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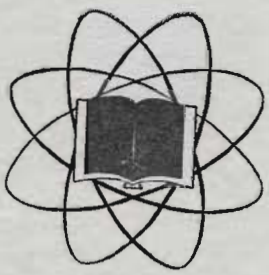

The fear of the Lord is the beginning of wisdom. Psalm 111:10

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The Journal Of The American Scientific Affiliation

Vol. 10 MARCH, 1958 No. 1

TABLE OF CONTENTS

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*The Physico-Chemical Synthesis of "Biological" Compounds**

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In any mechanistic hypothesis of the origin of life, one is faced with the problem of explaining the origin of the biochemical world. The problem of how inorganic matter was originally converted into organic matter, of a nature suitable for the ultimate formation of living systems, has been on men's minds for many years. As we view life processes today, we see that biochemical substances are formed and broken down (metabolized) by the action of biological catalysts which are, themselves, of a biochemical nature. The question of whether or not these biologically-active substances could have had a non-biological origin will be the subject of this paper.

An examination of living organisms, both plants and animals, reveals many differences in form and appearance; however, if we would examine the chemical make-up of living things, we would find that there are many striking similarities which transcend the boundaries of species, genus, and even kingdom. We find in plants and animals certain chemically similar substances which carry out the most basic processes of life. While there are a number of chemical substances found, more or less, universally in the world of living things, we will deal here only with three of the most important: enzymes, coenzymes, and nucleic acids.

The enzymes are proteins which possess the ability to speed up the multitude of chemical reactions taking place within an organism and without which life, as we know it today, would be impossible. Proteins are high-molecular weight polymers consisting of amino acids linked end to end in the form of long chains. The amino acids, or "building blocks" of proteins, are relatively small organic compounds possessing an amino and carboxylic acid group. There are about twenty different amino acids found to occur in proteins. The vast number of proteins vary only in the type, number, and arrangement of each of these amino acids. Some proteins do not contain all of the twenty varieties of amino acids; the protamines of certain fish sperm, for example, contain only about a third to a half of the known ones[1]. For a given protein, of a given species, there is believed to be a rather definite sequence of amino acids. The structures of some smaller proteins, such as insulin[2] and *B*-corticotropin[3], have been recently worked out.

The nucleic acids are found within every living cell and usually associated with protein (nucleoprotein); they are, like proteins, high-molecular weight substances. They consist of units of purine and pyrimidine bases, a pentose sugar, and phosphoric acid linked together in a definite manner. The nucleic acids may be divided into two classes, ribonucleic (RNA) and deoxyribonucleic acids (DNA). These are distinguished from each other by the type of pentose sugar they contain; RNA contains ribose, whereas DNA contains the corresponding 2-deoxy derivative. Differences in RNA and DNA from different species lies in the relative amounts of each of the purine and pyrimidine bases and, therefore, also in the base sequence. Chromosomal matter of the nucleus contains essentially all of the cell DNA, whereas the RNA is more widely distributed throughout other sub-cellular particles, such as the microsomes and mitochondria. Some viruses, such as the tobacco mosaic virus, consist entirely of nucleic acid and protein. Viruses are known of both the DNA and RNA varieties. Recently, evidence has been obtained which indicates that nucleic acids are involved in protein synthesis[4].

The coenzymes are relatively smaller molecular weight substances of a variety of structures, and which may be associated with one or more enzyme. They apparently take part in a reaction by forming a link between an enzyme and the substrate. Coenzymes vary considerably in their function, but playing a particularly important role in biological oxidation and reduction and also in phosphorylation reactions. It should be noted that not all reactions require the presence of a coenzyme. Some coenzymes are known which contain purines, pyrimidines, ribose and phosphoric acid, and others which contain amino acids in their structures, thereby showing similarities to the nucleic acids and enzymes. It is of interest to note that many of the known vitamins are coenzymes or part of coenzyme structures.

The three classes of compounds we have described consist of relatively few different "building blocks"; the number being something under fifty.

*Paper presented at the Twelfth Annual Convention of the American Scientific Affiliation, Beverly Farms, Massachusetts, August, 1957.

Proteins	20	(amino acids)
Nucleic acids	8	(purines, pyrimidines, and pentose sugars)
Coenzymes	10-15	(pyridines, flavins, pteridines, thiamine, sugars, etc.)
Total	38-43	

Many scientists, today, feel that life may have originated from the inorganic world via these basic substances (or part of them). What are the possibilities that this hypothesis may be true? Many investigators, not being satisfied with only a hypothesis, have looked into this problem, hoping to find at least a partial answer. If compounds such as proteins, nucleic acids, and coenzymes were formed via their sub-units during the prebiological period, under the conditions which existed on the earth's surface, these processes should be, in part, repeatable in the laboratory. If, as a result of experimentation, none of these substances could be prepared under a variety of possible primitive earth conditions, we would have to regard this hypothesis as rather unlikely.

Physico-chemical methods which have been used or suggested for producing "biological" compounds may be outlined as follows:

(1) Electric discharge through "primitive" gaseous mixtures.
(2) High energy irradiation of ammonium carbonate or acetate.
(3) Reactions of formaldehyde in aqueous solutions.
(4) Reactions of cyanogen.
(5) Reactions induced by heat (thermal reactions).

Electrical discharges, high-energy radiation, and heat have been known for some time to be capable of breaking molecular linkages. Similar but naturally occurring energy sources, such as lightning, radioactivity, ultraviolet and cosmic radiation, volcanic and also high pressures could possibly have been the means of forming a number of organic chemical structures during the prebiological period.

In 1913, Loeb[5] gave evidence for the formation of glycine after passing an electric discharge through a mixture of carbon monoxide, ammonia and water vapor. In recent years, electric discharge experiments have been carried out by Miller and others. Miller[6,7,8] passed an electric discharge through a mixture of methane, ammonia, water, and hydrogen. Within the apparatus was a refluxing aqueous phase which caused the gases to circulate and acted as a solvent for water-soluble products. After a week the aqueous solution was analyzed. The following biologically important compounds were isolated and identified: glycine, alanine, sarcosine, *B*-alanine, aminobutyric acid, aspartic acid, glutamic acid, formic acid, acetic acid, propionic acid, glycolic acid, lactic acid, succinic acid, and urea. Of particular interest is the fact that four of the amino acids common to proteins were produced. Abelson[9] reported that various mixtures of gases, including carbon dioxide-nitrogen-hydrogen-water, carbon monoxide-nitrogen-hydrogen-water, and carbon dioxide-ammonia-hydrogen, when subjected to electric discharge, gave rise to amino acids such as alanine and glycine. The action of the electric discharge in each of these series of experiments was such to cause the formation of free radicals. The free radicals then recombined with each other producing a variety of reactive substances such as formaldehyde, acetaldehyde, and hydrogen cyanide. These latter three substances along with ammonia reacted in water to form amino acids. In conjunction with these experiments, Miller investigated the possibility that purine and pyrimidine bases were present in the reaction products; however, using microtechniques, none could be detected.

Radiation has been suggested as an agent in the formation of organic structures. When ammonium acetate solutions were irradiated with beta rays from an electron accelerator, glycine, and aspartic acid were among the compounds formed[10]. Calvin and his co-workers[11] have irradiated aqueous solutions of carbon dioxide with helium ions and obtained simple organic compounds such as formic acid and formaldehyde. The latter compound would be a starting material for the production of several substances. When solid ammonium carbonate was irradiated with gamma rays from a cobalt-60 source, glycine and possibly alanine were formed[12]. Schweitzer[13] and his students, using solutions of ammonium carbonate, have found that several amino acids can be formed with a much smaller input of energy.

We have mentioned that formaldehyde is a starting material for the production of several compounds of biological importance. The reaction of formaldehyde with ammonia and hydrogen cyanide produces glycine, as was mentioned previously. Butlerow, in 1861[14] found that formaldehyde condensed with itself, in the presence of alkali, producing a sugar-like substance. Fischer[15], the great German organic chemist, reinvestigated the substance, which was called formose, and was able to isolate a small amount of DL-glucose from what was apparently a mixture of different sugars. The variety of sugars present in formose is indeed great, as was shown recently by Mariani and Torraca[16]. Using the technique of paper chromatography, they were able to show that at least 24 different sugars were present. They were only able to identify eleven of these, glucose, fructose, galactose, mannose, sorbose, arabinose, xylose, lyxose, ribose, xylulose, and ribulose. The majority of these substances occur in nature as such or in the form of polymers. It is of interest that ribose, one of the components of RNA, is formed in this reaction. Deoxyribose could, presumably, be formed by

a similar reaction between formaldehyde and acetaldehyde.

Bahadur[17,18] has given evidence for the formation of a number of amino acids by the action of light on formaldehyde and potassium nitrate, in the presence of ferric chloride. Paper chromatography indicated that glycine, serine, aspartic acid, asparagine, histidine, arginine, lysine, and proline were present. Of these only glycine, serine, aspartic acid and asparagine were positively identified. Oro[19] has heated solutions of formaldehyde and either hydrazine or hydroxylamine, two nitrogen-containing inorganic compounds, and obtained glycine, glycinamide, *B*-alanine, alanine, valine and lysine.

Cyanogen, a gas produced by the action of heat or an electric discharge on a mixture of acetylene and nitrogen, has been suggested as a precursor to biochemical compounds. The gas, by the action of water, slowly decomposes to form such substances as formic and oxalic acids, ammonia, hydrogen cyanide, and urea[20]. Many of these could, through further reactions, give amino acids, etc.

Thermal reactions, which result in the formation of biologically important compounds, have been investigated by Fox and his co-workers [21,22,23]. Heating the ammonium salt of malic acid or a mixture of the acid and urea, they obtained aspartic acid. The yield of amino acid increased when the product was hydrolyzed by acid, indicating that the aspartic acid formed existed as some type of polymer[21,22]. Further experiments with aspartic acid showed that a protein-like substance is formed, among other products, by heating the amino acid at 200° C. for 0.3 to 3 hours[23]. Under similar conditions to these, Meggy[24] was able to polymerize glycine. Other experiments by Fox and his group have shown that alanine and the isomeric *B*-alanine are also formed on heating aspartic acid[21,22]. *B*-alanine is of interest in that it is a constituent of Coenzyme A.

Lippich[25], in 1908, showed that an aqueous solution of aspartic acid and urea, in the presence of barium hydroxide, yielded ureidosuccinic acid. Fox reinvestigated this reaction and found that various alkaline substances catalyzed the reaction, giving a good yield of the product[22]. Ureidosuccinic acid is of particular interest since it is a known precursor of pyrimidines[26] and, therefore, also of nucleic acid.

As yet, there has been no production of the known purine and pyrimidine bases by the rather simple physico-chemical means previously described. Uric acid, an end-product of purine metabolism in some animals, possesses the purine ring system. This derivative was first synthesized, in 1882, by the rather simple method of heating a mixture of urea and glycine[27], substances we have shown previously to be formed by other physico-chemical means. Davidson and Baudisch[28] found that urea and malic acid, when treated with fuming sulfuric acid, which acted as a dehydrating agent, yielded uracil, a pyrimidine found in RNA and certain coenzymes.

We have, to this time, discussed, primarily, the formation of the basic "building blocks" of proteins, nucleic acids and coenzymes. Further comment should be made about procedures for forming the more complex substances. The formation of polymers of amino acids, for example, requires considerable free energy. This means that within an aqueous solution of a given amino acid, relatively very few of the molecules will react with each other to form dipeptides and still fewer to form high polymers. In experiments which involve the heating of amino acids such as were mentioned for aspartic acid and glycine, water, a product of the reaction, is removed under conditions of a high temperature. Such a reaction, as we pointed out, gives other undesired by-products. Curtis[29] and later, Frankel and Katchalski[30] showed that glycine ethyl ester condensed to form polymers, possessing many of the chemical properties of proteins. It is rather unlikely that such amino acid ester derivatives were formed during prebiological times; however, there is the possibility that "activated" amino acid derivatives could be formed in other ways. Certain inorganic phosphoric acid derivatives, the pyrophosphates, have been suggested by a number of writers[11,31] as being possible condensing agents. Recent evidence[32] indicated that amino acids, most likely, condense *in vivo* through phosphoric anhydride intermediates, adenosine triphosphate (ATP) being the phosphorylating agent.

Bernal[33] has suggested that as amino acids were formed, they were absorbed and then condensed on clay particles. This idea helps overcome some of the claims that the concentrations of amino acids and other "building blocks" were too dilute for condensation to take place.

