory level as well as the general public can gain insight into the wider dimension of science through this well structured and clearly written book. In using the first edition for three years, I observed a highly favorable student response. They were surprised to find a scientist who could write clearly. The new edition closely follows the pattern of its predecessor with amplification and strategic updating at many points. A series of helpful discussion questions has been added. The most significant change is the addition of carefully chosen pictures, charts, cartoons and a smashing full-color cover. I suspect that readers from the life sciences would retitle the book *Physical Science, Man and Society* because the illustrations overwhelmingly favor the "hard" sciences. This book ranks with the best of the growing number of books *about* science.

Reviewed by J. W. Haas, Jr., Gordon College, Wenham, Massachuetts.

PROEXISTENCE by Udo Middlemann, Downers Grove, Illinois: InterVarsity Press, 1974, 136 pp., $1.95.

Udo Middlemann is an associate of Francis A. Schaeffer at L'Abri Fellowship. He was born in Germany, has a law degree from Freiburg University, and received theological training at Covenant Seminary in St. Louis.

This book is the outcome of encounters with men and women who came to L'Abri to find meaning in their lives. It has a preface, five chapters and notations. The title is based on the observation that "God is for existence, not against it," and "is meant to suggest the stance of the Christian in the world."

In the book the author intends to suggest how people can express their unique identity and recognize that their lives are significant. There are some valid points made in the book, but for the most part they are obvious, and simplistic (pp. 28, 29, 49). The non-Christian for the most part, would probably agree with the idealism (pp. 57, 58, 83). In reading this book, one is reminded of Abraham Lincoln's description of a lawyer friend, "I never saw a man who could take so many big words and stuff them into such a small idea."

One point at which the book could have been vastly improved is in defining terms. The following are used without a clear definition: identity (p. 13), reality (p. 13), transcendence (p. 16), zero (p. 27), humans (p. 27), capitalist (p. 27), and craftsmanship (p. 28). A dictionary definition leaves one short of the operational one needed if action is to ensue.

The author seems to be inconsistent when he implies on page 30 that one's identity is not determined by what one does, but on page 35 that one's identity is. On page 27 one is shaped by one's job, but on page 35 one is not. His consistent use of "man" to refer to humanity (pp. 14, 15) is typical of evangelical writers but will appear sexist to many people. He attributes to technological "man" the belief that social and psychological engineering will produce a world of peace (p. 9). This is undoubtedly an overgeneralizaton. Stilted writing hinders readability. For example: "Man is the only being that is unable not to question his identity . . . (p. 14)." From the technical viewpoint, at least three typesetting errors occur (pp. 15, 17, 48).

The book abounds in assumptions, nebulous ideas and non-sequiturs (pp. 15, 19). Those who are already in agreement with the author will be carried right along but the disclaimers will stumble at many places.

There are a host of unscientific statements in the book in reference to animals (p. 16), imagination (p. 17), phonemes (p. 18), and property (p. 41). To take property as an example, the statement is made that "as far as we know . . . animals can *own* nothing." Compare that statement with the findings that birds build and defend nests, rats collect and hoard food, baboons select and protect sexual mates, Canadian wolves mark and claim geographical territory.

InterVarsity Press has produced many helpful books but this one does not contribute in any significant way to the betterment of the Christian community or humanity in general.

Reviewed by Richard Lee Ruble, John Brown University, Siloam Springs, Arkansas 72761

A Second Review of *Pro-Existence*

Pro-Existence is a commendable attempt to see the implications of a Christian world view in everyday, practical experiences of the Christian. The very title of Middelmann's work indicates that Christians should be for existence, not against it—that is, they should be involved in and permeate every part of the secular society. This volume gives a Biblical perspective concerning such facets of our lives as our work, leisure, property, money, suffering, and our relation to other people and to government. It is relationships with these areas that involve most of the Christian's time spent outside of worship and devotion. It is indeed encouraging to see such a volume, since much of evangelical preaching and teaching in these matters is either nonexistent or merely superficial; as a result most Christians have not integrated these aspects of life with their faith.

Chapter one examines the role of work, which is viewed as ordinarily a means for one to express his creativity. Human creativity arises because we are made in God's image. Also considered in this chapter is the relation of the Christian to money and leisure. The analysis is especially helpful in showing the value of man's creative activity, both in intellectual areas and in the things he makes. There is also a helpful consideration of ways one can be creative in jobs that appear mundane. This discussion thus avoids the common evangelical trap of considering work as an economic necessity or, at best, a means of contacting non-Christians.

Chapter two covers Biblical concepts of property. Property rights are seen as primarily protecting a person's creativity—protecting the means and results of his creative work. The rights of property are not contradictory to Scriptural concepts of social justice or community in the Church. Property and community each affirm the dignity of the individual.

