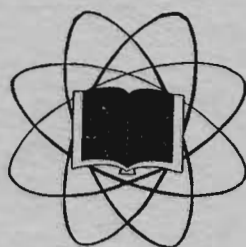


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AMERICAN SCIENTIFIC AFFILIATION



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

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EDITORIALS

FOREIGN THOUGHT

The feeling that evolution is a dying issue often appears in Christian circles. That such a conclusion is hardly correct would soon be revealed to anyone who examines current literature.

It is not always appreciated, either, that evolutionary philosophy has permeated the thought of scholars in such countries as India. At the recent Conference on Organic Evolution held at the National Institute of Sciences of India at New Delhi over fifty papers were presented, about half of them by Indians.

The papers covered a wide variety of topics, with adaptation and gene theories both accepted and criticized. Such topics as subterranean evolution and fetal behavior were presented.

CHALLENGE TO CHRISTIANS

In a recent article in *Nature* entitled "Chinese Science Revisited," J. Needham points out some of the rapid progress being made in applied science and engineering in China under its new regime. Theoretical work is encouraged also. A Chinese "TVA" is being developed with a system of sixteen dams; considerable construction has been completed.

Partly as a result of geologists needed in the preliminary phases of such activity, the number of geology students has increased from 35 in 1951 to 1,000 planned for in 1953. In other fields of science the increase is marked, particularly in medicine and biology.

For popular consumption, exhibitions of science and technology are provided in the larger cities. Popular science magazines are published along with others designed for juvenile reading. They are not discouraged from reading even though purchases are not made.

The Chinese scientists are of course interested in dialectical materialism as a working philosophy. It is pointed out, however, that it is not new in China since it was pursued as early as the 12th century A.D. in the Sung dynasty.

NEW PERIODICAL

The May issue of *World Science Review*, published in Great Britain by the deCourcy brothers, has as the feature article "Hidden Treasures," adapted from the Moody Institute of Science film of that name. The 10-page summary includes pictures.

The name of the magazine was changed from *Popular Science Digest* to avoid conflict with an American publication of a similar name.

ASA MINISTRY

A plan to increase our ministry to include aid to Sunday School boards of various churches was presented at the last Convention by Professor Peter Stoner. That this activity is appreciated is shown by the following excerpt from a letter to one of our ASA members who participated in such a project.

The letter is from M. U. Eller, Youth Editor for the Church of the Brethren Christian Education Commission.

"... Let me say that I deeply appreciate the contribution you and your scientific affiliation are making to the church through this service."

New Members

Betsy Ancker, of 1330 Grizzly Peak Blvd., Berkeley, Calif., is a research physicist at the University of California. She received a B.A. degree at Wellesley College, and a Ph.D. from Tübingen University.

Roy B. Clunes is an optometrist at 3754 Van Buren St., Corvallis, Oregon. He studied at the Glasgow Refraction Hospital in Scotland, became a Doctor of Optometry at the Northern Pacific College of Optometry (now Pacific University).

Lt. David L. Dye, USNR, is on active duty in the Navy, presently stationed at Sandia Base, Albuquerque, New Mexico. He holds a B.S. in E.E. from the University of Washington and a Ph.D. in Physics from the same institution.

John Floyd Gates is Assistant Professor of Bible and Theology at Kings College, Delaware. Degrees conferred are: Th.B. from Marion College, B.D. from Gordon Divinity School, Th.M. from Westminster Theological Seminary, and S.T.D. from Temple University School of Theology.

A. Meryl Grasse, M.D., graduated from Goshen College in 1944 and received his M.D. from Hahnemann Medical College in 1947. He at present is engaged in general practice at Calico Rock, Arkansas.

Charles A. Joss, whose home is at 4747 N. Kenneth Ave., Chicago, Ill., is a graduate assistant in zoology at the University of New Hampshire, where he is a candidate for his M.S. degree. He is a 1952 graduate of Wheaton College.

Donald N. Larson, 1726 W. Berteau, Chicago, Ill., is instructor of Greek and Linguistics at Trinity Seminary and Bible College. He is a candidate for a Master's degree in linguistics at the University of Chicago. He graduated from Wheaton in 1949.

Robert B. Luckey is Professor of Mathematics and Physics at Houghton College, Houghton, N. Y. He received both the A.B. and B.S. degrees from Houghton, then took an M.A. from New York University and a Ph.D. from Cornell.

Donald E. Martin of Maugansville, Md., has completed his first year as a student at Hahnemann Medical College, Philadelphia. He is a graduate of Eastern Mennonite College.

Alva J. McClain is President and Professor of Christian Theology at Grace Theological Seminary, Winona Lake, Indiana. He took studies at the University of Washington, Antioch College and Occidental College, and received the Th.M. degree from Xenia Theological Seminary.

Julian M. Pike, 5503 N. Kerby, Portland, Oregon, graduated from Cascade College with an A.B. in Biology in June, 1953. He is a member of the American Radio Relay League, plans to do missionary radio work later on.

Leonard F. Skibitzke, 10857 Rose Ave., Los Angeles, Calif., is a film representative for the Moody Bible Institute. He graduated from Wheaton with a major in archaeology, plans to do graduate work when his work permits.

Myron Sommers is a teacher in the public schools of Pueblo, Colorado. He graduated from Goshen College with a major in Biology, took further work at Akron University and Western State.

Stereoorganic Chemistry and Its Relation to Pre-Cellular Evolution

JOHN LEO ABERNETHY*

Certain Christians are altogether too complacent in their disregard for facing science as it actually is, rather than as they would like it to be. Consequently, such completely untruthful statements are often made as, "scientists no longer believe in evolution" or "a finite, expanding universe has come into disfavor". This reveals dangerous misconceptions. Persons responsible for such statements sometimes have a feeling that because they adhere to a literal Biblical interpretation of creation, and because God would certainly be all-knowing about such matters, they, too, have a knowledge of all scientific answers. Furthermore, they frequently have little regard for the problems confronting a scientist who is actually a Christian. That scientist may know of the inherent problems of his own particular field that cause untold difficulties, and yet he may also know that a Christian untrained in his particular field, is often wrong in criticizing the point of view of the scientist. Indeed, it is not true that scientists have abandoned the theory of evolution. On the contrary, the tendency on the part of an increasing number of scientists is to be so satisfied with the theory that they call it a fact, rather than a theory. There is little doubt but that scientific probing will strengthen, rather than weaken, the case for evolution. If one does not believe in a personal God, nothing else could logically happen from that viewpoint, other than emergence of life from chemicals on the earth through deterministic procedures and chance.

Only recently has the importance of the chemical aspect come into general prominence. The biological sciences have been absorbed in studies of the life processes, biological and geological remains and their chronology. It is often forgotten that the life processes are chemical and physical, in their ultimate make-up. Biological changes must be accompanied by alterations in chemical and physical constitution. The problem has yet to be answered, "what preceded the single cell, if an evolutionary process did occur?". It is important, as Christians, that we look into pre-cellular evolution—not that we must necessarily believe in it, but that we must be aware of implications pertaining to it. Unchristian conclusions resulting from a mechanistic, evolutionary, outlook need to be counteracted. By viewing the pre-cellular problem, we can extrapolate to the underlying problems of all evolutionary processes.

The origin of life is often casually pictured as a combination of chemicals under environmental conditions just right for the formation of the first molecule or combination of molecules, which complex could lead to a steady-state destruction and renewed synthesis of similar molecules or complexes. In other words, a chemical, reproductive system (in which elements of the atmosphere, soil and bodies of water, would combine to yield these substances that constantly undergo decomposition) is pictured as a precursor to cellular systems. Such a conception, however, fails to mention the most interesting and essential chemical features of

the life processes. In order for life to be perpetuated, an unsymmetrical system must be set up. It is the inherent nature of this peculiar, unsymmetrical, system that it has the power to partake of symmetrical, twinned substances and select just one of the twins. That automatically abandons the other twin. In some instances, the unsymmetrical system can prevent the formation of one twin, and produce only the other. Such exclusion, through selection or prevention, produces further dissymmetry. It should be noted immediately that life depends primarily on carbon, and its compounds, for its maintenance to a far greater degree than on any other element. Compounds of carbon are named organic compounds and through them the life processes, of plant and animal life, function.

One of the simplest carbon compounds is "natural gas" (methane). It occurs above deposits of petroleum and is commercially trapped for use in ordinary cooking purposes. Methane consists of one atom of carbon \bigcirc and four of hydrogen \bullet . Now, each hydrogen is held to carbon by means of a pair of electrons, and each such pair is known as a chemical bond. The bond can be represented by a straight line, or wire, joining the carbon and hydrogen spheres. Carbon is in the center of a tetrahedron, with the four hydrogens projected toward the corners of the tetrahedron. (Figure 1)

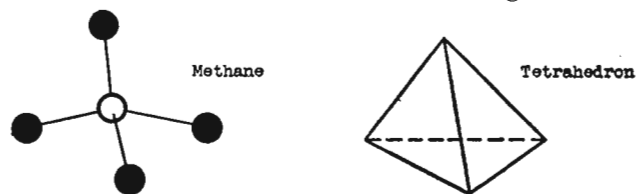


Figure 1

A tetrahedron is a pyramid with four triangular sides, counting the bottom triangle as one of the sides.