In summary, we have presented evidence that a number of biologically-important compounds, such as amino acids, can be formed by rather simple means. The problem of how these sub-units condensed to form more complex biologically-active compounds has also been considered. There is need for additional research to be carried out in this field, since a hypothesis becomes more satisfactory only as it is supported by more and more experimental data.

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*Theological Aspects of Mechanists' Views of the Origin of Life**

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There are few portions of the Bible which have come in for continued question in our modern age as have the first two chapters of Genesis. Although in many other passages God is referred to as the Creator, the Creator of all things, of man and beasts, of all things in the heavens, earth and seas, etc., yet here only is given the details of God's working. The view has been usual until recently that God created the matter of the world out of nothing, that then He shaped it into its present form, and then in succession created the various forms of plant and animal life out of existing matter, finally creating man from existing matter by a special creative act. This view is reviewed, for example, by Charles Hodge (*Systematic Theology, II, p.26*) and denominated by him the "commonly received and Scriptural doctrine." Hodge discusses at some length the theory that life arose by a chance association of atoms and forces and condemns it, quoting against it not only Scripture, but also some leading scientists of his day, e.g. Huxley. Hodge has much in his discussion (ib. p.4*ff.*) that we may utilize today.

The Scriptural argument against spontaneous generation is partly exegetical and partly derived from the general Scriptural principles. In the exegesis of Gen. 1 and 2, it appears clear that the author meant to imply that life was the product of God's explicit command. God gave these fiats on the successive days of creation and then ceased from creating. Evidently God's providential government which continues is of a different order from his work of creation which stopped. Furthermore God arranged that the organisms that He had created should propagate themselves, and He Himself enunciates the principle that life shall come from life. That living things arose by creative fiat rather than by natural law or by chance seems to be taught by the circumstance that the Bible and especially these chapters speak of creation as a never repeated thing. Rev. 10:6 links with the creation of the heaven, the earth, and the sea, the things also that are therein. Exegetically, there is not a hint that the creation of life is a repeated or repeatable act brought about by physical and chemical law.

Hodge's argument runs deeper. It concerns the nature of life. If the accidental or providential association of atoms and forces produced life, and if life results today upon a similar association, then life is purely mechanical. It matters not whether the original creation be ascribed to God's purpose or not. If in the origin of life God worked through second causes alone, then life and its reactions are as mechanistic as the wheels that spin in our factories. If we can manufacture life as we can manufacture motors, then living organisms are but machines. Then the instinct that sends a bird south in the fall or the thing that makes a dog wag his tail when you pat his head are but physico-chemical reactions no different in kind from the inevitable and predictable reaction resulting from putting sodium in contact

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with water.

Now we do not for a moment deny that life includes the physical. God made living organisms from the stuff of the earth. They operate in accordance with natural laws, but there is a freedom and a consciousness even discernible in animals which is most difficult to explain on mechanistic grounds. The eye of a horse receives images on the retina in accordance with physical law. But somehow that image is transmitted to the animal brain where it apparently means something. "The ox knoweth his owner." At the sight of one man on the sidewalk a dog will come running in delight. Another man in similar clothes, and of similar build will bring out the dog with a growl. The difference is somewhere in the dog's consciousness. The dog does not focus two cameras; he sees. And sight is mental. Animals react to burns and injuries in so similar a manner to our own reactions that we surely can say that they feel pain. Machines can have a heat indicator which will stop them when their bearings overheat. It seems elementary to declare that pain is different from this; pain is a state of consciousness.

I would not wish to overemphasize the similarity between animals and men. But we can not altogether discount these similarities either. Animals appear on observation to possess a freedom of self-determination analogous to our own. Hunger has in it, of course, an element of the mechanical and chemical. But what shall we eat? And why should we deprive ourselves of the choicest for the benefit of another organism which happens to be related to us by ties of blood or marriage or love? Yet animals, in a measure, also do this. Animals constantly show the marks of conduct which we are conscious of being due to self-determination in ourselves. Such phenomena are in no measure true of inorganic materials. What is the thing that so differentiates? What is life?

One characteristic of all life is self-propagation. This is marked out in the Genesis account as the peculiar characteristic that God gave to his creatures so that He would not have to continue giving creative fiats for each succeeding generation. God could, presumably, have arranged otherwise than He did. But He ordained that plants and animals should propagate and rocks and rivers should not. Propagation is perhaps one of the most marvellous arrangements of our universe. How handy it would be if Plymouths could beget Plymouths and if you could cross your Ford with a Cadillac! But it can not be. Again, we freely admit that there is something of the mechanical in procreation. Chemical hormones, osmotic processes, all have their work to do. Certain disturbing factors like arsenic or automobile accidents can stop the process completely. But is it conceivable that it is all mechanical? that we, if we had an infinitesimal biological assembly line, could plant in a germ all the factors which would cause that germ to grow, divide repeatedly, produce cells of various kinds in just the right places so that there should result a tiger with parallel black stripes - never looking like a cross-word puzzle and never having teeth on his back, but only in his jaws? With almost infinite ability and skill, would not the limit of our ability be to produce a lifeless cell and after that must come the fiat - Now live!

Certain constituents of our bodies have been long known and easily synthesized. Salt is a common chemical, easily made and necessary to life. The amines and hydro-carbons are more complex. It was a milestone when urea was synthesized, which does not occur in nature except as the product of life. Still, urea is merely a lifeless chemical. So are protein molecules. True, mere chemicals sometimes exhibit movement as we know from study of colloids and from the Brownian movement of gases, etc. It is possible that protein molecules may be synthesized or that they were synthesized in nature just before God's fiat creating life. They still are but the stuff of life. The assumption back of much of our experimenting today is that when complex molecules are made they will be found to be alive. Thus to believe is to make the whole mechanistic assumption. And it is an assumption totally unproved. It is quite antithetic to the Christian position. In the fairy story, Cinderella could gather the mice and the pumpkin, but it took the fairy's wand to produce from these the team and golden coach. Our laboratory technicians hope to assemble the stuff and then hope or even expect to get results without the Creator's miracle-working power. Complexity is not life. An intricate calculator is not a mind, though it may be called a brain. Polypeptide formation is not *ipso facto* creation of life, and to assume that it is, is not proper for scientists nor legitimate for Christians.

Hodge quotes Tyndall to say that materialism is absurd only if matter be thought to be in contrast to Spirit, whereas rather matter and Spirit should be thought of as "two opposite faces of the same great mystery." On this view of hylozoism, Hodge remarks, "If you only spiritualize matter until it becomes mind, the absurdity disappears. And so do materialism, and spontaneous generation, and the whole array of scientific doctrines. If matter becomes mind, mind is God, and God is everything. Thus the monster Pantheism swallows up science and its votaries." (ib.p.9) The point is that if consciousness, rationality, and freedom are illusions, then rational conclusions, be they theological or scientific, have no validity. If the brain secretes thought as the liver secretes bile, then the organism boasting a brain has no ability to investigate the liver or make any pronouncements upon its operation. If we reason ourselves out of rationality, it is time that we stopped and checked our reasoning.

Ocean tides and automatons do not engage in research and they who engage in research are not automatons.

There is a further assumption in the current expectation that life can be created in the laboratory. It is the assumption of the truth of biological evolution. It is not presumed that in ancient times a fortuitous concourse of atoms and forces produced a tiger burning bright in the jungles of the night. Rather, they produce, a prototype of a living cell which finally became a living cell or cells from which all present life has evolved. In this theory, so-called threshold evolution or progressive creation, in which God created the main forms of life leaving them to differentiate, will not do. All must have evolved from very elemental forms of life.

This too, is an assumption which I for one, am not willing to make. It has responsible scientific opposition and I believe it is contradicted by the Bible. The mechanics of such evolution are still a mystery. We were assured by Dr. Tahmisian at our meetings in Chicago last summer that he could find no evidence at all that mutations can be responsible for the origin of species. His witness can not be discounted, working as he continually does with the effects of radiation on life, there at the Argonne laboratories. Other such testimonies could be given. The paleontological record after years of the most intensive research still evidences great gaps between the species. Doubtless much here remains to be learned. Particularly in the field of the alleged evolution of man recent discoveries bring into serious question the confident assertions of a generation ago. The appearance of ancient but quite modern forms, like Swanscombe man and Kanjera man, and the appearance of numerous specimens of Carmel men with many modern features despite their alleged antiquity has upset the old neat progression from brute to man so regularly set forth in reconstructed models in most of our museums. The recent new approach to Neanderthal man, whose stooping and brutish reconstructions have long been standard, is most interesting. The old view is now said, I believe, to have been due to the prejudice and ignorance of the researchers. We may well remind ourselves that this is a field in which prejudice runs wild and our knowledge of the earth's life in the distant past is not so great but that we should be able cheerfully to admit some ignorance of its details. At the very least, it should be said that the paleontological record does not show an abundance of intergrading forms between the various species forcing us to hold that all life originated from elementary cells. The evolutionary tree in all of our textbooks consists largely of twigs on hypothetical branches stemming from an inferred trunk.

Numerous of the other earlier arguments for evolution are not now so much emphasized. The blood tests, the arguments from vestigial organs, the declaration that the embryo repeats the history of the race - these arguments are apparently recognized to be deficient either in fact or in significance. The one main argument remaining, appears to be the one from similarity. If similarity proves relation, then all life is descended from one source, for certainly all organisms are built on a similar plan. Hands are like paws, arms are like wings, skin with hair bears real resemblance to skin with feathers and with scales, fish are like reptiles, and even vertebrates are like invertebrates. In biochemical processes all animals have real similarities, and in reproductive arrangements, plants have real relations with animals. If similarity proves relation, there is an end of the matter.

But as I understand it, there are numerous cases where similar organs are claimed to have originated independently, without a common ancestral basis. One of these more often referred to, is the eye of the cuttlefish and the eye of the vertebrates. In this case, apparently a considerable degree of similarity in a complex organ is not claimed to be due to common origin. If such a significant exception be allowed, it seems that the whole argument from similarity is brought into question. Similarity there is, to be sure, but its explanation is obscure. Creation on a similar plan might as well be the answer.

Specifically these problems come to the fore in the topic of the creation of man. This subject is rather beyond our alloted time of discussion, except to remark that the mechanists find no stopping place from the original germ to the most educated German. The Bible, on the other hand, gives such emphasis to the creation of man as a special act of God, and is so specific in saying that Eve was created from a portion of the body of Adam, that the classic view of Bible-believing Christians has been that no tour de force of theistic evolution may here be admitted. Man, according to the Bible, " was formed by the immediate intervention of God." His body "did not grow; nor was it produced by any process of development," (Hodge, ib. p.3). In addition to his chemical constituents which he shares with the earth and his principle of life which he shares with plants and animals, he is possessed of a soul or spirit which was created especially by God and which returns to the spirit world at death.

The words for soul and spirit in both Hebrew and Greek are constantly interchanged. The word *nephesh* "soul" in the Hebrew is often just the reflexive pronoun meaning the person. These words are applied to animals as well as men to refer to the principle of life in them, (Lev. 24:18, Gen. 1:21, 9:10, 7 15, Eccles. 3:19, and Rev. 8:9) except that *pneuma* "spirit" does not appear in the New Testament to be applied to animals. For this and other reasons some have held to the view of trichotomy, that animals have bodies and souls like men, but only men have spirits. This view I reject on exegetical grounds which do not

concern us now, but it does give the idea expressed above that there is a kinship in life between animals and men, both differing from the world of the inorganic. The blood, the life, of both animals and men was sacred (Gen. 9:4f). Man's earthly life was sacred as well as his immortal life (Mt. 10:28).

For these reasons I, for one, deny that life can or will be made in a laboratory.

*Christian Beliefs and Personal Adjustment In Old Age**

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Much has been written and said about the contributions of Christian faith to the mental health of the individual, but relatively little systematic or scientific investigation has been made of these contributions. The effects of religious faith can logically be expected to be the most pronounced among the aged on whom religious beliefs and doctrines, or the absence of them, have operated over the longest period of time.

Related Studies

Because of the economic stresses and other strains of middle age, people sometimes depart from the religious "faith of their fathers." Allen has found that in later maturity many of these return to religion, consciously or subconsciously seeking consolation as they think of "the hereafter."[1] This may appear to be an illusional compensation to some, but to others the thought that they will be with their loved ones again in a better world is a source of true comfort.