Chapter three reviews philosopic thought from the eighteenth century to the present. It generally recapitulates Schaeffer's writing on this subject but focuses on concepts of reality. It points out the error of modern thinking which leads to a totally subjective world view—a view that perceives only one's individual experiences at a particular moment as the totality of reality. With this description of the subjective mentality, Middelmann develops his next chapters.

Chapter four discusses selfishness that arises when one has a subjective, self-centered view of reality. When we fail to see the reality of other people, of the world about us and history, and of God and His working we become selfish. The chapter considers several examples of Old and New Testament individuals of faith who looked to God rather than to themselves and their immediate situations when they faced problems. In looking to God to work out His purposes beyond the immediate circumstances, they did not put themselves first; thus they were able to lose their lives for His sake and find true life (Matt. 10:39).

Chapter five discusses the relation of Christians to the state and political movements. Here the basic problem is again selfishness, which leads to placing false hopes in either the establishment or the revolution. The Christian is to be subject to governmental rule; for, even if the government is not perfect, some degree of order is preferable to chaos. Subjection is qualified when laws conflict with God's will, but one should not rebel in a selfish way—that is when his own desires conflict with the government. The Christian should view his world in terms of a larger reality than himself and his immediate situation; he must look to God and His working in the total span of history. This does not imply inaction; God's people are to permeate and influence the structures of society; the Church is to demonstrate that Christ has healed relations among men. In so doing, Christians can demonstrate the relevance of their faith to the needs of society. Christians are to work for God's order in these efforts, but they must realize that what they can attain will be imperfect and that it takes time for God to work out His plan in history. Ultimate perfection will come when Christ returns to establish His kingdom.

In brief, Middelmann's work is helpful in presenting a Christian perspective on some very practical areas of living. It gives a well balanced Scriptural view on several controversial subjects such as property rights and relations of Christians and the state. The balance avoids allowing the Christian to place God's seal on whatever "ism" of the secular left or right he would support anyway. It is common for a philosophically oriented writer to appear abstract; Middelmann gives sufficient concrete examples to avoid this difficulty. Though particular subjects are treated comprehensively, they are not treated exhaustively; particular examples and illustrations of a Christian course of action are meant to stimulate the reader's thinking, rather than simply prescribe what every Christian should do in every situation.

Review by David A. Saunders, Boston Biomedical Research Institute, Boston, Massachusetts.

POLITICS: A Case for Christian Action, by Robert D. Linder and Richard V. Pierard, InterVarsity Press, Downers Grove, Illinois (1973). 160 pp. Paperback. $1.75.

Two of the authors of *Protest and Politics* have joined together to encourage Christian students to put their faith into practice while avoiding the twin paraly-

zing extremes of other-worldly pietism or nihilistic frustration. They counter the objections that have been raised against Christian participation in politics and argue that "one of the great cop-outs of our time is the suggestion that because Christ's kingdom is not of this world, his followers should stay out of political life.

Linder and Pierard urge Christians to become involved to act in the areas of modern concern, racism, war and pollution; and they point to four men in public life who can be taken as models of such involvement: Paul Simon, former lieutenant governor of Illinois; Albert H. Quie, congressman from Minnesota; congressman John B. Anderson of Illinois; and Senator Mark O. Hatfield of Oregon. They remind us that at the national governor's conferences in 1965 and 1966, Senator Hatfield cast the only vote against the administrations policies in Southeast Asia.

Areas of practical reform are high on the authors' list of motives for Christian involvement in politics. These areas include the curbing of the excessive influence of the rich in politics, judicial and legal reform to recapture the ideal of "equality before the law," and restoring confidence in government at all levels.

The importance of university students in the political process stems from the size of the student population, their role as the future leaders of society, their energy and enthusiasm, their idealism, and their participation in the formulation of political awareness and ideals at this time in their own lives.

Christians have unique contributions to offer the political process, the authors argue. These contributions include an understanding of the need for balance and moderation, a social conscience, a sense of integrity, the preparation to look at issues and not at men, and the possibility of exercising a stewardship of influence. Christians entering the political process personally, however, need to be aware of the necessity and the dangers of compromise, the complexity of the issues that will not yield to simplistic solutions, the harsh reality that politics is slow hard work, and the requirement of intense personal self-sacrifice.

The importance of a Christian awareness of political reality and responsibility is brought home by a quote given from Pastor Martin Niemoeller,

> In Germany they came first for the Communists, and I didn't speak up because I wasn't a Communist. They came for the Jews, and I didn't speak up because I wasn't a Jew. Then they came for the trade unionists, and I didn't speak up because I wasn't a trade unionist. Then they came for the Catholics, and I didn't speak up because I was a Protestant. Then they came for me, and by that time no one was left to speak up.