An odd thing happens when four different atoms or groups become attached to this carbon atom, instead of the four identical hydrogens of methane. Two different mirror image molecules can result. They are structurally alike in every respect, but one is the mirror of the other, just as the right hand is the mirror of the left. In other words, right hands are alike and will fit into a right handed glove. Only left hands fit correctly

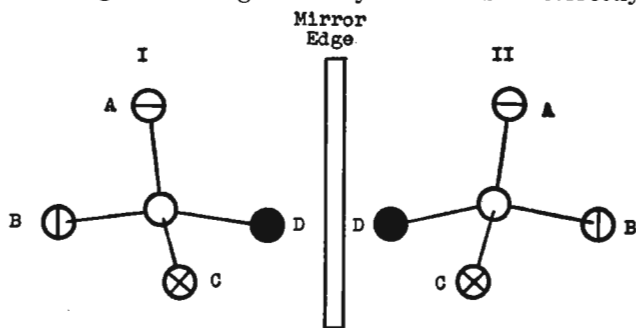


Figure 2. Mirror Image Molecules

* Formerly associate professor of chemistry, University of South Carolina; present address, Chemistry Department, Humboldt State College, Arcata, California.

into a left handed glove. Similarly, it takes a second right handed molecule to be exactly the same as the first; the left handed molecule will have exactly the same composition but will be different because it is a mirror image. (Figure 2)

As molecule I looks in the mirror it sees molecule II. Now if molecule II is turned around and placed on top of molecule I, the A and B atoms can be made to coincide, but not the C and D atoms at the same time, as shown in the overlapping molecules. By different overlappings, the C and D atoms could be made to coincide, but the A and B atoms then would not. The same thing is true of the right hand and the left. They will coincide on any surface facing each other as mirror reflections, but it takes two right hands to fit each other completely, as previously explained by the use of gloves. (Figure 3)

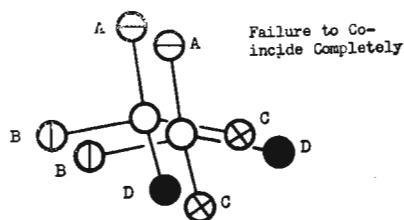


Figure 3

In the life processes, hundreds, even thousands, of mirror imaged molecules are known to exist. This possibility can be seen by altering an A group to Z, or a B group to W. An unlimited number of such adjustments is permissible. Particularly important are the proteins, carbohydrates and fats. The startling revelation is that the Creator has often carefully selected just one of twinned molecules, and has discarded the mirror twin. In other words, there could be a twin world, so to speak, of humans made up of mirror molecules of proteins, carbohydrates and fats. Those twin-molecule humans, of course, do not exist but had everything else in nature been of the mirror forms, those humans could function in every way as we do, without a single exception. In order to see this, in a manner that will not obscure the situation, it will be necessary to take certain liberties in simplifying matters. Suppose a **human** functions entirely on **proteins, carbohydrates** and **fats**. Had the Creator chosen the mirror molecules, a **namuh** would result (simply human spelled in reverse to represent, as concisely as possible, the mirror imaged individual). He would be composed of **snietorp, setardyhobrac** and **staf**.

As an additional aid in understanding the functional nature of these mirror substances, it will be convenient to isolate some pure, liquid, natural **nicotine** from tobacco. Then by known chemical reactions, synthetic, mirror, **enitocin** can be prepared in the laboratory. Both will analyze for exactly the same percentage of carbon, hydrogen and nitrogen, but their molecules will be mirror images of each other. It has actually been found that a very small amount of pure **nicotine** is lethal and will kill a human in an amazingly short time. The same quantity of **enitocin** will not because it is not nearly so poisonous. By observing the lists of the two humans tested (I and II), it can readily be seen that the behavior of the two should be different since those lists add up differently with **nicotine** and **enitocin**.

Human (I)	Human (II)	Namuh (III)
Proteins	Proteins	Snietorp
Carbohydrates	Carbohydrates	Setardyhobrac
Fats	Fats	Staf
Nicotine	Enitocin	Enitocin
(deadly)	(not deadly)	(deadly)

Imagine that the Creator suddenly deposited a **namuh** on the earth. This **namuh** could breathe our air and drink our water and behave just as we do, as long as he did not touch our **food** (he could live only on **doof**). If we injected nicotine into **namuh**, he would live. However, if we injected enitocin (which is not poisonous to a human) into this **namuh**, he would die. Look at list III. Notice that it is the complete reversal of list I. Therefore **namuh** would behave toward **enitocin** just as a human behaves toward nicotine. By looking back at the tetrahedral, mirror molecules, it is exactly what would be expected.

This simple little scheme has utmost significance to a Christian. From the standpoint of an agnostic evolution, the most vital question is this. How did nature separate those twinned molecules? This leads to the question, can chemistry bring about such a separation? The answer is yes, but it is not always easy. For consideration here, most important of the ways is probably seeding a solution of twinned molecules with a minute, small, crystal composed of molecules of just one of the twins. This causes that same twin type to crystallize from the mixture in the solution. Another method is to focus circularly polarized light on twinned molecules. Just one twin type undergoes decomposition by absorbing that particular form of electromagnetic energy. The other twin remains.

In the ordinary syntheses of twinned molecules, they are formed in equal amount. For example, suppose that alpha-chloropropionic acid is formed on chlorinating propionic acid in the usual way. Both twins result in exactly the same quantity. (Figure 4)

Each of the replaceable hydrogens of propionic acid is the same. There is nothing to cause one to be displaced more than the other in a large number of molecules. Now suppose that just one twin type of another compound, specially separated for the purpose (for instance one mirror form of **sec-butyl alcohol**), is placed in the reaction mixture during the chlorination. It would be found that more of one mirror form of alpha-chloropropionic acid would result than the other. This is due to an unsymmetrical effect induced by the "untwinned" alcohol. Had both alcohol twins been present in equal quantity, no unsymmetrical effect would have resulted and the chlorination of propionic acid would produce equal amounts of the twins of alpha-chloropropionic acid. This sort of thing, in various modified procedures, has been established experimentally.

By carefully separating many, many, different sets of twins, and by using combinations of these separated twins, the Creator has produced the phenomenal photosynthetic process. Solar energy is thereby stored up in chemicals and is said to be converted into chemical energy. In this process, dextrose (in cellulose) is made from carbon dioxide and water. There are eight pairs of twins, each single member of which has the same structural formula as dextrose, but not the same three dimensional relationships. Not only does the photosynthetic process give just **dextrose**, and not the mirror image **esortxed**, but that process also essentially eliminates all of the other seven pairs of twins. Separation of twins requires a large amount of energy. Production of just one twin means that energy is stored, equal to the synthesis and the separation. This

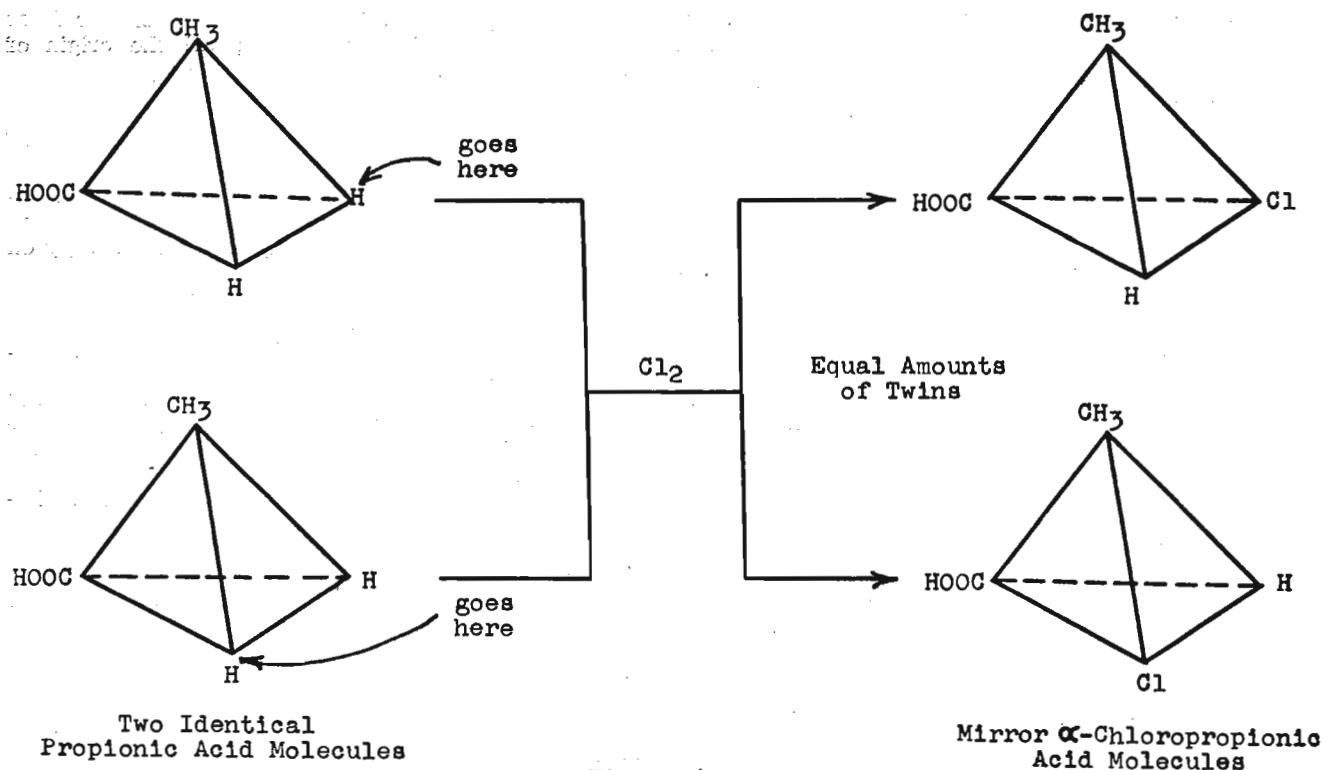


Figure 4

is made possible by chlorophyll (a and b), the green coloring matter of plants, because it, itself, involves two different (a and b) separated twins, along with thioctic acid (a separated twin) and all of the other separated twins comprising the enzymes, coenzymes and the other necessary substances. Photosynthesis represents a concerted process of these separated twins, to form the single, separated twin, called dextrose. Thus a tremendous storage of energy is made possible.