A renewed interest in religion in old age has been noted by many other observers. When persons reach later maturity, they often are more interested in religion than they have been since adolescence. Sometimes their physical condition prevents them from taking an active part of organized institutional religious activities, but their personal beliefs have a tendency to become modified, perhaps to be changed toward the beliefs instilled into them in childhood if they have since turned away from them. Psychologist Lawton has tried to explain this tendency of many old people by indicating that the longer we live, the more experiences we have to reflect upon and the greater our attempt to learn the underlying cause and meaning of joy and suffering.[10] We hence have reduced interest in the purely material sides of life and a growing concern in spiritual things. Searching for a principle of unity in the whole process of life, the older person has an increased hunger to explain his life to himself, to justify the world, and to discover justification for human nature as he has found it.

The nation-wide *Catholic Digest* survey of the religious beliefs and practices of Americans aged 18 and over gives us further evidence of the religion of the aged. Older people were found to be more certain than young and middle aged adults that there is a God. They also were discovered to be more serious about preparing for life after death than in trying to live comfortably, and they tend to read Scripture more than the young.[5]

In a study of about 50 persons whom he interviewed in 1941 Lawton found that next to health the greatest source of contentment in later life is "health of the spirit" or "trust in God."[11] Belief in an afterlife has also been reported to be related to good personal adjustment in old age in several more recent studies of retired school teachers, recipients of old age assistance, and others.[2,14,15,7] These findings suggest the hypothesis that the tendency of many old people to cling to or to return to religious faith is related to good personal adjustment in old age.

To test that hypothesis, Moberg divided the 60 church members in a sample of 68 elderly persons into 2 groups on the basis of religious beliefs pertaining to the person of Jesus Christ and the Bible.[12] Those who responded in a questionnaire to the Bible as being the infallible Word of God or as the absolute and final authority of faith and practice and who also considered Jesus to be truly God as no other person can ever be or the Savior who shed His blood for our sins were classified as "fundamentalists;" those who did not fully qualify as such were "non-fundamentalists" for the purpose of this study. The 51 "fundamentalists" were matched individually with the 7 "non-fundamentalists" on the basis of 11 characteristics used as controls (sex, white race, age, occupational background, eduation, marital status, health, presently unemployed, Protestants, frequency of religious service attendance when age 12, and age of joining church). The matched control and experimental groups of six persons each showed greater differences in mean personal adjustment scores than those that prevailed between the unmatched groups, the "fundamentalists" in both cases having

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higher mean personal adjustment scores. These differences were not statistically significant, perhaps because of the small size of the sample, but it was believed that the increase in differences in favor of the "fundamentalists" which resulted from matching might be indicative of some very real difference between the two groups. This, therefore, was a stimulus for the larger study reported in the remainder of this paper.

Method

The hypothesis that religious beliefs are related to personal adjustment in old age was tested as part of a larger study.[13] Questionnaires were completed, by interviewers in all but 2 cases, for 219 persons who were residents of 7 institutions in the Twin City Metropolitan Area (Minneapolis-St. Paul and vicinity), 5 of which are homes for the aged and 2 public homes in which others are cared for in addition to the aged. Included as part of the questionnaire was the Burgess-Cavan-Havighurst Attitudes Inventory which was used to measure personal adjustment in old age.[4] The validity and reliability of this widely-used instrument have been satisfactorily established.[6]

Five items in the questionnaire were combined to form a single *religious belief score*. The items included and the weights assigned were as follows:

1. *The Future.* Looking forward the most in the future or during the next year to the future life, eternity, "God's call," heaven, "looking for the Lord," etc.—2; looking forward to events that may or may not have a religious significance—1; looking forward to nothing, "never thought of it," "can't say," "don't know," etc.—0.

2. *Prayer.* Prays because of belief that God listens and answers prayer—2; prays for other reasons—1; does not pray—0.

3. *Sin.* Belief in sin with the belief that one's own sins are forgiven—2; belief in sin with the hope that one's own sins are forgiven, or thinks they are forgiven—1; all other responses—0.

4. *The Bible.* Belief in the Bible as God's perfect Word —2; dubious responses—1; belief in the Bible as inspired only like other great pieces of literature—0.

5. *Jesus.* Belief in Jesus as the Savior who shed His blood for our sins—2; dubious responses—1; belief in Jesus as merely a great man—0.

In the questionnaire only open-end responses were used to indicate the scoring of the first item, so it is possible that some persons who failed to mention otherworldly future hopes and plans did so, not because they did not believe in heaven, but because they felt such a belief and hope to be so obvious as not to be worth mentioning. Also it is possible that some who said they wished to die, "go home," "reach the end," etc. were thinking of heaven when they did so, even though they did not specifically mention it. It was therefore decided to give one point for having such plans and hopes even though spiritual or religious beliefs were not mentioned directly. Likewise with number 2, the mere fact of praying indicates a belief that prayer performs some function or does some good, so everyone who prayed was given credit for it.

Scoring was done by simple addition of the weights representing responses. The highest possible religious belief score is therefore 10, and the lowest possible score is 0. A high score indicates one who believed in heaven or a future life, and who mentioned that belief, believed in a prayer-answering God, believed that there is sin and that his own sins were forgiven, believed in the Bible as the perfect Word of God, and believed in Jesus Christ as the Savior who died a vicarious death. Persons with high scores were therefore called "believers," and those with low scores were called "non-believers," even though the latter in doubt have beliefs in the common meaning of that word about the included topics. "Believers" as thus defined could be classified as those whom some call conservative, fundamental, evangelical, or orthodox Christians, while the "non-believers" are more like those who are sometimes called liberal or modernistic Christians, or in some cases non-Christians.

One weakness of the questionnaire items on which the religious belief score is based, and hence a weakness of the score itself, was a tendency of many respondents to think to themselves, "What *ought* I believe about this?" Sometimes this was outwardly expressed in the words, "What *should* I say?" or "What is the *right* answer?" It is very likely, therefore, that conventional answers tended to predominate over the individuals' own covert beliefs when and if there were differences between the two. It is possible that this tendency reflects a realization on the part of many that Christianity is divided into various groups on these issues, and they wish to be true to the groups with which they have identified themselves.

Preliminary Findings

Religious beliefs were found to be closely associated with religious activities. The religious belief score had a product-moment correlation with a similarly-constructed religious activities score of .660 with a standard error of .038. This high correlation may in part have occurred because prayer was an aspect of both scores, but it also reflects the possibility that those who believe in the Bible as the perfect Word of God are most apt to read it reverently and consistently, and those who believe in Jesus as a vicarious Savior are most apt to engage in the religious activities of worship and praise.

The data summarized in Table 1 indicate the close relationship between the scores of personal adjustment in old age and the religious belief scores. The product-moment correlation of the two sets of scores is .462 with a standard error of .053. It is interesting to note that "believers" in the highest belief score category who were not church members at the time of interviewing had higher personal adjustment scores than church members in the same category. Also, church members with low religious belief scores tended to have lower

Table 1. Mean Personal Adjustment Scores by Religious Belief Scores and By Church Membership

Religious belief score	Church Members		Non-church Members		All Persons	
	Number	Mean Pers. Adj. Score	Number	Mean Pers. Adj. Score	Number	Mean Pers. Adj. Score
10	28	30.2	6	32.5	34	30.6
9	42	28.4	19	24.3	61	27.1
8	23	29.7	12	26.9	35	28.7
7	18	26.1	7	24.3	25	25.6
6	9	29.0	7	19.9	16	25.0
5	5	29.0	8	23.8	13	25.8
4	5	21.6	5	23.2	10	22.4
3	1	18.0	9	22.2	10	21.8
2	0	—	7	18.4	7	18.4
1	1	23.0	5	15.0	6	16.3
0	0	—	2	14.5	2	14.5
Total	132	28.4	87	23.3	219	26.4

High personal adjustment scores indicate good adjustment.

personal adjustment scores than non-members who had similar belief scores. Is this an indication that deviant church members have a sense of guilt because of the inconsistencies between their personal beliefs and their implicit profession as church members which tends to make them poorly adjusted?

Experimental Procedure

To test more precisely the hypothesis that religious beliefs are related to personal adjustment in old age, an ex-post-facto experimental design was developed in which an experimental group of persons in the 4 highest belief score categories (scores of 7 through 10: hereafter called "believers") was matched by pairing of individuals with a control group of persons in the lowest 5 belief score categories (scores of 0 through 4: hereafter called "non-believers"). Of the 219 subjects of the entire study 155 had religious belief scores of 7 or more, and 35 had religious belief scores of 4 or less. The matching of individuals from these two groups, pairing them on the basis of seven controlling characteristics (sex, self-rating of health, marital status, number of living children, education on the same level or within 3 years of each other, present employment status, and similar club activities in the past and present), caused a loss of 146 persons, leaving 22 "believers" matched with 22 "non-believers" of similar backgrounds.

Two null hypotheses were used for increasing objectivity in testing the hypothesis that religious believers have higher personal adjustment scores in old age than non-believers: (1) There is no difference in personal adjustment in old age between persons who have high religious belief scores and persons who have low religious belief scores when other characteristics of the 2 groups, are held constant by matching of individuals in the 2 groups, and (2) the observed differences in personal adjustment in old age between persons who have high religious belief scores and persons who have low religious belief scores are no greater than those that occur between 2 groups selected by random sampling from the same universe.

Findings

The matching of the 155 "believers" with the 35 "non-believers" had very little effect upon the mean personal adjustment scores of the 2 groups. The average score of the 155 "believers" before matching was 28.0, compared to 27.2 for the 22 "believers" who remained after matching. The 35 initial members of the control group of "non-believers" had a mean personal adjustment score of 19.9, and the 22 who remained after matching had an identical score. The first null hypothesis was therefore rejected for these 22 matched pairs. The critical ratio of the difference between mean scores of the 2 groups after matching was 3.7; this indicates that a difference of this magnitude could have come about by random selection of the 2 groups from the same universe less than once in a hundred samples. The second null hypothesis was therefore also rejected, thus again verifying the positively stated hypothesis (for these 22 pairs of persons) that "believers" have higher personal adjustment scores in old age, and hence

presumably better personal adjustment, than "non-believers."

It is possible that if a sufficient number of persons who have religious belief scores of 0 were available for matching with persons who have the highest possible score of 10, the observed differences in personal adjustment between the two groups would be even greater than those discovered in this experimental design which included several categories at each end of the continuum of belief scores.

Discussion

The observed difference between the personal adjustment scores of the "believers" and "non-believers" may be explained in various ways. It is possible that "the non-believer" who sees death approaching may be subconsciously, if not consciously, disturbed at the thought of dying and at his lack of assurance of life beyond the grave. Such a person may be bothered by feelings of guilt in not being certain his sins have been forgiven, even though he may *say* he does not believe in sin. (One of our respondents said she did not believe in sin at all and then went on to assure the probing interviewer that her own sins had been forgiven.)

The "believer" may feel a greater sense of usefulness than the "non-believer" because he believes that God hears and answers his prayers and that he therefore can help others by interceding for them even though he may be physically unable to offer any tangible or material assistance to those around him who are in need. The Christian "believer," even while recognizing his own imperfections and sins, may be rejoicing in his faith that the confession of his sins to God brings him forgiveness because of the sacrifice of Jesus Christ for him. The "believer" may be happy and well-adjusted even when suffering from physical infirmities and afflictions because of his assurance that there is a purpose in everything that comes into his life, even though at the time only God may know that purpose, and because of his assurance that God will make all things work together for good.

It is possible that adaptability is the key to the observed relationship between religious beliefs and good personal adjustment in old age. E. W. Burgess has indicated adaptability to be one of the important factors related to successful adjustment in marriage.[3] Hulett has similarly suggested the possibility that for life in modern society the "capacity to adjust to the elements of the future as they emerge" will give the individual the best promise of continuing ego-security.[8] As the older person loses status occupationally, socially, economically, and otherwise in our society, is it not possible that the adaptable person is the one who remains well-adjusted, while the unadaptable person becomes poorly adjusted? If the adaptability of the Christian "believer" is increased by his faith in the teachings of the Bible that "all things work together for good to them that love God" (Romans 8:28), that "my God shall supply all your need according to his riches in glory by Christ Jesus" (Philippians 4:19), and no trial comes to the Christian except as it is permitted by God (1 Corinthians 10:13), then we should expect such persons to be better adjusted in old age than those who are "non-believers" and presumably therefore less adaptable to circumstances. A double hypothesis is therefore suggested for testing: Adaptability makes for good personal adjustment in old age, and the Christian religion contributes to adaptability. It may be the presence of this factor that has led to the observation that the "graceful old person" almost invariably was well-adjusted in his youth,[16] and that "the best possible preparation for age is the habit of learning to adjust at all ages."[9]

Obviously, an important limitation of this study is that it is only one study on a limited population. The subjects of this study were reared in an age when what we have called "believers" were the predominant type of Christian. It is possible that the religious faith of one's childhood and youth is what gives the greatest comfort and contributes the most to good personal adjustment in old age. The findings of this study may hence be related directly to the type of Christian religion that was most common 60 to 70 years ago; if persons are reared in childhood and youth in a different religious atmosphere, they may experience the best personal adjustment in their later years of life when they conform to a type of religion similar to that of their own formative years. Additional research on other groups of older people in our own society who have different types of backgrounds, divergent life experiences, and various current living conditions, as well as groups of persons who have come from diverse religious backgrounds in childhood and adolescence, would undoubtedly help us to understand better the relationship between religion and mental health in old age.