To which the authors reply in conclusion,

> Forces of evil are abroad in the land and Christians must combat them. There are great issues to be confronted — proverty, racism, war, environmental pollution, drug abuse and many others. Who, in the name of Jesus Christ, will stand and speak for Martin Niemoeller? Will you? *Now is the time to stand, the time to speak!*

EVOLUTION, PSYCHOLOGY AND THE BIBLICAL IDEAL OF LOVE by Pearle F. Stone Wood, Exposition Press, New York, 1973. 45 pp. $4.00.

The authoress graduated with honors from Ohio Wesleyan University in 1922 and snbsequently received

Is there really A CHRISTIAN VIEW OF HISTORY?

What does it mean to be a Christian historian?

The contributors to this anthology view their task as a mediating one. Addressing themselves in particular to the evangelical community, they argue that the Christian historian must *integrate* his faith and scholarship.

The first group of essays deals with the subject in a general way, suggesting some fundamental principles that guide the work of the Christian historian. The second scrutinizes the efforts of three well-known historical scholars, Kenneth Scott Latourette, Herbert Butterfield, and Herman Dooyeweerd.

Important reading for Christians who are concerned with the interpretation of history.

A CHRISTIAN VIEW OF HISTORY?
edited by George Marsden and Frank Roberts
Paper, 160 pages, $3.45

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an M.A. from Northwestern, did graduate work at the University of Chicago Divinity School, and taught in the areas of high school math, college Bible, philosophy, psychology and sociology. She offers "a solution to the basic dilemma that there is a contradiction between the teachings of the Hebrew-Christian tradition and those of modern evolutionary theory." Unfortunately both her scientific precision and her Christian theology are sufficiently dilute that the promised harmonization offers little comfort to either evolutionists or Christians. The tone is set early in the book and can be discerned from the following quotation.

> I believe that even if we did not have the Hebrew-Christian tradition, recognition of the implications of the evolutionary process as seen in the development of society would lead us to appreciation of the fundamental importance of the message of the 'Sermon on the Mount.'

The principal impression conveyed by her little book is the effort by one raised in a Christian context and building on that cultural foundation to attempt to show that foundation can be constructed on the basis of evolutionary understanding; it would be an interesting exercise to see what would have happened if she had no Christian background to build on, but that, of course, is not possible. The evolutionary process quickly becomes anthropomorphized or divinized so that it may be spoken of as having "dictates" and "goals," and to it are attributed creative and constructive powers which take the form of "love" in the human being.

One can feel the sincere warmth of the authoress as she addresses her theme, but this merely accentuates the regret that her concept of theology extends not much further than the Fatherhood of God and the Brotherhood of man.

THEOLOGY, PHYSICS AND MIRACLES by Werner Schaaffs. Translated by Richard L. Renfield from the German, **THEOLOGIE UND PHYSIK VOR DEM WUNDER.** Canon Press, Washington, D.C. (1974). 100 pp. Paperback. $2.95.

It is the purpose of Prof. Schaaffs, professor of physics at Berlin Technical University, to show that the objections of modern theologians against biblical miracles are based on outmoded understanding of physical science. The theological key to Prof. Schaaffs' reasoning is his interpretation of Genesis 1:31; since this passage states that the natural laws of creation are "very good," it is improper to argue that God later set these laws aside to perform miracles. Rather it must be taken as a presupposition that "all the miracles of the Old and New Testament, including the Resurrection, are consistent with the natural laws of creation." The scientific key to the author's approach is the conclusion that modern physical understanding depends upon a statistical description of physical reality and hence makes miracles plausible.

As far as theology is concerned, Prof. Schaafs believes that the high point occurred in the early church and is summarized in the Apostles Creed, the Nicene Creed, and the Athanasian Creed. The error of modern demythologizing theologians such as Bultmann has been the result of their failure to realize that science has changed radically in the last hundred years from a position of physical determinism to one of physical indeterminism.

In spite of much valid and helpful material, the book takes on a curious flavor due to manifestations of unwarranted dogmatism or unexpected naivete on the part of the author. He argues that the acceptance of the Big Bang theory of the origin of the universe makes "the demand for a Creator-God . . . unavoidable." His arguments that atomistic indeterminism leads directly to macroscopic indeterminism appear simplistic. He claims to have explained the miracle of Moses' burning bush in terms of solar heating of "the volatile aroma of a large bush beyond its flash point," in the absence of wind or winged insects. On several occasions he makes the mistake of supposing that scientific indeterminism, i.e., chance, is the foundation for human freedom of choice; in one place he even goes so far as to say, "Like human beings, the atomic system behaves freely." In describing the relationship between soul and body, the author departs from both scientific and biblical evidence for the whole person and argues for a body-soul dualism, with the soul and the body living in two separate worlds. He calls "the human spirit . . . a bit of God's Spirit," and attributes omnipresence to the Devil with the words, "Just as the Spirit of the Lord has access . . . to each atom in our body, . . . so the confuser, too, has access to them."