For years, organic chemists have been studying the three dimensional nature of these chemicals. A steady stream of workers, from Karl Freudenberg of Heidelberg University, to Saul Winstein of the University of California at Los Angeles, has been building a substantial background of theoretical organic chemistry pertaining to such mirror systems. These chemists inherited a wealth of background from other scientists like Louis Pasteur, J. H. van't Hoff and Emil Fischer. The impact of this chemistry is now being felt in the biological sciences. It has been found that the membrane systems, the metabolism of food materials, and all of the important biological functions depend upon the untwining capacity of already separated, and therefore unsymmetrical, systems, through the concerted action of untwinned members of the systems. Life depends on the independent twins. If unseparated twins, only, were present, it can safely be said that life could not exist on our planet. Separated twins are required and organic chemistry can supply them in sufficient quantity, no other field of chemistry that excludes carbon. Without the carbon atom, such inherent power would be lost.

This has many fundamental, practical and theoretical, implications. Mention of a few will be sufficient to permit an insight into the impact this information will have in the very near future, as the significance becomes recognized. It is only recently that the situation has

reached a satisfactory status for the members of the chemical and biological sciences to combine their efforts and understand the relationships of one science to the other in this respect. The science of stereochemistry (space-chemistry) has matured and its complicated technical terms have now become clearly defined. The biological scientists are spending time in this field and are applying this information to the study of genetics. It is now recognized that gene mutations involve alterations centered about separated twinned structures (for example, *D*-ribose and *D*-2-deoxyribose of nucleic acids).

Atheistic evolutionists will naturally claim that from a simple, first, separation, of twins there developed the highly complex systems through natural processes of determinism and chance. A purely mechanistic basis of life is then a consequence of the separated twins in their concerted action. Primarily from cause and effect, and also chance due to electromagnetic energy of light from the sun, all of the complex and patterned life forms will be pictured to result. The diamond back of the rattlesnake and the yellow leptosidin pigment from the coreopsis would be due to the functioning of these separated twins, plus solar energy to keep life on the move. A personal God would hardly fit into such a picture. Those who develop a concept of a personal God, only because of a "first cause," are running contrary to scientists like Albert Einstein¹ of Princeton University or scientific philosophers like Hans Reichenbach² of U.C.L.A. Indeed, these two men emphasize the urgency or necessity for abandoning the concept of a personal God.

A Christian need not fear the logic of these conclusions, but he needs to be aware of philosophical inconsistencies that can easily entrap him. The necessity for belief in a personal God cannot be proven on the basis of the physical and biological sciences, alone. Otherwise, very brilliant men would be forced to accept

the demands of the logic involved. A God, that shows itself up solely in natural laws is not a God to whom one could pray. The periodic law of the elements and the atomic theory would lend a deaf ear because they are incapable of hearing. The Christian must base his belief upon the historic Christian faith. That faith is pragmatic, since it rests on the records of sensory experiences of the personal dealings of God with man. Miracles were performed, but without a belief in them logic would demand an agnostic or atheistic alternative. If God raised Christ from the dead, and He was experienced after death as a living person in the sensory experiences of men like Thomas, then belief in a personal God is logical. If God did not raise Christ from the dead, there is no such thing as a personal God; a God of causal law and mathematical chance is the same as the God of Communism—no God at all.

The carbon atom with four different groups bonded to it is called the asymmetric carbon atom. It plays the leading role in dreams, thoughts, actions, genetic variations, reproduction and life in every functional way that exists. Add to this the God of a real voice spoken from an actual burning bush and a miraculous and literal experience of Mount Sinai, then a personality is behind it all; a soul is reasonable, good and evil have meaning, and free-will and predestination have their place. On the other hand, without the miracles of the Hebrew-Christian faith, the behavior of people cannot be called good or bad, except in so far as you set an arbitrary standard of good or evil; people would merely exhibit neutral behavior, just as a plant or some animal.

One of the complete theories of the origin of the universe³ involves these steps: (a) an original cosmic explosion of compacted matter; (b) development of galaxies and other matter pertaining to the universe, as this matter underwent constant expansion resulting

from the explosion; (c) the production of our solar system, in our milky-way galaxy; (d) the origin of life through progressive chemical changes, particularly related to untwining the twinned molecules. Not only does a completely mechanistic picture, due to cause and effect and chance, do away with the meaning of good and evil, but this picture leaves no room for volition or free-will. The most sensible arbitrary standard for good and evil would probably be related to progress toward maximum ability to control energy on the earth. In the final analysis, that would pertain to control of captured solar energy, including the most intelligent life forms, and things like water evaporated from one level and deposited at a higher level; both processes, of life development and transposition of water, would involve increases of potential energy through absorbed solar energy. According to an atheistic viewpoint, functioning of the human brain would represent the present maximum ability to control energy on earth, by the concerted processes of the human anatomy.

Acceptance of the miracle of the Cross gives logic to a personal God behind the scenes in the production of life, and it gives the only genuine assurance of eternal life. A Christian scientific philosopher uses exactly the same methods of logical reasoning as the un-Christian philosopher, but his conclusions are vastly different because the Christian accepts the historic Christian faith as authentic.

1. Einstein, "Out of My Later Years," p. 28, Philosophical Library, Inc. (1950).

2. Reichenbach, "The Rise of Scientific Philosophy," pp. 302 and 315, University of California Press (Berkeley and Los Angeles, 1951).

3. The California school of scientists. See, for example, reprints of "The University Explorer," radio broadcasts of the University of California (Berkeley and Los Angeles; 1951-53): The Theory of Relativity; The Origin of the Universe; The Origin of the Earth.

Creation In Terms of Modern Concepts of Genetics and Physics

WALTER E. LAMMERTS

JOHN C. SINCLAIR

There has long been a need among Christian men of science for a working correlation of the facts of our environment that will be consistent with what we know of God. The more generally accepted theories today attempt this correlation apart from God. The purpose of this paper is to give a consistent correlation of certain genetical and physical data that will in addition, be true to the revealed Word of God.¹

A recent paper by Alpher and Herman of Johns Hopkins University gives a simple account of how they believe the elements could have been formed in the beginning. That there was a beginning some 2 to 3 billion years ago is evidenced according to these authors, by the amounts of radioactive elements such as Uranium and Radium, and by the present rate of expansion of the Universe. The expanding universe is what one would expect if the universe was once densely packed and was blown out by an explosion. The uniform relative abundances of the elements throughout the universe, except for explicable exceptions, as measured chemically on the crust of the Earth and meteors, and measured spectroscopically on the stellar bodies and gas clouds, points to a common origin of the elements prior to the condensation of the stellar bodies. Known nuclear reactions at the temperature and pressure that must have existed in the initial exploding mass, can account for these abundances.

Several hundred seconds after the initial explosion, the universe was uniformly filled with a very hot gas consisting of neutrons, protons, positrons, electrons, neutrinos, and electromagnetic radiation, (principally high energy light rays). Tremendous collisions between particles took place that at first shattered both collidants, but as the gas expanded and cooled, the colliding energy fell so that more and more of the particles stuck together after hitting, resulting in larger and larger aggregates. The larger aggregates had a greater ability to capture neutrons. As the neutrons became excessive the aggregates or nuclei became radioactive to electron emission, thereby raising the number of protons and hence its atomic number. It then continued to grow by further neutron capture. After an half hour to an hour the temperature had dropped so low, and the capture of neutrons and their radioactive decay had so reduced their number that little or no further synthesis could occur.

This theory assumes the particles and their properties, and the cohesive forces that bind the nucleus; and assumes it's initial high density and temperature. Granted these assumptions, they are certain that all other properties of the elements and their compounds can be explained by the chance aggregation and random motion of the sub-elemental particles. However, the assumptions they have made logically lead to the periodic table of the chemical properties of the elements and the present form of the physical universe, an order that God designed. Where they assume, we acknowledge the Hand of God. This theory as has

been mentioned,² fits in well with a creationist point of view and may well have been the technique used by the Creator in originating the elements. The suddenness and finality of the beginning postulated by Alpher and Herman is in sharp contrast to theories, such as the theory of Evolution, which assume that given enough time anything could happen.