Conclusions

Present knowledge indicates that, for the samples that have been studied, the holding of orthodox or Conservative Christian beliefs is related to good personal adjustment in old age. Additional research may result in the reinforcement, modification, or elimination of the possibility that this is a casual relationship, or it may lead to the discovery that both Christian beliefs and good personal adjustment in old age result from a common set of causal variables.

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*What Are the Scientific Possibilities For Original Kinds?**

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The majority of scientists today believe that all present organisms have evolved from a very early first living material. Belief in evolution is not moribund. It is as alive as ever! In fact many evolutionists are not even aware that a logical creationist position is held by a minority of competent scientists.

Recently a well-known scientist in one of the largest universities in our country gave four hours of lectures on some aspects of evolution to a class of well over one hundred graduate students. After one of the sessions a member of the class mentioned to the professor that he taught creationism in a small college. The immediate rejoinder was, "It must be a Roman Catholic school." Now this was not true. Names of several creationist professors were given as authorities for a non-evolutionist position. Whereupon the professor replied that he never had read anything on this side of the question and that all of his studies had been in the writings of evolutionists who had penned their opinions about the errors of a creationist position.

A biology teacher nowadays who wants a text that does not stress evolution must settle for volumes which place the mechanistic one-sided approach to questions of origins and variation in chapters by themselves rather than having it woven into the warp and woof of the text. We now need to have more conservative Christians engaged in the difficult tasks of writing and publishing quality scientific works.

Examination of the history of evolutionary thought reveals four presuppositions evolutionary workers have had. These are:

1. That our knowledge of natural phenomena comes from nature alone.
2. That the fundamental similarities among living organisms can be explained only on a basis of a relationship of descent.
3. That the variations or changes that are observed in living organisms are unlimited in their scope, and
4. That the causes of such changes are operative today in the same way they have always been in the past.[1]

Many Christians find these generally unacceptable because of their belief in Scriptural revelation and the activity of God in nature. Scientific data, that with which we are dealing, is concerned with factual knowledge and the interpretation of it. Higley has very adequately defined science as "knowledge of God's creation, its phenomena and laws, fully tested by adequate observation and interpreted by accurate thinking."[2] In scientific work great care must be exercised in interpreting the facts. To come to correct interpretations the Christian utilizes the inspired Scriptures in addition to scientific data.

As far as evolution is concerned today, we observe that Darwinism is gone and we have a neo-Darwinism which is built upon the framework of the original in the light of modern developments. No informed scientist today holds the same beliefs as did Darwin. His writings lack information about cells, physiology and biochemistry; and his attempt to explain variation

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and heredity by means of the hypothesis of pangenesis has brought forth the following from the geneticist, Winchester.

> His hypothesis of pangenesis, however, makes clear the fact that he was not a natural scientist. Rather he was a speculative philosopher and never attempted to devise practical experiments to prove or disprove his speculations.[3]

The pangenesis idea of Darwin (1868) incorporated the inheritance of acquired characteristics teaching of Lamarck and stated that all the cells or units of the body release gemmules which go to make up the germ plasm and are transmitted to the offspring. If a man used and thus developed muscles of part of his body, gemmules from this area would go to his germ cells and thence to the offspring where they may ultimately produce the same type of developed muscles. Today we know that germinal material is separate from somatic (body) tissues. However, in defense of Darwin we should bring out that he made many good observations and drew some sound conclusions. His writings merit our attention.

Now we will concern ourselves specifically with scientific evidence pertaining to the possibility for original kinds. In an attempt to correlate the Scriptural use of "kind" (*min*) with the facts of science we will mention first of all the "rings of races" or the "racial circle."

In this we have a striking illustration of borderline cases where there have been quite obvious small changes in a group of organisms. There lives in Europe and Asia a bird called a titmouse of the family *Paridae* (which contains our chickadee). The territory occupied by the titmouse is "C"-shaped. One subspecies covers an area from the Amur River between Soviet Russia and Manchuria down through Japan and southern China. This intergrades with another group which ranges across southern Asia from Indonesia through India over to Iran where it intergrades with another subspecies. The last covers Europe, North Africa, Persia, Turkey and extends across Siberia to meet the first subspecies at the Amur River. In juxtaposition in the arc the subspecies are cross-fertile but at the two ends there is no hybridization. Apparently the bird spread eastward from Europe in the north across Siberia and in the south across southern Asia. There apparently occurred small changes in the group until finally at the end of the two lines there is some sort of physiological difference preventing the formation of hybrids. This is an example of a condition where originally in all probability there existed one type of bird which underwent small degrees of change resulting in three groups, those living at the extreme ends ultimately being reproductively isolated from each other.

Moore has made comparative studies on the North American leopard frog, *Rana pipiens,* and found certain genetic differences. The northern races tend to produce larger eggs which are deposited in submerged masses whereas the southern frogs deposit their smaller eggs in smaller groups in thin layers or even a single layer at the surface. Northern embryos develop more rapidly at lower temperatures (12°C) and slower at higher temperature (28°C). There is an interbreeding population from Canada to Mexico but certain widely separated forms (Vermont and Florida) could not produce offspring. Apparently there has been variation, members of a single species distantly separated ultimately showing reproductive isolation when hybridization is attempted.

In the Pacific Ocean on the equator are the Galapagos Islands which are named after the large tortoises living there. The group is composed of thirteen larger islands separated by distances up to one hundred miles. Darwin, and about a century later Lack, studied the birds on these islands and noted local differences among the groups, especially the finches. There is a geographical separation of the races and so they differ on the different islands, the outlying islands having mostly distinct forms. All of the birds resemble those found on the South American mainland some six hundred miles away.

A similar situation exists with islands in the Great Salt Lake in Utah where are found some mammalian subspecies of mainland forms. Then there is much literature on the differences existing among snails isolated by some type of barrier. Many studies of this type have been made and in all the cases we have mentioned there are small differences observed to exist between groups in close proximity.

There are, however, two ways of interpreting these data. (1) The forms we see were made as they are, or (2) the existing groups have been derived from parent stock; that is, there have been some changes producing the varieties observed. There appears to be little question about the truth of the latter interpretation. In fact it was observations made by Darwin on the Galapagos Islands which played a big part in his losing faith in the then-current "fixity of species" concept.

Blind fish in Mammoth Cave, said Dr. Louis Agassiz, were created blind and placed in the caves. Respect as we must the scientific achievements of this great Christian scholar of the past century we must disagree. Living in the general neighborhood of the caves are similar fish with functional eyes, and it has been observed that the blind forms have eyes which reach a certain stage of development as normal eyes during the embryonic life. Later these eyes atrophy and are of no value for seeing. Is it not logical to believe that blind fish have arisen by some change from the normal, this change being passed on to offspring which were able to survive because of the sheltered environment?

As further evidence that small changes have occurred we note that in North America alone there

are 41 distinguishable groups of American deer (Genus *Cervus*), some 35 types of raccoons (*Procyon*), 102 types of ground squirrels (*Citellus*), 31 types of flying squirrels (*Glaucomys*), and 145 types of pocket mice (*Perognathus*) to name only a few forms. Considering rodents alone in North America, we find no less than 2,156 distinguishable types.[4] A good example of some changes in the plant kingdom is that of a kind of sweet pea which has given rise to at least five hundred varieties since 1700.[5] The fact that a great variety of human types exist today is in addition to the above conclusive evidence that changes have occurred from original stocks.

From a Biblical point of view there are two objections to the proposition that God made forms as they exist today, (1) the difficulty of Adam's naming them and (2) the problem of finding space for them in the ark. In saying this we realize that those were God-ordered events perhaps accompanied by some special conditions.

One who observes that such changes have transpired is led to the conclusion that this is evolution. Yes, and some have been thrilled with this information in thinking that they have caught evolution in the very act itself. We hasten to say that it is only evolution to a limited degree, and it has been called microevolution because it refers to small changes as opposed to macroevolution which refers to much greater changes. We may perhaps more properly use the term variation in reference to the small changes; it is in this realm that there is evidence for change. Macroevolution has not been observed and because of its very nature probably never will. Dobzhansky, an ardent evolutionist, has said, "A geneticist can approach macroevolutionary phenomena only by inference from the known microevolutionary ones."[6]

With data on the great diversity of plant and animal forms in hand evolutionists and creationists have carried on considerable discussion about the word "species." In classifying organisms into particular species groups some have split present groups into larger numbers of species and some have lumped present species together and called the members subspecies or varieties. It has been stated that the species is a systematic unit as judged by experts in the field. But often even they do not agree. There is great significance I believe in these extended discussions about species, for it seems to point to a realization, perhaps unconscious in certain cases, that natural groupings are in reality present in nature. There is discussion about the polytypic species concept which recognizes as a species group similar forms living in different areas. Turesson has mentioned "bridgeless gaps" and has considered the idea of variation within Linnean species.[7] Kleinschmidt's *Formenkreis* was a group with characters depending upon the environment. The *Rassenkreis* (racial circle treated already) is a term first used by Rensch (1929) and referred to by Goldschmidt, Mayr, Dobzhansky, and Stebbins. It is important in this consideration. Of this and the general idea of basic kinds Dobzhansky says:

> The book of Mayr (1942) which has been very effective in dissemination of the polytypic species concept in the last decade, contains an excellent account of this reform in modern systematics. Modern systematics has vindicated the intuitive conviction which workers in this field always had, and which was expressed concisely by Bateson (1922): "Though we cannot strictly define species, they yet have properties which varieties have not, and . . . the distinction is not merely a matter of degree.[8]

A member of the American Scientific Affiliation, Dr. Frank L. Marsh, treating this subject from the creationist point of view has coined a term, *baramin* from the Hebrew *bara,* created, and *min,* kind, to represent these original kinds.[9] The *baramin,* the Genesis kind, is the *Formenkreis,* the basic unit which has been modified giving us our present-day forms. In some cases the *baramin* is monotypic as in the case of man, and in others it is polytypic. The dog is an example of the latter where a fox-like variety, a dog-like variety and a hyena-like variety constitute a single polytypic group. The conception is of these three basic forms being the original types created by God. From them have arisen because of small genetic changes the better than seventeen dozen breeds of dogs, the foxes, wolves, coyotes, jackals and hyenas found throughout the world today. There would be other basic types such as the amoeba kind, cat kind, ape kind, squirrel kind, liverwort kind, sunflower kind, etc., all by variation giving rise to modern day fauna and flora. This concept is true to the facts in nature and in accord with the inspired record of Genesis. The production of these heritable changes depends on genetic mechanisms, namely: crossing over, independent assortment, segregation, chromosome aberrations and gene mutations.

Mutations as we know them have produced small changes but not the large changes necessary for one kind to pass into another kind. Mutations apparently are chance happenings, are not integrated, and lack unidirectional action. Dobzhansky says:

> To assume that an organism responds to the demands of its environment by producing only or even mainly those mutations that specifically answer these demands would mean that the organism has a prescience of the future. This is tantamount to the assumption of an intrinsic purposefulness of the living matter. On closer examination the theory of adaptive directness of mutation falls under its own weight.[10]

Polyploidy has been thought by some to be important in evolutionary processes, for in a number of plant varieties we see polyploid series. There is a series among members of the genus *Triticum* to which wheat belongs. *Einkorn* has 14 chromosomes (diploid), *durum* 28 (tetraploid) and common wheat 42 (hexaploid). Species among the genus *Chrysanthemum* have 18, 36, 54, 72, and 90. These polyploid

series are much less common among animals probably because (1) their more complex developmental processes are upset more easily and (2) the balance of sex determiners is disturbed. The phenomenon is most commonly seen among hermaphroditic or parthenogenetic forms. Concerning evolutionary progress and polyploidy Stebbins says, " . . . polyploidy, although it multiplies greatly the number of species and sometimes of genera present on the earth, retards rather than promotes progressive evolution."[11]

It is of interest to note that chromosome number is not to be thought of as an index of evolutionary advancement. Some animals and some plants have less and some have more chromosomes than humans. Then a great host shares along with man the diploid number of forty-eight. Some are nematode worms, a snail, Rhesus monkey, an ungulate, some teleost fish, the eastern gray squirrel, the white-footed deer mouse, tobacco and potato.