The book starts with a curious exchange between the author of the Foreword, who commends the book, but rebukes Schaaffs for seeking to demonstrate that all miracles have a scientific explanation and for championing evolution over *fiat* creation, and a "word from the publisher" that expresses Dr. Schaaffs' "serious reservations" about the criticisms of the Foreword.

Basically Dr. Schaaffs is on the right track but he has so interlaced a sound integration of science and theology with speculative and debatable material that his book is appreciably weakened for general use.

Reprinted from Christianity Today.

THEMATIC ORIGINS OF SCIENTIFIC THOUGHT: Kepler to Einstein, by Gerald Holton, Harvard University Press, Cambridge, Massachusetts (1973). 495 pp. Paperback. $3.95

This book contains a collection of essays written by the Professor of Physics at Harvard University in the area of "the history of science and related studies," over a period of about one decade. Its theme is to spell out the "thematic" content of science, "a dimension that can be conceived as orthogonal to the empirical and analytical content." In a variety of ways the author emphaizes the human ingredient in scientific research and the role of nonrational processes in the growth of scientific models.

The largest single portion of the book deals with an historical study of Einstein and the development of the theory of relativity – over 200 pages. The author makes clear that the attempt to prostitute the physical theory of relativity to support ethical and moral relativism has no grounds whatsoever.

> Relativity theory, of course, does not find that truth depends on the point of view of the observer, but on the contrary, reformulates the laws of physics so that they hold good for every observer, no matter how he

> moves or where he stands. Its central meaning is that the most valued truths in science are wholly independent of the point of view.

Final sections on the growth of science ("the pursuit of science is itself not necessarily a science") and science education argue for the need for a balance between the extremes of scientism and an attempt to live a meaningful life without due regard for scientific insights. The book is valuable as a means to show what science *is*, rather than what science appears to be in conventional summaries of scientific material.

SYMPOSIUM ON SCIENCE AND HUMAN PURPOSE of the Institute on Religion in an Age of Science, *Zygon*, Volume 8, Numbers 3 and 4, September-December 1973. 484 pp. $5.00.

Although not actually a book, this collection of 14 papers with a Prologue by Ralph Wendell Burhoe and an Epilogue by George Arkell Riggan, from a symposium held at the Institute on Man and Science, in Rensselaerville, New York, October 25-30, 1972, offers valuable insights into current thinking on a topic of broad interest. For Christian men and women of science who may commonly be immersed in an evangelical culture, it is a good experience to see the best offered by men who in general adopt a Teilhardian approach and a process philosophy without second thought. Editor Burhoe sets the stage in the Prologue when he candidly remarks,

> We are convinced that it is necessary to find ways to square our views of human purpose with the new scientific knowledge, even to integrate with contemporary scientific views some basic elements of the great religious system that has prevailed over the past 2,500 years in the West where the great expansion of modern science originated.

This theme is perpetuated in a later paper by Burhoe on "The Concepts of God and Soul in a Scientific View of Human Purpose,"

> We are seeking to relate the scientific insights to the older cultural, philosophic and religious traditions since those traditions have shaped viable societies in the past and may contain at least some hints of what we must do to shape viable societies in the present or future.

With the Judaeo-Christian religious insights thus relegated to whatever possible small hints they might yet contain, it is not surprising that *god* and *soul* become only symbol words, that the "invariance found in a scientifically established logical or mathematical equation . . . is almost the model to explain what theologians meant in saying *god*. . . ," and that "the failure of the scientific model of reality to provide an attribute of 'personhood' to *god*" may be readily accepted since "such personhood may not be necessary." Philosophically conditioned *interpretations* of the scientific record ride roughshod over both reality and the biblical revelation *in the name* of science. The biblical doctrine of an "eternal hell" as well as immortality created in "resurrection" both fail to be "credible in any literal way in terms of twentieth-century secular and scientific ways of viewing man and the world." Finally even the language of theologuese runs away and leaves the reader standing with mouth open,

> Today the sciences present a model about life that is equivalent in meaning to religious views of *soul*. The real core of human nature is not any particular body but an enduring pattern of flow. The flow pattern is generated by the interaction of the energy and boundary conditions set by habitat (or cosmotype), genotype, and culturetype, resulting in unending successions of ever-evolving levels of living forms. Culturally transmitted information may be cathected with genetically derived somatic structures to orient human behavior to these longer-range goals of life embodied in the soul.

Other authors participating in this symposium give an imposing list of names: Dobzhansky, Eccles, and Laszlo, to name but a few. With few exceptions each attempts to smuggle values into a scientific worldview by some non-scientific process — the most frequently encountered, of course, being the evolutionary interpretation of reality. Comments by author Parsegian in "Biological Trends within Cosmic Processes" are typical.