At first sight there would seem to be an infinite number of elements possible due to the infinite number of ways in which the sub-elemental units could be combined. But actually there is a limited number due to certain basic principles of exclusion. At first sight of the organic realm of living protoplasm there would seem to be an infinite number of possible basic designs or species, but actually there is a limited number of stable combinations of individual genes or genetic factors though no two individuals are identical. The genes in the organic realm seem to be the building blocks created by God just as the protons, electrons, etc., are the building blocks in the inorganic realm. The basic character of the genes is evidenced by the existence of similar enzyme systems throughout the breadth of organic life. However the total original complex of genetic factors from which all individual species were formed may have had no physical existence prior to the appearance of the individual species, but existed only in the mind of God. (All living things are able to organize lifeless elements into their own protoplasm. During the life of an individual the elements carbon, hydrogen, oxygen, etc. that once composed it, change; some of them many times. The protoplasmic patterns then are the lasting entities, not the momentary physical expression of them. Hence these patterns need not have had any physical existence prior to the moment God supervised their first physical expression. God then united and harmonized the individual genes or factors into discrete species patterns. This uniting and harmonizing act of God would explain why changes or mutations are usually deleterious. How and when God gave his species patterns a physical expression is not a problem when we realize that God was the one who did it, and that it did not and could not have occurred by any chance. The heterogeneity and the degree of variation possible in each species pattern is characteristic of each species and was characteristic at the time of Creation.

A brief presentation of a few of the authors reasons for rejecting the usual theories of gradual origin of the variation we find in the organic realm is now in order.

According to the geologic time scale as generally accepted by geologists, approximately 1,000,000 years have elapsed since Eocene times. According to orthodox paleontological thought the ancestor of the modern horse first occurred in Eocene times or at least skeleton remains are first found in stratified rock generally attributed to this era of geologic history. As stated by Cordelia Erdman³ "This little animal was about a foot

high, the size of a fox terrier, with a short, slender face and eye orbits in the center of the skull so that the face length was one half of the cranial length. Its legs were relatively long and slender and were unique in that the front feet bore four toes each, whereas the hind feet bore only three. Vestigial toes brought the number to a total of five for each foot. The teeth . . . were low crowned and in most species were bunodont, a condition in which the surface is smoothly undulating rather than ridged or folded. From this it may be inferred that Eohippus was omnivorous in diet, just as from his feet we infer that he was a forest dweller rather than a plains animal."

Obviously this group of animals differed from the modern horse in so many features that only by the use of a certain amount of "scientific imagination" called deduction can one understand the reasons causing paleontologists to consider Eohippus as the ancestral type from which our modern horse evolved. By successive stages or changes during Oligocene, Miocene, Pliocene and Pleistocene larger animals having fewer toes, longer legs and teeth more and more adapted to a plains grazing life gradually evolved until finally the modern horse appeared on the scene by the beginning of the Ice Ages in Pleistocene times.

From the genetic viewpoint the number of differences, each based upon at least once allelomorphous pair of genes or factors, between the presumed ancestral Eohippus and the modern genus Equus must be at least well over 100. What are the time requirements for the accumulation of such changes, i.e., the occurrence of the various original mutations and the subsequent incorporation of them into the genetic system of Eohippus in homozygous condition? Fortunately the answer to this question has been thoroughly worked out by Patau⁴ and a brief presentation of his conclusions are now in order.

Though admittedly most mutations confer no selective advantage, Patau makes the assumption that mutations do occur occasionally having a selective advantage of 1%, i.e., confer upon the animal in which they occur some superior physiological behavior or physical characteristic giving it a 1% advantage in survival and reproduction. Such a mutation according to Patau would increase in frequency from .01 to .1 percent of the population only after 900,230 generations. Another 100,511 generations are needed to increase the frequency to 100%. Certainly the time for natural selection alone to effect a change in a large population is enormous even geologically speaking. And very few mutations have been shown experimentally to confer any selective advantage. In small populations mutations are incorporated more rapidly, but one must assume very small populations indeed to appreciably shorten the time involved. Now the modern horse has a breeding cycle of about three years. Even assuming a yearling breeding cycle for the ancestral Eohippus it would take about 1,000,000 years for even one mutational change to become a constant feature of the entire species. Even assuming population 1/10 the size postulated by Patau, one would still have the slow rate of accumulation of one mutation per 100,000 years. Though several mutations could of course, be simultaneously undergoing fixation, obviously the number necessary to account for the many differences between Eohippus and the modern horse could hardly have occurred since Eocene time by natural selection of advantageous mutations.

The situation is the same no matter what groups of plants or animals is considered. As pointed out by Lammerts and Tinkle⁵ the differences separating even

very closely "related" species are very many. The only way changes are known to occur at present is by mutation and the overwhelming number of mutations are actually harmful to the organism in terms of survival. A particularly lucid review of this situation is presented in the American Scientist by C. B. Martin. The article entitled, "A Non-geneticist looks at Evolution," shows most conclusively that "all mutations seem to be in the nature of injuries that to some extent impair the fertility and viability of the affected organisms." He further states, "I doubt if among the many thousands of known mutants one can be found which is superior to the wild type in its normal environment."⁶ Even however assuming for the sake of the argument that occasional mutations are beneficial, their chances of incorporation in the genetic system of the organism or species are small indeed as discussed above. A satisfactory explanation of the remarkable diversity of the organic realm in terms of evolution by mutation and natural selection is indeed difficult, even assuming that the long periods of geological time postulated by geologists are correct. (An assumption incidentally, not granted by the authors.)

Is it not then time to consider the bearing of Alpher and Hermans concept of the formation of the inorganic realm on our ideas of the origin of specific diversity?

As discussed above by Sinclair, the old idea of the necessity of postulating enormous periods of time for the origin of the elements and development of the material universe has been seriously questioned by these physicists. Granted the right conditions of enormous heat and a potential system of various units of mass, the whole series of elements could have been formed almost instantly even on the basis of chance alone. How much more should we as Christians recognize the omnipotence of God in place of the chance reactions postulated by Alpher and Herman?

Applying this reasoning to the organic realm it seems quite reasonable to us that God first set up the gene system as the immaterial basis of life. By this we mean that a certain total number of distinctive genes or allelomorphous factors constitute the complexity of the many kinds of plants and animals. We do not imply, however, that all organisms have the same number of genes, though some genes are, of course, common to all organisms. Thus on the basis of economy of effort a wise Creator would certainly use the same genes in all organisms wherever possible, i.e., whenever the same function was to be achieved. Thus in all probability an amoeba and man have the same genes making possible the conversion of the various food compounds into protoplasm. For though the steps involved in digestion of food by mammals are more complex than the digestion of food by the amoeba, in all probability the final conversion of the organic chemicals to protoplasm is similar. Again all organisms may well depend on basically the same genes for the phenomena of cell division. Plants in terms of this creation concept differ from animals by virtue of a gene system making possible the synthesis under the influence of light, of water and carbon dioxide into sugar giving off oxygen which in turn is used by all animals. On the basis of economy of effort a wise Creator probably used the same set of genes or genic system to accomplish photosynthesis in all plants. All birds probably have many genes possessed "in common" so to speak since in their creation certain basically identical problems of adaptation to air flight had to be met. When we as students of nature attempt to group plants and animals into classes, orders, families, genera

and species we are attempting to correctly understand and classify the enormous complexity of God's organic creation in terms of which groups belong together by virtue of possessing most genes in common. The grouping then of all genera resembling the rose into the family Rosaceae if properly done, would merely mean that more genes were possessed in common by species of this group of flowering plants than were shared by a species of the genus *Rosa* and let us say a species classified in the genus *Geranium* of the order Geraniales. In no sense of the word would this classification imply relationship due to descent from a common ancestor. The relationship would be the result of creation from the original "stockpile" or complex of genes. My various friends of the evolutionary school of thought so frequently express the thought that creationists must have the ridiculous idea that one species can in no way be related to another. Or stated in different terms, they believe that if two species are shown to have a large number of homologous genes, i.e., genes which are identical, evolution from a common ancestor is thereby proved: Surely on the basis of economy of effort a wise Creator would use the same genes wherever possible and consistent with His obvious desire to create an organic world of marvelous diversity. The remarkable similarity of the eye of the octopus to the vertebrate eye so well described by George Barry O'Toole⁷ certainly cannot be due to any inheritance of genes from a common ancestor since the two classes of animals are obviously not closely related. From the evolutionary point of view the resemblance is apparent only, and marine zoologists go to considerable lengths attempting to show the importance of minor differences in eye structure in the octopus and the vertebrate eye as being proof of independent origin.

On the basis of the above creation concept, however, such similarities in the organic structures of relatively unrelated plants or animals is just what one would expect to find, i.e., similarity of structure and function because of the use of the same gene system whenever possible.