The question naturally arises concerning how far we must go to reach the extents of the basic kinds or *baramins*. Morphology (form), physiology (function), and the ability to produce offspring are criteria used by taxonomists. If two organisms are interfertile we may in accord with the Scripture say they belong to the same kind.

All races of men are interfertile, but there is no verified scientific record that man has ever crossed with any other organism such that a hybrid was produced. Some clever college students are said to have manufactured a wierd insect from parts of several varieties and afterward excitedly asked their supposedly doting professor what kind of bug it was. "Rare indeed," was the reply. "It's a humbug." Such are all imaginative forms like mermaids and centaurs which may be thought of as a cross between man and some animal. In fact members of different basic kinds cannot crossbreed. Several years ago a farmer friend of mine in northern Massachusetts told me about a neighbor who had an animal which was a cross between a cat and a rabbit. "Impossible" was the reply, "For these belong to different orders. You are not able to cross a lagomorph and a carnivore." But he was certain and he gave details of how the mating had taken place and how the offspring had characteristics of both parents. As soon as convenient, I visited the farmer to see his unusual specimen. When the man was queried he pointed to the barn where there was a whitish animal which looked like a regular tabby with a bobbed tail. "It's really a cat," he said, "But when it was young it jumped around like a rabbit."

In spite of the fact that many false stories have been foisted upon gullible individuals, we do have evidence that certain different forms can mate and produce viable offspring. The common crossing of the mare or female horse with the jack or male ass to produce a hardy mule is well known. The spermatozoa of the male mules are non-functional; so these animals are sterile. But the female or mare mules can mate with stallions (male horses) or with jacks. She will in both cases function as a horse and from the stallion a horse colt is produced and from union with a jack another mule. The horse and the ass each with its diploid complement of sixty-six chromosomes[12] belong to the same created kind.

At the Central Park Zoo in New York City there lived until the age of nineteen a male tiglon which had a tiger father and a lioness mother. Another example is the cross between the common cow and bison, the cattalo being produced. Each of these crosses has been made between members of the same kind. In the case of the horse and ass and the lion and tiger we have members of the same man-made genuses, and in the case of the cow and bison members of the same family.

Other crosses which have resulted in at least a beginning of development are horse x zebra, chicken x turkey, swan x goose, rat x mouse, ox x bison, dog x wolf, rabbit x hare, red deer x elk, killifish x mackerel, skunk x ferret, wheat x rye, radish x cabbage, wild tobacco x petunia and blackberry x raspberry.[13, 14] Crosses have not occurred between sheep and pig or between sheep and bull and there is no proof that a grapefruit is a cross between a grape and a lemon. In cases where crosses have been reported between echinoderms and mollusca or echinoderms and annelids, the development of the egg likely is due to activation by the sperm which later is put out of the egg. A true hybrid has not been produced.[15]

To return to the question of macroevolution and variation we will consider the fossil record. It is considered to be the footprints or the diary left behind by the evolution process as it did its work over the long periods of time. We note, however, that there are great gaps in the record. Darwin realized this, for in 1872 he wrote:

> Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any finely graded organic chain; and this, perhaps is the most obvious and serious objection which can be urged against the theory. The explanation lies, as I believe, in the extreme imperfection of the geological record.[16]

Austin H. Clark of the United States National Museum in 1930 wrote:

> The facts are that all of the fossils, even the very earliest of them, fall into existing major groups. This is indisputable.[17]

George Gaylord Simpson of the American Museum of Natural History in 1944 wrote:

> The facts are that many species and genera, indeed the majority, do appear suddenly in the record, differing sharply and in many ways from any earlier group, and that this appearance of discontinuity becomes more common the higher the level, until it is virtually universal as regards orders and all higher steps in the taxonomic hierarchy.[18]

These quotations indicate that intergrading forms do not exist. In truth this is negative evidence, but I submit that if you look for something long enough and thoroughly enough and do not find it, the odds favor its not being there. The Swedish geneticist, Dr. Heribert Nilsson, Professor of Botany at the University of Lund in Sweden, stated in 1953:

> My attempt to demonstrate evolution by an experiment carried on for more than 40 years, has completely failed. Anyway, I should hardly be accused of having started from a preconceived anti-evolutionary standpoint.[19]

> It may, therefore, be firmly maintained that it is not even possible to make a caricature of an evolution out of palaeobiological facts. The fossil material is now so complete that it has been possible to construct new classes and the lack of transitional series cannot be explained as due to the scarcity of the material. The deficiencies are real, they will never be filled. . . The idea of an evolution rests on pure belief.[20]

Thus we have confirmation of previous statements that there are bridgeless gaps between large categories of individuals. These discontinuities in some cases may correspond to the gaps between monotypic and polytypic created kinds.

Now in examining the history of evolution and creation in recent centuries we find a number of outstanding men who championed the cause of creationism. Among these are: Linnaeus, two hundred years ago in Sweden, Cuvier, one hundred fifty years ago in France, and Agassiz, one hundred years ago at Harvard in Cambridge, Massachusetts. In spite of their mistakes these men made great contributions to science. Now providing we are correct in the propositions we have set forth, then today we need more capable, enlightened, scientifically-disciplined champions to work in these areas of science and to present creationism to the scientific world.

In summary we may say that evidence in nature indicates that there have been small changes within limits (variation) among organisms; crossbreeding can be done only to a limited extent; and there are unmistakable gaps in the geological record. These facts are consistent with the teaching that God created basic kinds separated from one another by bridgeless gaps, and then these kinds by variation, multiplication and migration brought about conditions observed today.

> For the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made, even His eternal power and Godhead.[21]

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20. *Ibid.*, p. 1212.
21. Romans 1:20.

NEW MEMBERS

William S. McBirnie, 315 E. Mulberry, San Antonio, Texas, is Pastor of Trinity Baptist Church, San Antonio, Texas. He has earned a B.A. degree from Kletzing College, B.D. degree from Bethel Theol. Sem., and M.R.E. and D.R.E. from Southwestern Baptist College.

James G. McKernon, 1430 Dick Drive, Aberdeen, South Dakota, is Assistant Professor of Psychology and Education at Northern State Teachers College, Aberdeen, South Dakota. He earned a B.A. degree at Colorado State College of Education, M.Ed. degree at the University of Colorado, and Ph.D. degree at the University of Denver.

Ronald H. Russel, The Storm King School, Cornwall, - On - Hudson, N. Y. is a graduate student of Brooklyn College. He received the B.S. degree from Kings College and Th.B. degree from the American Divinity College.

Harold M. Spinka, M.D., 10412 So. Whipple St., Chicago 43, Illinois, is a self-employed physician as well as being Clinical Instructor in Dermatology at the University of Ill. College of Med. Dr. Spinka received both his B.S. and M.D. from Chicago Medical School.

John A. Sutherland, Jr., 3431 - 9th West, Seattle 99, Washington, is a Junior Engineer with Boeing Airplane Company, Pilotless Aircraft Division. He received a B.S. degree from the University of Washington and completed a 1 year grad. course at Multnomah School of the Bible.

IN GENERAL

1958 Convention

At the last Executive Council meeting held in Chicago November 23, 1957, it was agreed to hold the next annual convention at Iowa State College, Ames, Iowa, August 26-28, 1958. It was through the kind invitation of Walter Hearn of the Iowa State Chemistry staff that this location was secured.

The following appointments were made for the meeting:

General Chairman ..... Walter Hearn
Program Committee .. Wayne Frair, Chairman
Wayne Ault
J. Frank Cassel
Theodore Tahmisian

Tentatively, the location for the 1959 convention is planned for the Pacific Northwest.

Textbook on Science and the Scriptures

The council considered a suggestion from *P. W. Stoner* that a group of about four qualified people work together to author a textbook on science and Scripture for college students. He noted that there was no satisfactory book of such nature available. This was approved and Mr. Stoner was appointed to be the Editor of the text.

Joint A.S.A.—E.T.S. Meeting

A committee to consider publication of the papers given at the 1957 joint meeting was approved and is composed of *H. Harold Hartzler, Robert M. Page,* and *Paul R. Bauman.*

Washington Section Meeting

"Practical Aspects of Competition for the Scientist" was the title of *Wayne Ault's* paper presented at the October 27, 1957 meeting of the Washington group. Considerations for the Christian in the present day competitive research, business and academic life was discussed.

The following officers were elected for the section:

President ..... Dean Walter
Vice-President ..... Glen Kirkland
Secretary-Treasurer ..... George Fielding
Program Chairman ..... Glen Kirkland
Extension Chairman ..... James Kraakavik
Membership Chairman ..... Samuel Elder

Ten Scientists Look at Life

A tract with the above title was published recently by Good News Publishers with the cooperation of members of the A.S.A. Testimonies by scientists in various fields provide an excellent summary of the reasons for the firm Christian faith held by many scientists.

The price is 15 copies for $1.00 or 100 copies for $5.50. Orders should be sent directly to Good News Publishers, 99th and Roosevelt Road, Westchester, Illinois.

Executive Council

We welcome the newly elected member of the Executive Council, *Walter Hearn*, who is Assistant Professor of Chemistry at Iowa State College. Dr. Hearn replaced *D. N. Eggenberger*, whose term expired at the end of 1957.

It was voted at the last Council meeting to make the Editor of the Journal an ex-officio member of the Council, with non-voting status.

Indiana Section

The Indiana section held a local A.S.A. meeting December 7 at Anderson College, Anderson, Indiana. *William J. Tinkle* was program chairman.

Director of Research at NRL

Robert M. Page, Fellow of the A.S.A., was recently appointed Director of Research at the Naval Research Laboratory. He will direct and coordinate the Laboratory's over-all research program which includes 14 fields of physical science.

Dr. Page is credited with building the first pulse radar system with which he detected aircraft in flight in 1934. He also developed the theory of radar receiver design and has patents, 38 granted and 29 pending, covering all basic elements of radar.

His awards include a Citation from the Office of Scientific Research and Development in 1946; the Presidential Certificate of Merit in 1947; the Navy's Distinguished Civilian Service Award in 1945; the Harry Diamond Award of the I.R.E. in 1953; and, in 1957, the Stuart Ballantine Medal of the Franklin Institute.

Books by A.S.A. Members

A. van der Ziel is the author of a recent book entitled "Solid State Physical Electronics" (Prentice-Hall 1957. 593 pp $9.75). Dr. van der Ziel published a book a few years ago on "Noise" in which he considered the physical and mathematical aspects of the subject.

R. Laird Harris received the Zondervan $2500 prize for his textbook "Inspiration and Canonicity of the Bible" (Zondervan 1957. 256 pp $4.50). A review by Wilbur M. Smith appeared in his column "In the Study" in Moody Monthly for February 1958, page 37.

Arthur Custance is publishing a series of booklets called "Doorway Papers". The following have been received by the A.S.A. library: Bibliosymposium on Genesis (40pp), The Problem of Evil: Some Little Considered Physical Aspects (56 pp), The Influence of Environmental Pressures on the Human Skull, Between the Lines: An Analysis of Genesis 1:1-2 (42 pp), and Why Noah Cursed Canaan Instead of Ham (10 pp).

Los Angeles Section

The Los Angeles Section has elected the following officers:

Chairman—Edgar C. Smith

Secretary-Treasurer—Lewis H. Humphrey

See in this issue of the Journal a summary of two years of activity in this section, compiled by *Earl C. Rex.*

A.S.A.-E.T.S. Joint Committee

President Hartzler has appointed three A.S.A. members to be part of the joint planning committee to prepare for our joint biannual meetings. These are *Henry Weaver Jr., James O. Buswell III* and *John W. Klotz.* The E.T.S. has appointed *Merrill C. Tenney, J. Barton Payne,* and *John C. Whitmore Jr.,* as its representatives on this committee. Drs. Weaver and Tenney will be co-chairmen of the group.

Local Sections Secretary

F. Alton Everest has been appointed by the President to act as coordinator to promote the activities of local sections and assist in forming new ones. He also furnishes news of the sections and their people for the Journal.

The 2-Year Period from 1955-1957 Of the Los Angeles Chapter of the American Scientific Affiliation

Earl C. Rex

In the Los Angeles Chapter of the American Scientific Affiliation, the first fall meeting is customarily a planning one attended by members and a few, or no guests. The officers (President and Secretary-Treasurer) are elected, committees appointed, and topics tentatively chosen. In the fall of 1955, Earl Rex was elected President and Clayton Rasmussen was elected Secretary-Treasurer.