> The struggle of each individual to live as long as possible and especially the abundant provisions that nature has made for each species to perpetuate itself suggest that there is even moral obligation to continue the evolutionary processes, whatever the reason. . . . Taking lessons from the long evolutionary strivings of the past, reason demands that a primary purpose of man be the maintenance of conditions that assure his own survival and that assure evolutionary progression.

There are valuable insights and comments scattered throughout the book, and it is certainly worthwhile reading for anyone interested in efforts to produce an ethics on the basis of science, either alone or adjusted in some slight way toward a religious perspective. Birch, in "A Biological Basis for Human Behavior", realizes clearly that "In which direction man should develop is a matter of values and ethics, not of biology. . . . There is no way to derive values from biology. . . . Science and technology lead us to the judgments but leave us there without help."

The name of Jesus appears for the first (and one of the few times) time on p. 374 in the paper by A. R. Peacocke on "The Nature and Purpose of Man in Science and Christian Theology." Peacocke's paper is far more perceptive of the biblically based Christian worldview than any other paper in the symposium. It is well worth reading as a commendable attempt to synthesize a worldview incorporating both evolutionary thinking and biblical theology. As a consequence Peacocke is roundly criticized in the Epilogue by George Arkell Riggan,

> The logic of this theology obviously is not processual. Basically it is Cartesian, the logic of an inverted Newtonian ontology in which externally related atoms are displaced by externally related spirits.

The conclusion of his Epilogue, reveals the position of Riggan and probably the majority of those participating in this effort: "We trust the cosmic evolutionary process that brought us into being and designed us for significant participation in its continuing creativity." Evolutionary process has become *god*, and the idolatry involved is not even recognized.

Reviewed by Richard H. Bube, Department of Materials Science and Engineering, Stanford University, Stanford, California 94305.

A Second Review of a *Symposium on Science and Human Purpose*

I found myself agreeing strongly with statements like "the counterculture movements would be laughable were it not for the fact that the poverty of our primary culture – in its failure to present a credible vision of human purpose – makes men hungering for it turn to the most ridiculous visions that purport to provide it" (Burhoe, p. 181), and especially the final statement that "Man's chief end is to glorify God and enjoy Him forever" (p. 480).

The tone was high in general. It was uplifting to read Birch's rejection of Monod's "chance and necessity" thesis, or an eminent scientist like Dobzhansky maintaining that man is indeed not just another animal, in opposition to what seems to be the prevailing intellectual climate.

I recommend this book for reading mainly for philosophers with scientific training, and possibly as a reference for courses like "science and society" for seniors with strong philosophy and science backgrounds.

Reviewed by Martin LaBar Central Wesleyan College, Central, South Carolina 29630

A TRIP INTO YOUR UNCONSCIOUS, by W. A. Mambert and B. Frank Foster, Acropolis Books: Washington, D.C., 1973. pp 279; $6.95 cloth, $3.95 paper.

There is little redeeming social value in this book to merit serious review. However it is a prototype of the current genre of "pop" religious psychology, which reflects the philosophical/religious mood of the time.

It is probably artificial to view history in decades, but there are some crude correlations between "pop" books and the moods of recent decades. The post-war 1950's was the silent generation, yearning for peace and quiet after the tumult of war, presided over by benign grandfather Eisenhower. Two key books of pop religious psychology were *The Power of Positive Thinking* by Norman Vincent Peale, and *Peace of Mind* by Joshua Liebman. Both offered a bland humanistic religious theology and a re-assuring interpretation of depth psychology. Freud and psychoanalysis were the keystones of psychology. The symbolic author of the decade was J. D. Salinger, whose chronicles of the Glass family combined an uncommitted but earnest religious concern with profound psychological conflict. In *Catcher in the Rye,* the psychologically traumatized youth finds rescue and peace at the hands of the friendly psychiatrist. Psychodynamic understanding of the self was the salvation of the soul.

The troublesome 1960's moved from blandness to bombast. Social action and social salvation became the tenor of the day. Individual psychoanalysis went out and encounter groups came in. Esalen was the church of experience, ecstacy, encounter, and enlightenment. The interpersonal psychology and transactional analysis became the fulcrum, centered on Thomas Harris' *I'm O.K., You're O.K.* In religious circles these concepts found application in the popular books by Reuel Howe on Christian group dialogue and Howard Clinebell on church growth groups. The best seller of the genre was Keith Miller's *A Taste of New Wine.* Social relationships now became the salvation of the soul.