In order to allow for variation in the environment, all species, some more than others, are endowed with a number of genes capable of responsive adaptation, the resulting character expression being greatly influenced by the environment. Thus peach varieties vary greatly in the amount of winter chilling they require, some being practically evergreen and thus adapted to semi-tropical climates while others require more than 1200 hours at 40° F. or lower to break dormancy and leaf out. It is of interest that varieties having a long chilling requirement are also the ones which first go dormant in the fall, thus being better adapted to survival of sudden drops of temperature in the fall, and accordingly, having the maximum degree of winter hardiness. Fortunately, the number of factors involved in this adaptive response is small enough that varieties may readily be bred combining almost any degree of winter chilling requirement with desirable fruit and flower characteristics. A series of varieties adapted to the almost sub-tropical conditions of Southern California, combining large double ornamental flowers and good quality fruit have accordingly been recently developed and introduced.*

Many characters of both plants and animals are dependent on quantitative factors present in heterozygous

* Daily News 2, 3 and 4 Star varieties, originated by W. E. Lammerms of Descanso Gardens, La Canada, California and Altair originated by H. C. Swim, Armstrong Nurseries, Ontario, California.

condition. Rather rapid adaptation to changes in the environment within a few generations is thus possible. Undoubtedly this potential of individual variability is as much a characteristic of certain species as any of their physical characters such as flower shape, color or petal number. Indeed, we must realize that in many genera and species we may often have specific and varietal diversity simply for the sake of variety as such. Thus *Camellia cuspidata* is a remarkably constant species having inconspicuous small white flowers, whereas *Camellia japonica* is a highly variable one exhibiting many thousands of beautiful varieties. Yet both are diploid species having the same number of chromosomes. The limits of individual variability within the species were then also set at the time of creation along with the potential physical expressions of the gene systems.

The total number of genes necessary for us to assume for this concept is by no means infinite, or even very large. Possibly a total of less than 100,000 would suffice. Even only 12 different gene pairs give us 4,096 different combinations of true breeding organisms. Not only were all species created almost simultaneously according to our concept, but also all the potentially possible individual variations were anticipated and their limits set.

We must also realize that originally, along with the creation of the organic kingdom, a perfect world in which the gene systems making up the myriad of plants and animals could function perfectly was also created. The gene systems and the environment in which they functioned were perfectly attuned. Obviously to secure such complete balance practically instantaneous creation was necessary, since each part of the organic realm is so dependent on every other part. One of the fundamental weaknesses of the evolution theory is the failure to appreciate fully this relationship. Thus, how could the animal life of the ocean exist for millions of years without the corresponding complement of land plants? Or could the many flower feeding types of insects live without the higher forms of flowering plants?

As long as a perfect world existed, complete balance was possible. But with the entrance of sin a vicious unbalance began leading to a more and more imperfect relation of the gene system with the environment both internal and external. Even the very basic system of gene reproduction by chromosome division and transmission became subject to flaws and imperfections. Hence we witness the large number of mutations which are mostly defective in one way or another.

It is believed by the authors that a careful study of the facts of genetics, embryology, geology and paleontology will show that all the marvelous complexity of the plant and animal kingdoms was created from a common total sum of genes arranged in various integrated patterns of complexity. Their materialization as recorded in Genesis was accomplished in a very few days.

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The Moody Institute of Science

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Several men with red bandannas tied over their heads were busily knocking bricks out of a store front amid clouds of dust. Shortly after, they were seen in amazing pantomime postures walking gingerly down the sidewalk and closer inspection disclosed the fact that they were carrying a large sheet of plate glass which was acting like the main sheet of a schooner in the brisk wind. It was October, 1945. World War II activities were fast declining as the Japanese had but recently capitulated. Bricklayers and carpenters were almost as hard to find as the materials needed for the renovation, but quite obviously these men had their eyes on a goal far beyond the immediate job of re-vamping a former lodge hall. This was the start—at least the first outward physical manifestation—of the founding of the Moody Institute of Science.

Quite typically, the indefatigable leader in the dusty job of brick breaking was the Director of the newly formed organization, Dr. Irwin A. Moon, the man with the IDEA. But ideas without a lot of this sweat and toil are just theoretical entities of only passing interest. As early as 1937 Irwin Moon was engaged in nationwide lecturing with his SERMONS FROM SCIENCE equipment, talking on a beam of light, allowing six-foot sparks to jump from his fingertips as he stood atop a million volt-transformer. More than just a fascinating display of the marvels of a modern scientific age, Moon had a real purpose behind it all. Concerned by the way the prestige of science was leading the world into a materialistic philosophy which left no room for the omnipotent God he loved, he used these scientific experiments to demonstrate the reliability of the Scriptures, the reality of God, and to provide a foundation upon which the Gospel of Christ was presented with great earnestness and sincerity. Thousands came to a saving knowledge of Christ through this unique ministry. A considerable proportion were those who harbored great prejudices against the church and preachers in general but who, coming to these demonstrations in civic auditoriums and other neutral gathering places, were reached through the scientific slant.

Eight years have passed and the SERMONS FROM SCIENCE idea has reached into the most remote corners of our earth. Since the founding of the Moody Institute of Science laboratory, Dr. Moon has not been able to continue his lecture-evangelistic work, although two other men, George E. Speake and G. Keith Hargett, each have their own array of demonstration equipment and are active in this phase of the ministry.

While presenting his lectures at Military bases during the war, Dr. Moon was deeply impressed by the way raw recruits were changed in a few months to well-trained military men through the lavish use of training films. Training units that had taken many days were reduced to a matter of hours, with better

trained men as a result. Why not put SERMONS FROM SCIENCE on film instead of continuing on a one-man basis?

This vision has become a reality as the sixth SERMONS FROM SCIENCE film, "The Prior Claim," is released this fall. "God of Creation," made from footage Dr. Moon had shot in the upstairs portion of his home before the founding of the laboratory, was the first motion picture assembled by the newly formed organization. "God of the Atom," followed shortly after the first Bikini tests. "Voice of the Deep" told of the fish noises in the "silent" deep, and "Dust or Destiny" and "Hidden Treasures" followed.

The IDEA caught on throughout the world. Today under the direction of the Moody Bible Institute of Chicago, the parent organization, the films are used in 62 countries in some 15 different languages. In these languages, 23 foreign versions are available while at this writing 19 more are in process. In New Zealand each of these films has been shown to every secondary school student. In England, pioneer work was done in showing the films in military groups and industrial factories; both areas being large users of the films in this country today. In the U. S. military, there are about 1,000 prints of these films in active use in character guidance and other programs. The films are not available for sale in the usual commercial sense of the word. However, missionaries, school film libraries, and the military can obtain copies of the film under certain conditions at print cost. The Moody Bible Institute carefully guards the distribution of these films, and every decision is in the direction of making it an effective ministry rather than a business.

A logical question then is, "How is this work financed?" The answer is simple: by the gifts of thousands of Christian people across the country who see in this ministry an effective evangelical tool to reach young people nurtured on scientific lore and steeped in scepticism.

Moody Institute of Science has one of the best equipped 16mm motion picture production facilities in the world, especially as pertains to the production of specialized scientific films. These facilities have been built in the MIS shops, in large measure from war surplus equipment. Sound recording is done on 16mm magnetic machines throughout all of the early production steps. Sound stage, film editing, release printing, photomicrographic laboratory, still photographic laboratory, art department, offices and machine and electronic facilities are encompassed in the 25,000 sq. ft. of the renovated three-story brick building. In addition to this, considerable space is devoted to vivarium rooms where the plants and animals under photographic study are maintained. Approximately a million feet of color release print is produced each year. All aspects of film handling are done within the confines

of the laboratory walls except the actual processing of the color film.

The "secret weapon" of Moody Institute of Science, however, is not in bricks, or microscopes, or shiny recording equipment; it is in the tightly-knit group of men and women bound together in sacrificial devotion to the high Christian calling of spreading the Gospel to the millions outside the influence of any church. Only a handful of people is engaged in this work; less

than twenty at this writing. The small staff and small film budgets amaze Hollywood film producers.

The future opportunities before MIS are staggering. This scientific film material is in great demand in form suitable for classroom use and also for television presentation. Plans for the production of films for these specialized uses are now being made without curtailing the existing world-wide ministry based on the longer (usually 45-minute) science films.

A.S.A. Publication Policy

J. C. Sinclair

The Los Angeles A.S.A. members recently made a study of the first chapters of the proposed book on Creation, written by Professor Tinkle. Part of the study was devoted to a discussion of general publication policy. Mr. Eggenberger felt it would be desirable to publish certain of these considerations in the Journal. The views expressed are a result of thoughts expressed by and impressions gained from other A.S.A. members.

We as a group of Christian men of science are challenged by a tremendous need. Many of our youth from Christian homes and fundamental churches are lost to us during their high school and college years. My own brother challenged me that no one with an open mind could take the courses he had taken at the University and still believe the Bible. Many not actually lost to us are defeated in their Christian life. They avoid being known as Christians. I experienced this same feeling myself. If I told anyone I believed in Jesus Christ as my Saviour they might make statements I couldn't answer. They might state, for instance, that man evolved from lower forms of life just like the horse and other animals, and there was nothing I could say to disprove it. Inwardly I still believed in Christ, but I lacked conviction.