Then on December 5, 1955 a meeting was held in the Fuller Theological Seminary, Pasadena, California, to which the public was welcome. At this meeting, Dr. Bernard Ramm's book "The Christian View of Science and Scripture" was discussed. Dr. Donald Robertson took the Biology section. Dr. Wilian La Sor related the exegetical implications, and Dr. Dilworth discussed the reviews of the book. The attendance was estimated at 300.

The next meeting, also at Fuller, was held on February 15, 1956. Mr. F. Alton Everest gave an illustrated lecture on Radio Astronomy using moving picture films and slides. Following him, Dr. Carl F. H. Henry discussed the cleavage between Christianity and science. Visitors again were welcome. The attendance was estimated at 50.

On April 9, 1956, a meeting open to the public was held at Pepperdine College. Dr. Donald Robertson considered the evidence for the origin of new genes. Mr. John Sinclair followed with a discussion of the nature of genes, the unit of heredity. Attendance was about 75.

At the October 19, 1956 meeting, Mr. Clayton Rasmussen was elected President and Mr. Earl Rex was elected Secretary-Treasurer.

The next meeting was on January 18, 1957. Dr. Kenneth Pike gave a general outline of Linguistics and told of the contribution of Christians, notably Wycliffe Translators, to this subject. The attendance was about 25.

On March 22, 1957, a meeting was held at George Pepperdine College. Subject for discussion was the earth satellite. Mr. Clayton Rasmussen and Mr. Lewis Humphrey led in the discussion. The attendance was about 25.

The last meeting of the two-year period was a joint meeting with the Santa Barbara Chapter at Westmont College. It was held on the afternoon of May 4. A panel composed of Dr. Raymond Brand, Mr. John Sinclair, Dr. T. Fetler and Dr. Robert Dilworth led in the discussion of the scientific method. The moderator was Professor Peter W. Stoner. A second panel composed of Dr. John Abernethy, Dr. John McLennen, Dr. Edgar C. Smith, and Mr. George H. Blount was also heard. The moderator was Mr. F. Alton Everest. The attendance was about 25.

On October 28, 1957, a meeting was held at the home of Mr. Earl Rex, at which Dr. Edgar Smith was elected President and Mr. Lewis Humphrey was elected Secretary-Treasurer. At that time, plans were made for the year 1957-1958.

Concerning An Isthmus

William J. Tinkle

Anderson College, Anderson, Indiana

It was some time in my sophomore year in college that I was first taught that no truth can contradict another truth. If there is a real conflict, one idea or the other is not true. Or perhaps the ideas are not well understood and do not contradict each other after all; for no idea that is true can be at variance with another true idea, even though they seem to be in diverse realms.

I recall quite well the deep impression made upon my mind by this principle and the stimulus it gave to investigation. No truth that I might discover in science, philosophy, or any other realm could rob me of the cherished verities which my soul already possessed.

But to remove the specific barriers between the diverse groups of thinkers and find the narrow straits which connect the different oceans of thought has taken much time. A small, narrow, and otherwise unimportant body of land may hold two mighty oceans apart. Recall how the Isthmus of Suez separated the

Mediterranean Sea from the Indian Ocean for many centuries. Because of this barrier, see the caravans toiling slowly along with their burdens of silks and spices from India. See the Portuguese as they fearfully but daringly explore the western coast of Africa seeking a waterway to India. See the Genoese mad man, as he was called, setting out boldly with his three ships across the Atlantic to find a new route to that same country.

Later, see Ferdinand de Lesseps as he dips out the sand to remove that barrier, and so connect the Indian Ocean and the Mediterranean Sea by means of the Suez canal. Stimulated by this example, George Goethals cleaved a mountain range and united two larger oceans.

In the realm of learning there are areas which seem small, but like an isthmus, are important far beyond their size. In such places the American Scientific Affiliation works. The barriers which divide the devotees of revelation and of investigation are largely assumptions and denials and they can be scooped away. For this work the A. S. A. was organized, rather than to extend the borders of science, which is being done by other groups. If we wish to conduct research *as individuals* there is no objection but there is no reason to form a new organization for such work.

Furthermore we already have enough men and women to accomplish our task if we will work at it. While a membership of 700 seems small as compared with some organizations, the ratio is greater than that of the Suez Canal to the Mediterranean Sea.

BOOK REVIEW

A New Answer to Darwinism, by James L. Baldwin. Published by Mary E. Baldwin, Manhattan Building, Chicago 5, Illinois. $1.00.

James L. Baldwin's "A New Answer to Darwinism" says that God created a basic cell for each species and let each cell evolve into the present adult type by a predestined growth. This he calls "creo-evolution" which is similar to Augustine's "the seeds of future things, to be brought forth out of their concealment visibly in convenient places through the extent of the ages."

Such a theory is a combination of evolution and creation, but it is creation of small beginnings and evolution for each species of a magnitude similar to a human body's development from a fertilized egg. The embryological facts are used to support the theory, but I think the author fails to incorporate in his thinking the many facts learned from the comparison of different species and the geographic distribution of them which indicate the derivation of some species from others. So nothing is gained in the evaluation of the many kinds of evidence which point to transformation of species.

I checked the author's chapter on "The Electrical Mechanism of Growth" with an anatomist who recently received his Ph.D from a large state university. He knew nothing of the material which Baldwin gives in his pamphlet. Either Baldwin has some bioelectric knowledge which is way beyond the kind filtering into our textbooks, or he is devising or following some ingenious theory which orthodox scientists do not commonly teach or have discarded. References to sources would be helpful to check on debatable points.

The book is written with careful use of words on a high level, and has not suffered in appearance from private printing. R. L. Mixter

November 27, 1957

OF INTEREST

"The Religious Motivation of Christopher Columbus" D. W. Baker. *Eternity* 8, 18 (October 1957). Columbus' desire to convert the natives he found in the New World was one of his primary objectives. Interesting features of his belief and life are gathered in this article.

"Bringing Old Testament Times To Life" G. E. Wright, *National Geographic Magazine* 112, 833-864 (December 1957). This well-known archeologist brings together a number of observations to clarify some Old Testament statements. It is accompanied by a series of excellent paintings by H. J. Soulen, each depicting his conception of a passage from the Old Testament.

"Guiding the Educated to Faith" H. J. Ockenga. *Christian Life* 19, 16-18 (December 1957). A question and answer session in which the well-known minister of Park Street Church expresses some practical pointers in soul winning among the educated.

"Proximity or Neighborliness" W. A. Smalley, *Eternity* 8, 11 (October 1957). This is an enlightening discussion of the social contacts of missionaries with the natives to whom they minister.

"The RSCF Annual Conference" *The Christian Graduate* 10, 192-3 (December 1957). A summary of the five papers presented at the conference of the Research Scientists' Christian Fellowship is here recorded. The Conference had as its subject "When and in what sense does the Bible speak scientifically?" One suggestion was that Genesis 1 to 3 could be explained in terms of a model.

"The Sumerians" S. N. Kramer, *Scientific American* 197, 70-83 (October 1957). Some enlightening comments are presented on this somewhat obscure people. They lived in the Tigris-Euphrates area from about 3000 to 1700 B.C. when they were lost to history.

ARCHAEOLOGY

The Sons of Ham

Allan A. MacRae, Ph.D., President and Professor of Old Testament Faith Theological Seminary, Elkins Park, Philadelphia, Pa.

In considering the relation of archæology (or any other science) to the Bible, it is extremely vital that we make sure what the Bible actually says. Sometimes men have spent a great deal of time trying to prove that some scientific theory or statement agreed or disagreed with the Bible, without first making an accurate determination of the real meaning of the relevant Biblical passages..

It is vital to recognize the fact that there are many matters with which the Bible does not deal. For example, it tells in detail of the relations of Ahab with the prophets and with the religion of Israel, but does not fully present those important political and international actions of his, which we learn from archaeology to have been of great significance. It is not the purpose of the Bible to give us a full presentation of any science, or even of history, but to present those facts which are vital to our understanding of the relation of God to the universe. Since God is the real author of the Bible, we can be sure that no statement or reasonable inference will be contrary to the actual facts of the material universe that He created. It is very easy to misinterpret the Bible and to read our scientific ideas or theories into it. Consideration of any phase of the relation of science with the Bible should always be based upon a very careful study of the actual teaching of the Bible in the original.

Yet it is strange how frequently we find interpretations advanced which can easily be shown to be utterly false, simply on the basis of the English Bible.

One of the most glaring instances of this is the widespread idea that the Bible teaches that the world was created in 4004 B.C. Actually the Bible does not give us data for an exact chronology, and when we get further back there are long periods regarding which we have no data at all. There is absolutely no way, as far as the Bible data are concerned, to tell whether man was created at 4000 B.C. or at 400,000 B.C. As far as creation of the material universe is concerned, the suggestion that it may have occurred billions of years prior to the creation of man is not contradicted by anything in the Scripture.

A most interesting chapter in the Book of Genesis is Genesis 10 with its table of the nations, showing the descent of various peoples from the three sons of Noah. It has often been assumed that this list is complete. Nothing could be further from the fact. The list here is not intended to give us an understanding of the background of all the people of the earth, but only to show the development of those nations which came into important contact with the history of Israel in ancient times.

Thus there is nothing in the chapter to give the slightest indication as to which of the three sons was the ancestor of the English, the Scotch, the Germans, or the French. As far as Biblical evidence is concerned, they may equally well have been descended from Shem, from Ham, or from Japheth.

It is often assumed that Ham is the ancestor of the Negroes, but there is not a word in the chapter to suggest that this is the case. The Negroes are as completely unmentioned in the chapter as are the English and the Scotch.

The only descendants of Ham who are mentioned in the chapter are the Ethiopians, the Egyptians, the Libyans, and the Canaanites. Some of these have rather dusky skins but all are recognized as belonging to the white or Caucasian race. The descendants of Cush are stated to include the founders of the great Assyrian Empire. The Assyrians are far more different from the Negroes than they are from the English.

During the years immediately after the flood it stands to reason that the children of the three sons of Noah intermarried extensively. Probably the blood of all three sons runs in all the people of the earth. The table of nations simply gives a descent along the male line to the leaders of various nations, thus showing the general political arrangement in Old Testament times. In fact there is strong reason to suspect that in some cases the genealogical table here indicates political relationship rather than heredity at all.

It is strange how widespread is the idea that Genesis 9:24-27 expresses a curse upon the Negroes, condemning them to slavery. There is no mention of the Negroes in either of these two chapters, any more than there is of the Chinese, the Russians, the English, or the Americans. The curse that came from the lips of Noah was a curse upon Canaan. Canaan was one of the four sons of Ham. There is no curse stated against Ham whatever. The Canaanites were white people of the land of Palestine, who were conquered by the Israelites. By that time they had degenerated morally to such an extent that it was God's command that they be completely wiped off from the face of the earth. This command was only partially obeyed, and those who were left were reduced to "hewers of wood and drawers of water." Thus the curse from the lips of Noah is fulfilled in the Canaanites and has nothing whatever to do with other descendants of Ham, nor is there the slightest evidence that the Negroes are descendants of Ham. They might equally well be descendants of either Japheth or Shem.

Great changes have occurred in the physical constitution of mankind since the days of Noah. The Chinese, the Japanese, the American Indians, the Negroes, and other groups illustrate the great variety of

appearance that has arisen. What the appearance of Noah was, nobody knows. It may be easier scientifically, to think of a background of the yellow race being altered in natural development into both the white and the black, than to think of the yellow as having come from either of these. There is no evidence to tell in what direction the development went. All that we can say from a Biblical viewpoint is that all the human beings upon the earth are descendants of Noah. We have no way of telling from which son any of us came, except those who are specifically mentioned in this table - and this includes only those in the general region in which the Israelites lived in the Old Testament times. The others are simply not discussed in this chapter.

It would be of no value to note the nature of Noah's curse on Canaan (Genesis 9:24-27). Noah did not bring a calamity upon some of his descendants. There was no way in which he would have power to do this. He simply was allowed to make a prediction about something that, in God's providence, was going to occur. His prediction referred to the Israelite conquest of the Canaanites many centuries later.

It is interesting to compare Genesis 49:7, where Jacob speaks of the bloody deed that had been done by two of his sons, Simeon and Levi, and predicts that they would be scattered abroad among the tribes of Israel. This was literally fulfilled in the case of Simeon, which tribe disintegrated and the people were scattered among the other tribes. In the case of Levi the prophesy was fulfilled in an entirely different way. The Levites went as God's representatives through all the tribes, scattered through the land of Israel, but living there under God's blessing as God's representatives as a reward for their loyalty to God during the wilderness journey (Exodus 32:26-29). Thus no one can say that he is under a curse and therefore can look forward to nothing but misery. If one sincerely looks to God for help, God can turn any curse into a blessing.