The curious 1970's has shown a turning again toward the inward self. But in a different way, for rational psychodynamics and scientific psychology are out. The modal psychology of the day is anti-social, anti-rational, anti-psychiatric. The key figure is R. D. Laing, a radical, British, existentialist psychoanalyst, whose best seller is a collection of cryptic aphorisms, titled *Knots.* There is no balm in the traditional psychological knowledge of self—that is passe. So too is the discovery of the self in social relations. Usher in a new mysticism and syncretistic religious philosophy. The symbolic author of the decade is Carlos Casteneda. Beginning with *The Adventures of Don Juan,* he presents a menage of quasi-scientific anthropology, mysticism, romantic primitivism, and existential philosophy, in the body of the ephemeral new healer who is a primitive shaman.

The book under review is an excellent example of current pop religious psychology in the mood of the times. It is written for popular audiences by a psychologist and a Baptist minister training in Jungian analysis. Their message is that you can find the good life through a mystical psychological appreciation of the self. You do not examine your motivations, your behavior, or your values. Rather you plumb the depths of your primitive unconscious through dream analysis. (A rather simplistic cookbook analysis at that.)

But the matter does not stop there, for true to the times, the authors manage to include all the "consciousness-expanding" fads of the day to aid their cause. There is a place for psychic prophets, like Edgar Cayce, for parapsychology, for communication with the dead, for spiritism, and for similar mystic phenomena, experience, and groups, who all share a "supra-conscious" religious philosophy. This is syncretistic religion at its apogee, and syncretistic psychology at its banal depth. Congruent as this book is with the ambience of the day, it will no doubt be gobbled up by those who believe the blurb on the cover, that this all will help you "experience a new awareness of yourself."

Reviewed by E. Mansell Pattison, Department of Psychiatry and Human Behavior, University of California, Irvine.

TO LIVE AND TO DIE, by Robert H. Williams, ed., New York: Springer-Verlag, 1974, 346 pp.

Robert H. Williams is professor of medicine and Head of the Division of Endocrinology and Metabolism at the University of Washington at Seattle. He provides a preface, prologue, epilogue, and five chapters. Other contributors include Joseph Fletcher, Elizabeth Kübler-Ross, and E. Mansell Pattison.

This book of readings has 27 chapters on matters relating to life and death. The contributing authors present major considerations, emphasize their own concepts, discuss future patterns for living and give some recommended readings. There is a wide range of topics included, such as euthanasia, origin of life, careers, children, crime, and law.

Tentative conclusions are indicated on the subjects presented. Some of what is written here will be familiar and unappealing to the average reader; some will be unfamiliar and uninteresting; some will be relevant and stimulating. The intended audience seems

to be medical students and physicians although others in the helping professions can profit from reading this book.

Reviewed by Richard Ruble, Department of Psychology, John Brown University, Siloam Springs, Arkansas.

GOD'S TRUTH, by Alan Hayward, London, England: Marshall, Morgan, and Scott, 1973, 302 pp., $3.00.

God's Truth is a book by a scientist who shows why it makes sense to believe the Bible. Dr. Hayward is a Principal Scientific Officer in a British Government research laboratory. All his adult life he has studied the Bible with the same analytical enquiry that he applies to his scientific work, and this has led him to an intense conviction that the Bible is indeed the Word of God. Most people who dismiss the Bible today have never read it, claims Alan Hayward, whose work as a research physicist has taught him never to believe anything without examining the evidence. Dr. Hayward has examined the evidence and he is convinced that the Bible cannot be proved untrue.

God's Truth covers in three parts such topics as: Fulfilled prophecy, evidence for the Resurrection, the uncanny harmony of scripture, the inspiration and infallibility of the Bible, the authorship of the Bible books, the accuracy of copyists and translators, problems of interpretation, the historical accuracy of the Bible, apparent errors and contradictions, the Bible and Science, miracles, the flood, creation, evolution, "prehistoric" man, and the problem of suffering. Thus the book appears on the surface to try to cover too many topics in so few pages. But the book is by this very nature an excellent introductory textbook into the major problems in Christian Evidences and Apologetics. "This book was written for ordinary men and women." And for this reason Dr. Hayward uses simple English and tries to avoid what might be called scientific language. Dr. Hayward increases the value of the book by consulting with world famous experts in writing the various sections of his book (e.g., F. F. Bruce advised him on Chapters 16 to 18).

Dr. Hayward starts his book by asking and answering the question: "Why Bother?" Just as the complexity of the human body (Dr. Hayward's example) has been taken for granted, so has the Bible, because it has become so commonplace we do not give it a second glance. *God's Truth* is written for people "motivated by that powerful urge, the spirit of curiosity which lies behind all research and discovery. People prepared to examine a few facts about the Bible."

Part One of *God's Truth* is a statement of "some remarkable facts about the Bible," which, Dr. Hayward thinks, supports the contention that the only possible explanation is the factual reliability of the Bible. "Yes this all sounds very plausible on its own, but what about all the damning evidence against the Bible?" Dr. Hayward in Part Two attempts to deal with all the most popular objections to the Bible. Part Three is "for people whose minds are half made up." This last part attempts to tell you how you can settle the matter of the nature of the Bible once and for all. You who are interested in how this can be accomplished should buy the book and read for yourselves!