It was this condition repeated in the lives of scores of Christ's precious ones that led to the forming of the A.S.A. and the writing of "Modern Science and Christian Faith." This book gave our Christian students the information they needed—information their professors hadn't bothered to give them—information that didn't fit the professor's "science." It wove these facts into the whole fabric of the student's specialty giving him a clearer insight into the basic phenomena he studied. An insight that brought the conviction that truly all things were made by Jesus Christ, and without Him was not anything made that was made.

The highly technical nature of the book has, however, limited its usefulness. It takes a geologist to grasp the geology chapter and a Biologist to grasp the Biology chapter. It is felt also that the book because of its composite style lacks readableness and coherency. For these reasons a book on Creation was contemplated. We didn't want a revision of M.S.&C.F. but M.S.&C.F. in simple readable form, giving the high school student and the Christian layman in his language the knowledge he needs to make a valid judgement

concerning the many conflicting theories abroad today. It wasn't intended to be the last word on all of these issues, nor the official position of the A.S.A., nor the personal perspective of any one man, but an available source of A.S.A. scholarship.

But is a book like this the only answer to our problem? The American Scientific Affiliation has among its members many competent scientists in various fields of study. It would be very desirable if the Christian public could be informed by these scientists on issues within their specialty. Scientists are under demand from many secular sources today to put new developments into simple language. Several popular magazines such as "Life", are currently carrying articles of this sort. It would not be unreasonable to expect our scientists to do the same for Christian publications. Any thinking layman can be helped to clarify his general concept of science relative to God, if he is given enough individual articles, though each deals with a specific subject. In some ways specific articles are better for they are more widely and thoroughly read. Very few people I have talked with in college circles, who have read M.S.&C.F., really grasp all that is in it; partly because, I believe, they have not read it as carefully as a shorter work would have been read.

Shorter articles could be more objective in their style. The high school student is usually introduced to objective thinking in college. Wouldn't it be appropriate to acquaint him with it through A.S.A. writings? Nothing would go farther to validate his faith in God and immunize him to the attacks of unbelief, than the feeling that real scientists can trust in Christ as Saviour and Lord. Objective writing might be stated as first—Telling what is known about your subject; second—Giving the more important theories that attempt to account for what is known and how these theories point to further knowledge; third—What the author believes with his reasons for his conclusions.

Shorter articles are easier for busy men to write. Very few of us have the time to write a book; but all of us could whittle away at a short article. What then should be the A.S.A. policy towards our efforts, as we labor together for the Faith of the Gospel? Should we attempt to compile scholarly volumes with all the answers? Or should we work through short but widely distributed articles?

ARCHAEOLOGY

by

Allan A. MacRae

The Present Status of Biblical Archaeology

In contrast with the golden era of Palestinian Archaeology which ran from 1921 to 1939, the period since the war has been one of considerable frustration. A number of things have contributed to this. First of these is the unsettled political condition of Palestine. Even during the thirties archaeology was hampered to some extent by riots and interracial difficulties, as for instance, when the excavator of Lachish, James Leslie Starkey, one of the greatest of Palestinian excavators, was brutally killed.

In 1948 the difficulties reached a climax in the partition of Palestine. Since that time the land remains in uneasy truce with a no-man's land straight down through its entire length. The highest and least fertile portion of the country is now a part of the Arab Kingdom of Jordan, while the remaining section forms the new nation of Israel. Israel is prosperous, prices are high, and excavation is very expensive. Excavation in Jordan is much less expensive, prices in Jordan are low, wages are low, there is much unemployment, and the poor nature of the soil and the difficulty of transportation to other countries offers little possibility of amelioration in the near future. The great majority of the promising archaeological sites are in Jordan.

Some of the archaeological institutes of the various nations are in the part of Jerusalem which is in Jordan, while others are in the part of the city which is in Israel, and intercommunication between the two is extremely difficult and cumbersome.

Another difficulty lies in the fact that most of the great experts in Palestinian field archaeology have become superannuated or have died. There are few men available for Palestinian field work who have had much experience. Some of the younger experts have an attitude of skepticism toward the results of their predecessors which at times goes to the extent of being definitely unreasonable.

Despite these difficulties some important excavations have been carried on, notably at Jericho, and at Diban in Moab. Moreover, this spring Professor Joseph Free of Wheaton College began excavation at Dothan, one of the most promising sites in the whole land of Palestine.

Outstanding has been the discovery of the Dead Sea Scrolls, containing Biblical material in Hebrew many centuries earlier than any that was previously available.

In Egypt and in Mesopotamia little of outstanding significance has been discovered since the war. The rise of nationalism in both these countries has greatly hampered archaeological activity, although some important progress has been made in both lands. Perhaps outstanding in Mesopotamia has been the discovery of new law codes pushing back the history of ancient law considerably earlier than was previously known.

Archaeology differs from other sciences in that the results of its work have little utilitarian value. Consequently it must look for its support largely to popular gifts, and to contributions of foundations and educational institutions, which in turn are often dependent

upon popular support. The result is that efforts are usually made to publicize discoveries as soon as they occur. Unfortunately, when material is first discovered it is often very difficult to be sure what its real bearing is. In archaeology, as in every other science, it is not so much the first discovery that is vital as the ultimate conclusions which are reached.

Often results of excavation are widely publicized as soon as something startling is found, even though there is little idea yet of the true bearing of the discovery. Later on, after scholars have studied the material from various angles and have reached conclusions as to what it really means, the results are printed in scientific publications which are hardly seen outside of the profession, and the ideas which are circulated among the public and among our educated classes in general are the results simply of the first general publicity.

Since the rise of modern archaeology, point after point in the Bible which previously stood absolutely alone, has come to have other information and evidence relating to it. It is a mistake to jump to sweeping conclusions from this evidence; it is equally wrong to fail to draw from it its true importance, which is very great indeed. At point after point the accuracy of the Biblical statements is supported by new archaeological discoveries, and they are shown to give an accurate and dependable record of events in Biblical times. It will be our attempt in these columns, from time to time, not only to keep up with the newer discoveries in the field of archaeology, and with some of the newer researches which are published, but also to point out some of the established results of archaeology and the great help which they bring to our understanding of the dependability of the Word of God. God is the Author of the Bible. He is also the Creator of the universe, and the Director of history. What He has done in one sphere is bound to tally what He does in another sphere. It is easy for us to draw wrong conclusions from the data of science or from the data of the Scripture. The facts of the two, however, are bound to agree, since God is the author of both.

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ASTRONOMY

by

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For the beginning article on the subject of Astronomy to appear in the Journal, I have the pleasure of presenting the following interesting item from the pen of Owen Gingerich, one of my former students at Goshen College and now a graduate student in Astronomy at Harvard University.

A major revolution in the distance and time scale of the universe has taken place during the past year. As a direct consequence, the age of the universe as determined from the expansion of galaxies has been doubled, as well as the distances to most external galaxies.

The roots of this change go back over 30 years, when Harlow Shapley first used the period-luminosity relation of Cepheid variable stars to determine the distance of remote objects. This relationship was de-

rived from the Magellanic Clouds, in which the stars can all be considered roughly the same distance. Here it was found that the brighter Cepheid variable stars had the longest periods. Shapley's contribution consisted of finding the zero-point on the graph; by statistically determining the distance of similar Cepheids in our own galaxy, he was able to establish the distance to the Clouds as about 80,000 light-years.

This work resulted in several anomalies. Perhaps the most striking was the fact that our own Milky Way galaxy appeared to be twice the size of any other in spite of vigorous searches to find another giant galaxy. In addition, the globular clusters associated with the Andromeda galaxy were much smaller than those of our own system.

The new result which resolves these anomalies is the first important contribution of the 200" Hale telescope at Palomar Mountain. From our present knowledge of galactic structure, it seemed inevitable that large numbers of cluster-type Cepheids, (those with periods under a day) should be found in the nucleus of the Andromeda Galaxy. The light gathering power of the 200" was just sufficient to find these stars, assuming that the distance of 750,000 light-years was correct. When all attempts failed, it became apparent that the distance to this spiral had been underestimated. The work of Walter Baade and his student Allan Sandage at Mt. Palomar and Mt. Wilson showed that the error was close to a factor of two, that is, the Andromeda Galaxy was actually about 1,500,000 light-years away.

Why did the error come about? Probably because Shapley and the other astronomers assumed that the short period cluster-type variables were the same general series as the "classical" Cepheids with periods of from 3 to 20 days. The period-luminosity relation was forced into a single continuous curve. Baade has shown now that actually two stellar populations exist. The cluster-type Cepheids belong to Population II, associated with globular clusters and the nuclei of spiral galaxies, while the classical Cepheids belong to Population I, associated with spiral arms and the Magellanic Clouds. Related in a continuous curve with the cluster-type variables are the W Virginis stars, which can be differentiated from classical Cepheids of the same period by the appearance of the light curve. In other words, the cluster-type variables and W Virginis stars of Population II form a continuous period-luminosity relation, but the classical Cepheids are brighter for a given period and form their own separate relation.