It is unfortunate that such completely unbiblical ideas should have become widely disseminated in this country as that Noah's statement about Canaan meant that the Negroes were doomed to servitude. It is particularly difficult to understand why such statements should be used as evidence against allowing Negro children to participate in the benefits of the same schools as are available to white children. If the curse upon Canaan referred to the Negroes (which it could not possibly do), it would mean that perpetual slavery should be their fate and this I suppose that no one in the United States is advocating. It certainly would have nothing to do, in any event, with the matter of where they took their schooling.

If we examine the Scripture carefully to see exactly what it says, we find that the facts of archaeology, or of any other science, fit together with it perfectly. If we jump to conclusions about the meaning of the Scripture we will naturally find that many discoveries of science will contradict our ideas. On the other hand it is also very easy to jump to conclusions about the teaching of science and this is done by every generation. People constantly try to twist the Bible to fit the scientific theories of their day on points on which the Bible does not speak. Then, if the next generation finds that the scientific ideas of the previous generation on this particular point were false, they think that the Bible has been proven wrong. We should carefully avoid reading into the Bible ideas that it does not contain.

BIOLOGY

I. W. Knobloch, Ph.D.

Life, Man and Time by Frank Lewis Marsh. Pacific Press Pub. Co., Mountain View, California, 1957. This book of 200 pages was written by a member of the American Scientific Affiliation. Dr. Marsh had quite a bit of experience in upholding Biblical teachings against false accusations. I will first mention some points where opinions may differ, with the critic still having considerable hope of eternal life. Later I will bring out some more favorable aspects of the book, of which there are many.

On page 19 Dr. Marsh speaks of Darwin suggesting the evolution of basic types. The author knows but does not make it clear in this sentence that Darwin did not discover evolution but only a method (and not original with him either). On page 26 Marsh interpolates the word "alga" in the creation story. Actually the Bible mentions only a few things by name and it had better be left there. On page 48 the author assumes that terrific volcanic activity took place in the closing months of the flood and thereafter. Many believe that most of this took place long before the flood. The difficulty here is that Marsh believes in a "6000 yr." old planet and to obtain all the sedimentary rock in the world, one would have to hurry things along. I believe the matter of the age of the earth has been dealt with completely by others before me and so I will not argue the point here. On page 90 Marsh has non-fossiliferous strata forming in a day or two, another illustration of the point above. On page 57 the number of chromosomes in man is given as 48, as it is in many books. Lately, by using smear rather than paraffin section methods, the number has been found to be 46. Another of Dr. Marsh's points is that the Noachian Flood was a universal one. Certainly not all the earth was peopled at that time and hence one might argue that there would be no need for a universal flood unless one takes the

position that the lower animals and all plants can sin. On page 131 one finds the reason for the injunction against the use of pigs for food namely its feeding on garbage. I believe also that the pig was forbidden because it carries parasites injurious to human beings and the people of that age would not understand the reason for thorough cooking. On page 164 it is said that the creationists hold that the fossil-bearing strata were largely laid down during the flood. Some believe this and some don't.

Most of the above are rather minor points. I do not believe that the acceptance or rejection of any of the points made in Dr. Marsh's book make one iota of difference as far as Salvation is concerned. His book is not primarily concerned with Jesus Christ and His Atonement but is slanted at harmonizing science and religion. In this regard, he does rather well although he does not attempt to exhaust the subject. I might close with a personal feeling on the subject of harmonizing. A prominent member of the Lutheran Church (Missouri Synod) admits that there are copyist errors (at least one) in the King James Version and the new revised editions have changed things about wholesale. In view of but these two instances, it seems surprising that we are able to harmonize as much as we do.

Methods of Evolutionary Biology and Anthropology—Part I, Biology by Theodosius Dobzhansky. *Amer. Scientist* 45:381-392,1957.

This paper was read at a science and philosophy conference in New York City in 1956. It takes up the performist doctrine and shows that although fallacious it found an outlet in the orthogenesis concept of evolution. Next epigenesis is discussed as a more acceptable approach. The role of the environment in evolution, mutation, sex and hybridization, preadaptation and other aspects of the evolutionary process are mentioned and briefly discussed. The article is well written and lucid. The generally accepted approach to evolution is laid before the reader in non-technical terms.

Dobzhansky is in the "top ten" of leaders of current thought on evolution and one so much less experienced in these matters, such as myself, is presuming a great deal to criticize the author. Dobzhansky is, however very sure of himself and hence makes some rather sweeping statements which are subject to clarification and interpretation.

Not only are some of his statements sweeping but they are also dogmatic and it is held here that dogmatism is not one of the scientific attitudes. He says that man with his 10^{13} cells has arrived where he is by gradual evolution from virus-like organisms to protozoans, to worms, to fishes, the reptiles and finally to man. This is the way it all happened. One found similar statements in the *Life* Magazine series on man some time ago where we learned that man did not *probably* arise from reptiles but he *did* so arise. The poor stupid layman then thinks that this is all good, hard scientific fact whereas the idea of man's evolution is still in the deductive theoretical stage. Dobzhansky says that "*every* response of the organism to its environment is determined by the genes". Does he mean that putting on one's earmuffs against the cold is gene-determined? Certainly we need clarification here. Natural selection comes in for the usual praise much of which I would say is teleological. One statement along this line may be sufficient. He says "Man is the product of a long evolutionary history *guided* by natural selection". I am sure that the author realizes that the environment or natural selection only can act on what variation is presented to it. There is some confusion on the production of variability. On page 385 he says that "these variants arise by mutation" but on page 386 he speaks of the incredible amount of variability which can arise by hybridization. It is my opinion that a mutation cannot be said to exist unless one knows intimately the geneotype of the experimental organism and this is not known even for *Drosophilia*. We must also bear in mind what the author says about genes "the development of an organism is brought about by all the genes which it has acting in concert." Note the word "all" and the factual nature of the statement. I must have missed this piece of research. There is a tendency among many modern evolutionists to ascribe every anomaly to a mutation such as the development of resistance to antibiotics. Surely there is great heterozygosity in all organisms not homozygous and resistance can be as well residual in a population as can be the production of mutations. The genes of an organism have a "range of expression", let us say. Would we not be violating Occam's Razor if we said that a maple leaf growing in the shade and producing two rows of palisade cells has a different genotype than a leaf from the same tree growing in the sun and producing only one row?

Finally he says we are unreasonable in expecting to see evolution when so much time is needed. If he is right, we should find all sorts of intermediate forms in the rock and strata of the earth, our measure of time.

CHEMISTRY

Walter R. Hearn, Ph.D.

Important Notice: If you plan to attend the A.C.S. meeting in San Francisco and would like to meet other A.S.A. members there, notify *Dr. Richard L. Ferm*, 7421 Park Vista, El Cerrito, California, as soon as possible. Dr. Ferm has graciously agreed to make arrangements for a lunch or dinner meeting, and it will make things much easier for him if he

knows how many to plan for. I know from correspondence that many of you plan to attend and I know you would enjoy getting together. Harold Hartzler reported that seventeen A.S.A. members held a fine dinner meeting during the A.A.A.S. meeting in Indianapolis in December. If you have any suggestions or preferences for the type of get-together, let Dr. Ferm know when you drop him your letter or postcard. And don't forget to thank him for setting it up!

Notice to Biochemists, Physiologists, Nutritionists, and Others: Those of you who plan to attend the Federation meetings in Philadelphia in April be sure to drop *me* a postcard or letter: *Dr. Walter R. Hearn,* Department of Chemistry, Iowa State College, Ames, Iowa. I'm sure there are at least a dozen of us who will be in Philadelphia for those meetings and I think we should try to get together. If enough of you let me know soon enough, I will try to have one of our members there make arrangements for a breakfast, lunch, or dinner meeting, and notify you of the plans in advance.

This column is being written for the March issue before the December issue has been out long enough for you chemists to let me know what you think of having our own column, but many of you have been replying to my letter of inquiry. In fact, so many have replied already that I can fill up this column and have enough left over for the next issue! Thank you for taking time out of your busy lives to introduce yourselves — and it is certainly clear that all of you are busy, both in professional activities and in Christian service. Those of you who haven't answered my letter yet need not apologize for putting it off, since this is only a *quarterly* journal, but do send me some information about yourself and your work when you can find the time. And to those of you who have already checked in, remember to keep me up to date on your activities and accomplishments. If you are a chemist and did not receive my letter asking for information, forgive me for overlooking you, and write to me anyway.

In addition to the information you send me, I have the usual biographical sources such as American Men of Science, and also author indexes of Chemical Abstracts. It is a bit hard to track down the publications of so many, so I appreciate your sending me your bibliographies, if that is convenient for you. I hope I get everything straight, but of course I'll be glad to correct any mistakes I may make if you will point them out to me. The order is not alphabetical or geographical but chronological — the same order in which I received information from each of you.

Now, let's get acquainted:

Donald R. Carr sent me an interesting brochure on the activities of his company: Isotopes Incorporated, 123 Woodland Ave., Westwood, New Jersey. Don is a Vice President and Director of this rather young organization, and I gather works chiefly on probems of instrumentation for radio-istotope research projects sponsored by industry and government agencies. A subsidiary company at the same address, Crystals Incorporated, produces scintillation detectors and crystals for the optical and electronic fields. Don did his Ph.D. work in the field of geochemistry at Columbia with *J. Lawrence Kulp*. They have published four papers together, on the geology of the ocean floor, radiocarbon dating, and other isotope studies. Larry Kulp, incidentally, is also a Director of Isotopes Incorporated. Both have attended several A.S.A. Conventions. Don was on the program of the 1957 Convention.

Roy M. Adams is Acting Head of the Chemistry Department of Geneva College, Beaver Falls, Pennsylvania, teaching courses in general, organic, and advanced inorganic chemistry. Roy's field is boron chemistry, and he also serves as a consultant with Callery Chemical Company of Pittsburg, a firm you have probably been reading about in C. & E. N. Callery has recently announced production of "HiCal," a solid, boron-based "zip" fuel for rocket propulsion and other uses. Roy took a year's leave of absence from Geneva in 1952-53 to serve as Head of the Chemistry Department at Callery while their high-energy fuel program was being set up. He has a paper coming out on organoboron compounds as part of the Advances in Chemistry series, and plans to give a paper on the preparation of diborane in San Francisco. There is no graduate program at Geneva College, a small Presbyterian school, but Roy has two seniors doing undergraduate research on the chemistry of boron compounds and hopes to get some publishable work from this undergraduate research. Roy serves as an elder and Sunday School teacher, and has been a member of the A.S.A. for about three years; he hasn't been able to attend an Annual Convention yet but intends to make it to Ames in 1958. He writes that he would like to see the word "Christian" in the title of our Affiliation, and that he hopes the doctrinal statement in the constitution will not be "liberalized."

Alf W. Swensen is one of our senior chemists. He is Head of the Chemistry Department of Wartburg College, a small Lutheran school at Waverly, Iowa. Dr. Swensen has been associated with Wartburg since 1921, with two leaves of absence to obtain his M.S. and Ph.D. degrees at the State University of Iowa; for one year he was acting head of the analytical division at S.U.I. His Ph.D. work was on the polarographic reduction of praseodymium (JACS, 1949), but he has also done extensive work on the correlation of degree of intoxication and the quantitative determin-

ation of ethyl alcohol in various body fluids; in fact, he was a charter member of the National Safety Council Committee on Tests on Intoxication. He manages to attend the state scientific meetings, the national A.C.S. meetings and the *MACTLAC* (I guess *MACTLAC* stands for "Mid-west Association of Chemistry Teachers in Liberal Arts Colleges," but it sounds more like one of those high-powered analog computers!) All this activity has not kept Dr. Swensen from serving as a Sunday School superintendent for the past twenty-five years! Naturally, he plans to attend the 1958 A.S.A Convention in nearby Ames next August.

Howard W. Post, Professor of Chemistry at the University of Buffalo, is another one of our senior members, and a very distinguished one. Dr. Post has published at least fifty papers in the field of organic chemistry over the past thirty years, and is the author of two well-known reference works published by Reinhold: "The Chemistry of Aliphatic Orthoesters" (1943), and "Silicones and Other Organic Silicon Compounds" (1949). He has also just written the section on silicone resins in Reinhold's "Encyclopedia of Chemistry." Dr. Post teaches a sophomore organic course and alternates with two other professors in senior and graduate courses; he has an active research group of four M.A. candidates and four Ph.D. candidates. Besides serving as faculty advisor for the campus chapter of Inter-Varsity Christian Fellowship ever since it was founded in 1947, Dr. Post has served the Genessee Conference of the Methodist Church in several capacities. He has not yet had the opportunity of attending an A.S.A. Convention but hopes to be able to do so; however, the A.S.A. members of the Buffalo area plan to hold three local meetings a year, and were to hold one this January, I understand.