Reviewed by T. L. Miethe, Ph.D. Candidate in philosophy at Saint Louis University.

JUDGE FOR YOURSELF, by Gordon R. Lewis, Downers Grove, Illinois: Intervarsity Press, 1974, 127 pp., $2.25.

This is not a book for the lazy, the complacent or the unconcerned. *Judge For Yourself* goes beyond the simplistic Bible study that many engage in so that they can feel comfortable; it lays down a challenge for both the Christian and the non-Christian to take seriously the message of Jesus Christ and its implications for today. On the front cover is the comment, "for those who are tired of being told what to think," and Lewis directs himself to this audience. Instead of drawing a multitude of conclusions and speaking dogmatically on the topics under consideration, he states a question, summarizes various options and then guides the reader in seeking his own conclusion based on a multitude of Scriptures provided in each chapter which speak to some facet of the problem being discussed. While realizing that Christians can agree on the main points of an issue once they are appropriately enlightened by the Bible, Lewis is sensitive to the fact that there may be shades of meaning and understanding on a topic, and that not all Christians have grown to the same level of knowledge and comprehension of the faith.

The range of topics covers most of the basic questions which confront Christians today and which, if answered properly, show conclusively the depth of meaning and value offered in a Christian life. Lewis begins with two key questions: "Is Christ the only way to God?" and a corollary: "What about those who have never heard of Christ or trusted him?". Only when these two issues have been resolved and the authority of Jesus is established can there be a foundation for answers to further questions. The problems of suffering and miracles are then dealt with in separate chapters. The final three chapters deal with perhaps the most difficult questions, difficult because they are the most personal. Questions about hypocrisy in the church and whether the Christian faith and life really work in the world of today require more than an intellectual "Here's what the Bible says" answer; they require a personal assessment of our own lives so that we can "go . . . and tell what great things the Lord has done. . ." (Mark 5:19).

While Lewis does present arguments against Biblical teachings and criticisms of the Christian position, he does so in capsule, summary form. This could leave him open to the charge of building straw men to knock down. However, as one studies the Christian response in each section, an awareness quickly comes that the issues are being dealt with fairly. In addition, there are references at the end of each chapter to direct the reader to primary sources if a fuller discussion of alternate positions is desired.

This book serves as an excellent guide either for individual study or group discussion and puts the Christian in a much better position to deal intelligently with some of the basic questions of life today.

Reviewed by Donald F. Calbreath, Director of Clinical Chemistry, Watts Hospital, Durham, North Carolina 27705.

ASA Annual Meeting 1975

Meeting of the Executive Council: (left to right) Claude Stipe, Dewey Carpenter, Executive Secretary Bill Sisterson, Dave Willis, Jack Haas, Jr., and Jim Buswell, III.

Doris Parker and Arlene Parker

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Journal Guilty of "Snide Denigrations," "Spleenful Hatchet Jobs," Etc.

I was a little disgusted with the book review section of the June *Journal ASA*. Are you people on a holy war against your brethren of the CRS? When Aulie spent most of his review of the CRS Biology text dealing with 18th century ideas, this was not serious analysis but a poorly disguised attempt to belittle the CRS team. His arguments throughout dealt superficially with straw men. It is evident at several points that he is not at all well acquainted with the writings of the CRS people. . . .

Then there is the spleenful hatchet job on Dr. Gish's *Evolution–The Fossils Say No!* Again the reviewer is very ignorant of the writings of CRS scientists. For example, he says, "The author's criticisms of radiometric dating is, considering its importance for the theory, weak and biased." He follows this with a "rebuttal" which is blissfully oblivious of the extensive writings on radiometric dating of such men as Cook, Morris, Slusher and others. Dr. Gish, a biologist, does not claim to be expert in radiology but summarily incorporates the findings of those who are.

It is the same reviewer (same spleen) who reviews Whitcomb's book on the Flood. He says that *The Genesis Flood* was "competently criticized" in the *Journal* earlier. Since I've only been reading the *Journal* a year I missed that. I hope that the present review of *The World That Perished* is not a sample of that "competence". His argument on the capacity of the Ark does not come to grips with the problem. One must at least count gene pools–not species. And then this boner: "Old errors are repeated without modification, such as the odd notion that the second law of thermodynamics is incompatible with evolution." Will your biologists never understand the meaning and impact of the Second Law?

The *Journal ASA* has dealt mostly with psychology and sociology–not much with the physical sciences. The attitude seems to be that all the hard science questions were settled 10 to 20 years ago and there's nothing else to be said on the subjects; hence, we must move on to higher planes of abstraction and All Truth.