The method of finding the age of the universe by computing the recession of the distant galaxies backwards till they reach a common point is affected since the galaxies are now twice the distance formerly believed. The rate of recession of course remains the same. Earlier Hubble found 1.8×10^9 years. Hubble was misled by assuming an absolute magnitude of galaxies which is too bright, and hence he misjudged their distances. Recent work shows that there are many dwarf galaxies, and that the bright spirals shown in astronomy textbooks are actually the exceptions. This alone would correct the figure to about 2.5×10^9 years, while the zero-point correction doubles this to 5×10^9 years, a figure in good agreement with the best radioactive dating of the rocks.

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SEPTEMBER, 1953

BIOLOGY

by

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Spontaneous Generation - Concluded

In the last quarter of the eighteenth century, the work on oxygen apparently opened up the controversy regarding spontaneous generation since flasks boiled and sealed were apt to be low in this important respiratory gas. In 1836 Schultz passed air into flasks after a passage over sulphuric acid but his cultures sometimes spoiled. Theodor Schwann, co-founder of the cell theory also tried his hand at solving the riddle. He passed his air through red-hot tubes. However, his work could not always be duplicated with sugar infusions. Schröder and von Dusch invented the cotton plug and thus made their contribution to the problem. Generally their cultures remained sterile but not invariably with milk or meat preparations. Also, it was argued, cotton was a plant tissue and it deprived any possible organisms of needed oxygen.

In 1859 Felix Archimede Pouchet, Director of the Museum at Rouen, France published a large work on spontaneous generation purporting to prove its probability. His crucial experiment was as follows—

He sealed a flask of boiling water, inverted it over a mercury bath and thrust the neck of the bottle under the mercury. He broke the neck of the bottle under the mercury and connected it with an apparatus which, when heated, produced oxygen. The gas bubbled in and displaced the water. When half full of gas and half full of water, he took a piece of hay which had been heated and, with sterilized forceps, pushed it underneath the mercury and into the mouth of the bottle. The hay floated in the water. After a few days, the infusion was found to be full of small organisms. Triumphantly Pouchet asked where this evidence of life could have come from—not from the hot water—not from the heated hay—not from the oxygen which had been produced artificially?

Louis Pasteur was intrigued by Pouchet's claim and, over the objections of his friends, entered the fray. He felt that Pouchet was wrong but how to prove it! His task was to make a fool-proof experiment, one avoiding the criticism of the work of Spallanzani, Needham, Schultz, Schwann, Schröder and von Dusch. First of all, he confirmed the discovery of Helmholtz (1843) that the air contained solid contaminants. He soon found that dust caused spoilage because it was the carrier of micro-organisms. Pasteur's classic experiment then was to put yeast broth into flasks, draw out the neck into the shape of a swan's neck, heat the flasks the proper time and then allow them to cool slowly. Of course the dip in the neck "caught" the dust and with it, the bacteria. His flasks remained sterile. Pasteur did many other experiments all related to this topic and all leading to the same general conclusion. In presenting his findings to the world however, it was necessary to dispose of his rival, Pouchet, once and for all. This he did by disclosing the errors in Pouchet's experiment described above. He threw a powerful beam of light on the mercury which was used and showed the dust particles thereon. Pouchet had, of course, pushed some of this dust (with the attending bacteria) into the flasks.

It might be mentioned in passing that Pasteur was

rather fortunate in that he used an acid medium, generally unfavorable to bacterial growth and, secondly no spore formers were present. Proper sterilization procedures and the use of intermittent heat came later.

The Englishman, John Tyndall, played a "Huxley" to Pasteur by devising such an elaborate experiment that the critics of the Frenchman were silenced. Tyndall set forth his results in 1876, twelve years after Pasteur's great experiment and the details of the experiment will not be recounted here as they are well known. It should be stated that Tyndall was never able to detect living organisms arising from non-living matter. The question of spontaneous generation has not been seriously raised since the time of Tyndall.

Evolution is not connected directly with the origin of life. Biologists affirm their belief in some type of evolution but they profess ignorance of how life first started. It is quite an anachronism that while scientists disbelieve in spontaneous generation yet they cling to a physico-chemical theory which, in actuality, is very little different from spontaneous generation. In closing this short summary of the story of spontaneous generation, it is only fair to point out that in the story of creation, God Himself changed inorganic matter into organic. This was deliberate however and not quite the same as spontaneous generation.

Phylogenetic Trees

One of the pleasant pastimes of the last half of the nineteenth and first half of the twentieth century has been the construction of family trees. These arborescent or shrubby creations purport to show phylum relationships and derivations. If one assumes the evolution of large groups into other groups, they serve, no doubt, a useful purpose. Lately, however, there have appeared in the literature some startling statements which will be quoted without comment. It might be said that some scientists, at least, are becoming less naive and more realistic.

"All views which have been expressed concerning the phylogenetic interrelationships of plant families are largely a matter of personal opinion. To the authors, as indeed to many other botanists, it appears highly improbable that the families of flowering plants—have been evolved from one another. Those that agree with each other taxonomically in many respects may well have had a common ancestry, but it seems fundamentally misleading to arrange them in a single, linear, phylogenetic series even if this has the form of a branched tree."—From "Anatomy of the Dicotyledons"—C. R. Metcalfe and L. Chalk, Clarendon Press, Oxford, 1950.

"The Evolutionary tree proves to be not a tree at all but a profusely-branched shrub."—W. Pauli—*The World of Life*—Houghton Mifflin Co., 1949.

"A phyletic tree so often resembles less a trunk with branches than a bundle of sticks."—I. Manton—*Problems of Cytology and Evolution in the Pteridophyta*. University Press, Cambridge, 1950.

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PHILOSOPHY

by

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Probably the most incandescent philosophical movement of the present time is Existentialism. The name of this movement was injured by the faddists who paraded under the name; however, the movement itself does not have its origin in a fad nor is its significance exhausted within the walls of the Parisian clubs. As a philosophical movement it derives its name from the fact that it holds that existence precedes essence. In this it opposes the classical tradition in philosophy, and in our country it should receive a boost from the attacks of pragmatism and instrumentalism along this same line. We find that its influence is felt not only in philosophy but also in theology, where it has been making itself felt the most in America up to the present. The movement appears to be losing some of its strength in Europe, but it is just appearing in print in America, and because of its potential influence it is worthy of our consideration. Its acceptance in Europe has been laid to the crisis mentality after the war (See e.g. Randall in *The Theology of Paul Tillich*, p. 159). It is not as likely to thrive where the sense of crisis is not so strong; yet many foremost American theologians are influenced by it and of the American students studying abroad many are bound to bring it across.

We shall not attempt to characterize this movement in any adequate way. We only refer the reader to the short and penetrating article of Paul Tillich, "Existentialism," *Journal of the History of Ideas*, Jan. 1944. Tillich says the movement got its impetus in the reaction of Schelling, Kierkegaard, et. al., to the idealistic tradition, especially as it found its highly systematized form in Hegel, though it can also be traced back to thinkers like Böhme.

That it is a reaction from idealism gives a clue to the way it should be approached. The enthusiast who plunges into the study of Kierkegaard along with the rest is likely not to understand him well. Since it is such a reaction phenomenon we believe that it can be understood well only after a thorough study of Idealism, and especially Hegelianism. Such a study is long and difficult; but without it the Christian scholar is likely to find himself rudderless. At the turn of the century James Orr, e.g., utilized the idealistic philosophy, Hegel as mediated through Green. Now we are not so inclined to do so, especially in our theoretical work, though Christians still speak vaguely of Christianity as that which is concerned with "spiritual values." There is a real danger that we shall be swept along by the general reaction to Idealism and uncritically accept many of the existentialist positions as they come to us, though its ideas of freedom, authenticity, etc., have a non-Christian character. What we need is a careful and thorough study of this movement in its various forms. In that encounter we should be stimulated by the richness and vitality of its thought.

Kierkegaard performed his literary work in near obscurity. It was only when he was rediscovered in this century that his name attracted wide attention. Since that time his influence has been tremendous. Especially four thinkers in this century who are

thought to be pre-eminently the philosophical exponents of Existentialism.

Heidegger and Sartre are atheistic existentialists, whose thought has been dubbed "une discourse sur l'absence de Dieu." Heidegger is well known for his startling work, *Sein und Zeit*, 6th ed. Tübingen: Neومانus Verlag, 1949. He has never completed this work, either from an inability to carry out the program he set for himself or from a change of mind. That there is a change in Heidegger has been claimed on the basis of his later works. Sartre's main work is *L'Être et le néant*. Paris: Librairie Gallimard, 1943. This has been the object of much puerile diletantism, but it is certainly a strongly reasoned book. From the Christian point of view the study of these existentialists can be of value because their thought illustrates the extremes to which the modern idea of human freedom leads. Their studied attempts to eliminate God and anything emanating from him and the resulting despair remind us of the claim of James Orr that one who rejects the Christ of the Scriptures is bound for despair. His position might profitably be illustrated by a study of Heidegger and Sartre in our time.