Thomas D. Parks is now working on Exploratory Development for Proctor and Gamble Company, Miami Valley Laboratories, P. O. Box 175, Cincinnati 31, Ohio. He was formerly Vice President for Research of Chlorox Chemical Company, which was recently purchased by P. & G. Tom has published more than two dozen papers in the analytical field, most of them dealing with instrumental methods of analysis. He is active in the local assembly of Plymouth Brethren and does a considerable amount of Bible teaching, speaking to Christian Business Men's meetings, and preaching. He is particularly interested in "inorganic teleology." Although he has been a member of A.S.A. since 1944, he has not yet been able to attend one of our Annual Conventions; however, now that he is located in the Midwest, he expects to make it to Ames for the 1958 Convention.

Henry Weaver, Jr., is now Associate Professor of Chemistry at Goshen College, Goshen, Indiana. He teaches general, analytical, and physical chemistry, plus calculus; and is working on the kinetics of formation of certain complex ions, following them by conductance changes. He has recently finished up his Ph.D. work on the reaction of Cd in HCl and expects these studies to be published soon in the Journal of Corrosion. Hank is a Mennonite and for the past two years has served as Secretary of Broadcasting for that denomination, being responsible for broadcasting the Mennonite Hour in more than half a dozen languages (including Japanese and Navajo!). He writes that he would like to see the purpose of the A.S.A. more clearly defined so we could build a really solid organization rather than dilly-dally with too many purposes. He has attended several A.S.A Conventions and has given us some fine papers on the philosophy of science, such as "A Physical Scientist Defines the Scientific Method," *JASA,* September, 1955. "The purpose of fellowship of Christian scientists has been the largest drawing card for me so far, and I am inclined to think we might better tacitly admit this is the purpose and enjoy it as such!" I'm inclined to agree with you, Hank.

Keith Cressman is a biochemist at the Central Research Laboratory of International Mineral & Chemical Corporation, 5401 Harrison Street, Skokie, Illinois. Keith is working in the field of plant nutrition, studying materials that can be used in fertilizers to supply the so-called trace elements or micro-nutrients. He has an M.A. in biochemistry from Purdue, but is considering the possibility of doing further work in soil science, with minors in biochemistry and plant physiology. Incidentally, his wife, *Kay Cressman,* is a medical technologist and also a member of A.S.A. They attended the 1956 A.S.A. Convention at Wheaton, and hope to make it to Ames in 1958.

John DeVries is Chairman of the Department of Chemistry of Calvin College, Grand Rapids 6, Michigan. He is a physical chemist with special interest in the field of molecular structure, but teaches organic and a course in physical science for liberal arts students. Our members will be interested to know he has just completed writing a text for such a course, stressing the Christian implications in the physical sciences. The text is being published by Eerdmans and should be ready for circulation by now. Some of you may be familiar with another book by Dr. DeVries, "Beyond the Atom," also published by Eerdmans in 1948. (I found out about it through the author index of Chemical Abstracts.) There are five men on the chemistry staff at Calvin, a school of the Christian Reformed denomination. They have an active undergraduate research program, supported by grants from DuPont, Standard Oil, and the Johnson Foundation. Six qualified senior

students are taking part in the program this year, reporting once a month in a seminar meeting with the entire staff. Dr. DeVries has been interested in the A.S.A. since its earliest beginnings, and recalls attending a meeting in Chicago some seventeen or eighteen years ago to discuss the formation of such a group. Unfortunately, our Annual Conventions usually come at an inconvenient time of the year for him, and he has been able to attend only one of them. He writes that he usually attends the fall A.C.S. meetings and thinks it will be wonderful idea to have an evening dinner meeting of A.S.A. members, followed by an evening of fellowship. Anyone else for Chicago in September?

William J. Schepp is President of the Schepp Laboratories, 21-23 Summit Avenue, East Paterson, New Jersey, the research division of Wm. J. Schepp Co., Inc., manufacturing chemists. Another one of our senior chemists, Bill Schepp has apparently had a long career of practical investigations in the field of colloid chemistry. Wm. J. Schepp Co., Inc., produces chemical specialties such as colloidal graphite, colloidal sulfur, powdered pigments, etc.; the Schepp Laboratories is a consulting service specializing in this field and doing research for industry on a contract or project basis. Having studied Hebrew and Greek, Schepp makes a hobby of applying his scientific knowledge to Biblical passages which are difficult to understand or interpret otherwise. He sent me some interesting clippings describing some of these interpretations. You may remember his article, "The Speckled and Spotted Goats Shall Be My Wages," *JASA,* June, 1951. He has contributed a number of other papers to A.S.A. Conventions, and has often spoken on his analyses of Bible passages before church groups and Christian Business Men's luncheon meetings.

Robert G. Zeigler has been at Lincoln Memorial University, Harrogate, Tennessee, since September. He is Assistant Professor of Chemistry in that small school of about 500 students. Bob has an M.S. degree from Oregon State College and is currently teaching analytical and organic. He was formerly a research chemist with the Nitrogen Division of Allied Chemical and Dye Corporation, and was co-author of a paper presented at the September A.C.S. meeting entitled "Apparent Loss of Organic Nitrogen in Fertilizers Containing Urea and Natural Organics." He is teaching a young men's Sunday School class and is active in the Brotherhood organization of the First Baptist Church in Harrogate. He writes that recently he came in contact with *Roger Rusk,* professor of physics at the University of Tennessee, who spoke at L.M.U. during a symposium for science teachers. He had met Roger previously at the 1954 A.S.A. Convention at Harrisonburg, Virginia.

Don't forget to let Richard Ferm know if you plan to attend the coming A.C.S. meeting, or let me know if you plan to attend the Federation meetings. And do put the A.S.A. Convention in your plans for August. We really are trying to make it something the whole family will enjoy, so you can make it a part of your family vacation. The A.S.A. will grow in significance only if more of our members attend the Annual Conventions and catch a vision of the importance of what God has for us to do together. The public hysteria over Sputnik emphasizes the opportunity we have to speak to both the scientific community and the Christian community. In fact, we are, in a sense, the only ones who *can* speak to both groups, which gives us a tremendous responsibility to "speak the truth in love." All of us realize our obligation to testify of our faith in Jesus Christ to our scientific colleagues; but do you also realize how great a need there is for us to speak to our Christian brethren who have little knowledge or appreciation of science? I clipped this letter in its entirety from the Open Forum column of the Des Moines Register at the height of the Sputnik scare:

"Science is a tool of the devil. It is time our preachers should preach more out of Revelations, the last book in the Bible, which tells us the signs of the times and the last days. Nature is wonderful but science wants to destroy it."

The American Scientific Affiliation has a big job to do.

PHILOSOPHY

Robert D. Knudsen, S.T.M.

Karl Jaspers on the Meaning of Science

Many thinkers are concerned with the variety in modern science. Its fields and methods have become so various and the mass of collected data has become so unmanageable that the unification of science has appeared to many to be an outstanding problem of our time.

There have been various attempts to answer this challenge. We can think of the *Encyclopedia of Unified Science.* A more general concern has been behind the publication of the *Syntoptican* and the great books movements. It is hoped that even a contact with a variety of works of genius may provide some moral anchor. In education the need for a unifying principle is also felt. There is increasing emphasis on general education programs.

Karl Jaspers, professor of philosophy at Basel, Switzerland, is also concerned with the fragmentariness of knowledge, in particular science. Unlike the composers of an encyclopedia of unified science, however, he does not believe that it is possible to find a

unifying principle that would give a definite direction and meaning to science. Taken in itself, he says, science can not give us the clue to its own meaning. It can offer us particular facts and explanations; but it is unable to give us a total view of things. It is limited to the observation of particular objects, with particular methods, and from particular standpoints. If science is expected to reach beyond this limitation and to develop a view of what the world and our life in the world is about, it becomes lost in a maze of possible combinations. It is not possible to know either the ultimate origin or the ultimate goal of things, in terms of which the meaning of life - - and thus of science! - - could be obtained. In the attempt to *know* we can never find rock bottom, an ultimate ground on which to stand. Every attempt in this direction must ultimately shipwreck on the multiplicity, even infinity, of aspects and viewpoints. Any claim to the contrary is a veiling of the true state of affairs. It also means a violent elevation of a particular standpoint into an all-embracing faith. This means the destruction of the genius of science itself. Concerning a knowledge of the meaning of life as such or science as such we must say *ignoramus* and *ignorabimus*. It is not even possible to say as an item of knowledge that science is or should be to the glory of God. While it gives us compelling insights, which are generally valid, as to its goals, methods, and results science remains piecemeal, without any ultimate origin and orientation. In fact, if one tries to establish *the* meaning of science, he must conclude that it is *meaningless*.

It is Jaspers' view, however, that behind the criticism that leads to this nihilistic view concerning the meaning of science there is a positive impulse.

The negative criticism which denies the possibility of knowing *the* meaning of science - - which is a radicalization of Kant's anti-metaphysical views - - is the means of giving science its freedom from being bound to "finite" ends. Jaspers would find such a binding in Instrumentalism (Dewey), where the meaning of science is as an instrument in the adjustment of the biological organism to its environment.

As our thought again and again pushes to its own boundaries, Jaspers says, there comes to view the fact that the impulse to knowledge cannot arise simply out of finite impulses or goals. There is a deeper impulse, which Jaspers calls "possible existence *Amogliche Existenzo*.

(To be continued)

SOCIOLOGY

Russell Heddendorf, M.A.

Over a decade ago, the National Research Council presented a criticism of social science which stated, in essence, that man and his behavior are not a part of nature that can be studied as basic, "pure," natural science. In addition, social science is a nondescript category consisting mainly of reformist and propagandist ideologies and issues. This has been the case too often in the social science field, particularly in the area of what might be called "Biblical Sociology."

The concept of using the Bible as legitimate data for "social investigation" was largely advanced by advocates of the Social Gospel. The writings of Rauschenbusch, McCown, and Ellwood, in particular, are filled with uses of scripture to substantiate their views. This material, however, received none of the analyses which would be acceptable in the field of sociology today. Such attempts at sociological use of the Bible are simply *post factum* explanations of social factors and do not contribute to the development of sociological data. These "sociological" interpretations certainly were propagandistic and ignorant of social phenomena as a field of study. Interestingly, the most complete use of the concept of Biblical sociology probably appeared in a work by Philip Vollmer, entitled *New Testament Sociology* and published in 1923. Not only does it present lucid sociological perceptions but also tends to imply a more sound fundamental Christian view.

Perhaps it could still be asked whether or not the Bible constitutes a valid source of data for developing material in the social sciences. The view of the writer is that if God has given us an absolute basis for our understanding of the physical world, history, and ethics, He has also given us an absolute basis for our understanding of social relations. If there are any "natural laws" for social living, which could be transformed into sociological theories, they should be observable in scripture.

A number of incidents portraying such truths are readily available. The account of the dispersal of the inhabitants of Babel in Genesis 11:1-9 is basically an account of God's use of cultural diffusion and urbanization to perform His will. Observations of such phenomena have been made by the 14th century social philosopher Ibn Khaldun and all of his predecessors up to the present. If we read Ephesians 4:11-16 with the understanding that it refers to the concepts of social differentiation and stratification, it is possible to note that God has indicated that such processes have the particular functions of maintaining group unity and developing the individual's efficiency. It has been in

only relatively recent times that such a view of differentiation and stratification has been forwarded to complement the standard view that such processes only provide for division and group conflict.

Although it is important for the sociologist to isolate social processes and trace their consequences, as well as their histories, it is of much greater significance to understand the working of such processes. It is the comprehension of such mechanisms which give the sociologist his predictive ability and provide those long strides in scientific growth.

The sociological understanding of Paul's masterful statement of the consequences of sin in Roman's 7:7-25 would be of critical importance. The process of un-purposive means to ends social action has been an area of conflict for such eminent men in the field as Znaniecki, Sorokin, and Parsons. Though the social nature of social action prevents a congruency of the two processes, an understanding of the social implications of Paul's passage could be of importance to an understanding of social action.

Simply then, it seems that God has given absolute information on the nature of social phenomena as He has done with physical phenomena. A concept of Biblical sociology would have to provide an analysis of such data in the Bible.