In contrast the CRS Quarterly is full of hard scientific output. If you ASA people don't get off your supercilious rocking horse and back into the harness, you're going to lose this contest. If your science is so much better, let's see some of it. Deal with the Second Law of Thermodynamics, geological deceptive conformities, missing ancestors of Cambrian fauna, improbability of chance mechanism for chemical evolution, polystrate trees, "cretaceous" human fossils and tracks, the non-equilibrium of carbon-14, diminishing geo-magnetic moment, missing meteoritic nickel, short period comets, radiometric problems and many other phenomena bearing on origins and ages.

But for goodness sake read the CRS works on these subjects first so you'll know what you're supposed to be responding to. Dr. Gordon Mills article on hemoglobin and abiogenesis is excellent but in no way supports the snide denigrations of the other writers.

Frank Vosler
8011 Morse Road
New Albany, Ohio 43054

The Changing Content of Catastrophism

A recent article (June *Journal*) caught my eye, entitled, "The Doctrine of Special Creation," by Richard Aulie, because of its subtitle, "Catastrophism." Many diverging opinions on catastrophism exist today, and have existed in the past, while being poles apart. It is commonly misunderstood, but not all diluvialists are catastrophists. Those who are dubbed "deluge geologists" today cannot be equated with the "catastrophists" of the early nineteenth century, since the latter almost unanimously believed in numerous cataclysmic events. The early geologist Conybeare spoke of "three deluges before the Noachian." (Quoted in Haber, P. 216) Diluvialists today speak almost unanimously of one single deluge.

The thesis of Aulie–that the authors of *Biology: a Search for Order in Complexity* should have resorted to nineteenth-century diluvialists for their weaponry–is rather far-fetched and antiquarian in nature. They certainly would not want to depend upon Cuvier, the father of catastrophism, because it would be like placing their weight upon a reed that would split and then pierce them. It is doubtful whether Cuvier actually believed in the Biblical deluge, according to one historian of science, M. J. S. Rudwick (see his book *The Meaning of Fossils*, pp. 133 ff.). Aulie mentions the French title of Cuvier's book which came out in 1812, but it would be instructive to add that in 1813 Robert Jameson published the English edition, in the process transforming it by infusing it with numerous references to the Biblical flood. Since then most historians have become acquainted with Cuvier via Jameson; they have been misled into thinking that Cuvier was attempting to prove the Biblical account, which he was not, if the original French edition is considered.

William Buckland, although a gigantic figure of his day, is a poor one to turn toward for diluvialist support. Aulie omitted the well-known fact that Buckland abandoned catastrophism, and what Aulie did include misrepresents him on a couple points. He mentions Buckland's 1836 widely-read work as "arguing for a universal deluge." Historians today would not agree on this matter with Aulie. "When Buckland's *Geology and Mineralogy Considered with Reference to Natural Theology* was published in 1836, it was evident that he had reversed himself on Diluvialism and had completely abandoned Biblical chronology in prehistory. . ." (Haber, pp. 220-221) It would be even better to let Buckland speak for himself, the following quote being from the same book published in 1836:

> "Several hypotheses have been proposed, with a view of reconciling the phenomena of Geology, with the brief account of creation which we find in the Mosaic narrative. Some have attempted to ascribe the formation of all the stratified rocks to the effects of the Mosaic Deluge; an opinion which is irreconciliable with the enormous thickness and almost infinite subdivisions of these strata. . ." (p. 16)

Aulie's statement that Buckland "tried to show how the successive fossil record matched the *Genesis* account" is the very opposite of the picture as presented by Buckland a page or two further. He mentions: "A third opinion has been suggested, both by learned theologians and by geologists . . . that the order of succession of the organic remains of a former world, accords with the order of creation required in Genesis." (p. 17) Then he goes on to demonstrate that the two sets of sequences–that of Genesis and that of geology–cannot be reconciled because marine animals precede the evidence of vegetable remains in the geological record while Scripture has the latter first. Thus the days of creation cannot be stretched into geological periods (p. 18).

If neither Cuvier nor Buckland could come to the rescue of diluvialists today, neither would the third individual cited by Aulie, the glaciologist Louis Agassiz. His catastrophism was even more complex than his forefathers, admitting up to twenty catastrophes. It is interesting that the one who led Buckland to attribute the so-called "drift" deposits to glacial action and not to diluvial action was Agassiz himself (see Cannon, pp. 48, 50). Agassiz' catastrophism was a unique brand.

It would be well if the writer and readers alike of the article referring to the highly controversial issue of "catastrophism" would be aware of its changing spectrum as the issues shifted, so that it is now several wavelengths apart from its roots in the early nineteenth century. True, the catastrophism of Buckland and Agassiz is today obsolete.

Warren H. Johns,
Michigan State University
East Lansing, Michigan 48823

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