Not an atheist, at least in the usual sense of the term, is Karl Jaspers, the massive Swiss existentialist thinker. The central ideas of his system are freedom, transcendence, and God. His two major works are: *Philosophie* (2nd ed. Berlin: Springer Verlag, 1948) and his huge *Von der Wahrheit* (München: R. Piper & Co. Verlag, 1947), the first volume of his philosophical logic. Just recently his book, *Der philosophische Glaube* (München: R. Piper & Co. Verlag, 1948) was translated and appeared with the title, *The Perennial Scope of Philosophy*. We also mention a treatment of the three central concepts of Jaspers' thought: Hartt, J. N., "God, Transcendence and Freedom in the Philosophy of Jaspers." *Review of Metaphysics*, vol. 4, no. 2, Dec. 1950, pp. 247-258. From the Christian point of view an article has just appeared on Jaspers' view of transcendence: Zuidema, S. U., "Jaspers idee van het transcenderen." *Philosophia Reformata*, 18th year, 1st quarter, 1953, pp. 1-12. In keeping with a growing policy in Dutch Christian writing this article is accompanied by a summary in English. For the understanding of Jaspers it is said that a study of his work, *Nietzsche: Einführung in das Verständnis seines Philosophierens* (Berlin und Leipzig: Walter de Gruyter, 1936) is of great help.

Still closer to the Christian camp is the philosopher, Gabriel Marcel. He is a Catholic, though his existentialism has met with disfavor at the Vatican. His writings have been regarded as a helpful antidote to the atheistic existentialism of Sartre. Of his works the *Journal métaphysique* (Paris: Librairie Gallimard, 1927) and his *Être et avoir* (Paris: Aubier, 1935) are representative.

Of interest to the Christian is the volume of J. M. Spier, *Christianity and Existentialism*. Philadelphia: Presbyterian and Reformed Publishing Co., 1953. This work does not meet the need I mentioned before of a thorough study of Existentialism; nevertheless, it is a well written introduction to the movement from the Christian point of view, and it should provide the reader with good insights to use in his further study.

In this country we are influenced by Existentialism largely through theology. Barth, Brunner, Niebuhr, Tillich, and Berdyaev are all deep thinkers of an existentialist stamp. It is not likely that the movement will make much headway among us except in theology; but its stimulus will be felt. Even because of its prominence in theology it is worthy of deep study. For the

Christian scientist existential thought is of interest because any success it has must mean a reversal for the naturalism and positivism which so dominate the American scene.

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SOCIOLOGY

by

Frank E. Houser

It was suggested in this column in its first appearance that there were some empirical data relevant to the question of whether or not religion integrates the personality. Interestingly enough, just as there are social scientists who believe religion integrates the personality, so there are those who contend religion integrates society. It is with this recent development of social theory that this column deals.

Religion has not always been accepted by sociologists. Together with some anthropologists there have been times when outstanding sociologists regarded religion as both erroneous and impractical. Herbert Spencer and E. B. Tylor were concerned with "explaining away" religion by disclosing its origin. That origin was found in man's simple error of deducing the soul from the fact that while his body remained in one place, his self wandered about when he dreamed. And, early man's observation indicated that upon death the body disintegrated. This left the disembodied spirits of men to roam rather freely—with disconcerting effects. In this fluid state of affairs a tooth ache became the work of an evil spirit, a sweet old grandmother becomes a carping mother-in-law (science is still working on this), white cows become sacred, and stepping on a flower could be tantamount to murder. At this point Spencer broke with Tylor's animism—suggesting that men couldn't be so ignorant as not to distinguish between the animate and inanimate.

Then Max Müller embellished the explanation of man's preoccupation with the soul by suggesting the influence of external nature upon man. He said early man deified the most striking aspects of nature.

Modern sociologists interested in religion regard these theories as post hoc efforts which reflected the biases of evolutionary and rationalistic assumptions. The quest for origins is indeed a will-o-the-wisp adventure. And why, the contemporaries ask, has religion persisted if founded on error? Surely it is not subject only to man's rationality, but also to his emotional and social needs. Even more of interest to the modern sociologist is the way in which religion serves the group's needs or ends. As one of them puts it: "Religion, then, does four things that help to maintain the dominance of sentiment over organic desire, of group ends over private interest. First it offers, through its system of supernatural belief, an explanation of the group ends and a justification of their primacy. Second it provides, through its collective ritual, a means for the constant renewal of the common sentiments. Third it furnishes, through its sacred objects, a concrete reference for the values and a rallying point for all persons who share the same values. Fourth it provides an unlimited and insuperable source of rewards and punishments—rewards for good conduct, punishments for bad. In

these ways religion makes a unique and indispensable contribution to social integration."¹

Such an analysis is called the functional theory of religion. Kinsley Davis, W. Kolb, W. Goode, Talcott Parsons, and Robert Merton are building on the functional-structural type of sociological analysis developed by William Robertson Smith, Emile Durkheim, A. R. Radcliffe Brown, Bronislaw Malinowski, and Max Weber. "The mode of analysis toward which all these men are driving . . . assumes that society is an emergent whole determined by the organization of its parts and that, being something different from the mere sum of its parts, it cannot be understood in purely individualistic and utilitarian terms. Also the parts of society cannot be understood apart from but only with reference to the whole."² The interests of the functionalists are not, of course, confined to religion.

One of the first books to be published on the functional theory of religion is W. J. Goode's **Religion Among the Primitives** (Free Press, 1951). Goode uses the comparative method in examining several primitive societies about which there is much extant literature. Obviously the functional approach is not easily amenable to quantitative interpretation. The subject matter is as broad as society—and, as significant as society. If society is a unitary process then the sociologist is forced to expand his horizons for understanding's sake. In doing so he must resort to logic and fragmentary induction.

A fascinating footnote to the functionalists has been raised by W. Kolb who claims that cultural relativism and philosophical positivism are common assumptions among contemporary sociologists—even among "functionalists". To them values have no ontic status, for that is beyond scientific determination. Their positivism precludes the validity of the non-empirical. Kolb then concludes that the "functional theory of religion, if sound, forces these men into a position where they can no longer adhere to a purely subjective theory of value validity and still believe in the possibility of human freedom and a democratic social structure. They may, perhaps, continue to be men of good will but they cannot continue to believe that it is possible for all men to have equal access to knowledge and truth. The reason is simple. Sociologists have believed for some time that in order for a society to exist the members of that society must share a system of values. If the ultimate significance of the functional theory of religion is to indicate that at least most men in a society must not only share values but must also believe that these value-ideas are connected with a realm of values which has ontic status, the positivistic sociologist who prefers a free society is placed in an intolerable dilemma. It is a prime postulate of the theory of freedom that knowledge of the truth will make men free and that in a democratic society all men must have access to the truth. Yet if the idea that values have ontic status is false but necessary for the existence of society, the sociologist cannot spread such truth. To give all men access to this truth would be to destroy society, for men cannot know to be false what they must believe to be true. To refrain from spreading the truth is to deny men their freedom and dignity, for the sociologist would then be placing a lie at the center of their social existence and would be making himself a member of an elite who know the truth but must conceal it from the mass."³

1. Kingsley Davis, *Human Society*, MacMillan Co., N. Y., 1949, p. 529.

2. *Ibid.*, p. 518.

3. William Kolb, "Values, Positivism, and the Functional Theory of Religion," *Social Forces*, May, 1953, Vol. 31, No. 4, p. 307.

GEOLOGY

by

Karl Turekian

The history of geological progress bears in bold print the names of many Christian geologists. Though, it often seems, men have derided the Scriptures as obscurantist in its perspective yet the evidence shows that the Bible has provided motivation and purpose to countless scientists. To these Christian scientists it became an imperative of God to discover and delight in the mysteries of nature.

This is seen graphically in the life of James Dwight Dana who is perhaps best known in the field of mineralogy at present but whose influence during his lifetime covered a wider field. On graduating from Yale College in 1830 he began his life of discovering God's creation. The late part of the 19th century was to see him as an influential teacher at his old **alma mater** and also the editor of the **American Journal of Science**.

His work ranged from zoological treatises on corals to his famed mineralogical system. He found time in his busy life for investigating volcanos, elaborating his theory of cephalization and other widely varying problems.

Dana was often accosted with that familiar contemporary problem—the relation of Genesis and geology. For these inquiries he formulated his ideas and included them in his **Manual of Geology** (first published in 1862).

He was perhaps one of the first to emphasize the varied meanings of the Hebrew and translated "day" in Genesis I. He considered the word to mean the equivalent of "stage" and then listed the creation in Genesis in terms of what was then known regarding our planet. In doing so Dana found no contradiction between Genesis and geological history.

Though at first he rejected any form of evolution, believing in the direct creation of each species, in later life he altered his stand and affirmed that the pageant of life came " . . . through the derivation of species from species . . . with few occasions for supernatural intervention."

He wrote to one clergyman concerned with the problem: "While admitting the derivation of man from an inferior species, I believe that there was a Divine creative act at the origin of man; that the event was as truly a creation as if it had been from earth or inorganic matter to man. I find nothing in the belief to impair or disturb my religious faith."

Whether Dana was right or not in his stand will be difficult perhaps to ascertain in this life. It is interesting though that men of both a devout faith and outstanding scientific ability are numbered among the great in the halls of geology.

On considering this question one is forced to be less dogmatic on any particular interpretation of Scripture when several alternatives are possible. Indeed it is probably most in keeping with the attitude of the Scriptures to welcome new facts and sack our old theories and interpretations when rapprochement is not found between the two. In such honesty, certainly neither the Bible nor our Christian faith need suffer.