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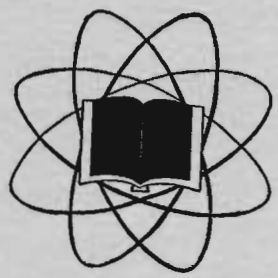

The fear of the Lord is the beginning of wisdom. Psalm 111:10

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The Formation Of Living Organisms From Non-Living Systems[*]

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In 1859, Charles Darwin cautiously stated, "Science as yet throws no light on the . . . problem of the essence or origin of life."[1] Actually, the possibility of observing the "spontaneous generation" of living things from inorganic matter was at that time a very controversial scientific question, as Pasteur had not yet completed his conclusive experiments along these lines[2]. However, instead of praising Darwin for this reluctance to extend his theory too far, critics of Darwin and of the theory of natural selection have often attacked at this very point, saying that the power of the theory to account for biological variations is vitiated by its failure to account for biological origins. Thus Clark, in 1950, stated that the influence of the theory of natural selection probably did biology more harm than good, by concentrating attention on small changes in living things and diverting it from the problem of their origin. He went on to say:

> "For the materialist, organisms are limited by the properties of atoms and molecules. Somehow or other, he must explain how chemical molecules of gigantic complexity came into existence and have been able to arrange themselves in increasingly complicated ways. This is the fundamental problem of evolution, yet it is generally ignored in modern books on the subject, nor, (at least to the author's knowledge) has the problem ever been fairly faced ."[3]

Oparin's book on the origin of life[4] was published in English translation in 1938 and certainly faced the problem fairly. The current scientific literature abounds with papers facing the problem, and today there is no reluctance at all to extend Darwin's principle of natural selection into the pre-biological realm, making the origin of living organisms merely a consequence of a still more fundamental "chemical evolution" of non-living molecules. The tendency today is to regard the original spontaneous development of living things from inanimate matter as not only highly probable, but actually inevitable[5]. What are the factors which have led to this recent extension of the evolutionary concept?

In the first place, the time available for a process of chemical evolution is now generally accepted to be about two billion years[6], which is regarded as adequate if the process is considered to be the over-all result of a large number of continuing small changes. Since Oparin[4], this gradualism has been a predominant feature of the theory, and has largely served to discredit arguments such as that of Lecomte du Nouy[7], who calculated that the formation of a single molecule of protein would require 10^{243} billions of years, if the probability of the chance collision of its constituent atoms were the only factor taken into consideration. If a series of stepwise reactions is postulated rather than a single all-or-none jump from simple molecules to complex ones, the probabilities dealt with are entirely different, and such calculations become meaningless.

A second factor, I think, has been an increased appreciation for the stability of biologically important molecules. Two previous papers in this symposium have described experiments in which mixtures of very simple compounds have been submitted to conditions simulating pre-biological conditions on the earth, and have produced more complex molecules identical to those common to living organisms today[8,9]. Undoubtedly such experiments demonstrate the intrinsic stability of amino acids and other such compounds and make their prebiological accumulation on the earth's surface highly probable. Another line of investigation is that of Abelson and others in the field of paleobiochemistry[10]. It has been found that recoverable amounts of the original organic matter are present in such fossil materials as shells, bones, petroleum, and coal, and possibly even in the Pre-Cambrian black shale. For example, it was possible to study the content of protein and amino acids in the shells of clams (*Mercenaria mercenaria*, the quahog of the Atlantic coast) now living and in those of the same species 1,000, 500,000, and 25 million years old. The 1,000 year old specimen had the same protein content and the same amino acid pattern as the modern specimen; the 500,000 year old specimen contained no protein and smaller amounts of amino acids, some of which were still in peptide chains; and the 25 million year old shell contained only a few of the original amino acids and no protein or even peptides. Laboratory experiments on the stability of alanine at various temperatures indicated that this amino acid would be sufficiently stable at a temperature of 20° C for half of the original amount present to remain after a period of about three billion years. Substantial quantities

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

of porphyrins, compounds of the same type as the chlorophylls or the heme of important respiratory pigments, have been found in petroleum samples at least tens of millions of years old. Such studies not only open up the exciting possibility of discovering something about the metabolism of early forms of life, but also emphasize in a dramatic way the inherent stability of these biologically important compounds. If their pre-biological synthesis was possible, as I think has been more or less clearly demonstrated, then they *must* have accumulated and set the stage for further developments.

Perhaps it should be pointed out here that our notions of the instability of large complex molecules rest partly on theoretical grounds and partly on the grounds of common experience. If chemical bonds have a certain probability of being broken, it stands to reason that under the same conditions a molecule with a large number of bonds will more likely be broken down to smaller molecules than will a molecule which has fewer susceptible bonds. However, organic chemists know that chemical bonds in a molecule may affect each other in different ways: in some cases a bond is "labilized" by the presence of other bonds (that is, made more susceptible to attack), but it is also possible for bonds to be "stabilized" by the influence of other bonds (for example, as by resonance in the case of the porphyrins already mentioned, or by the formation of zwitterionic dipoles in the case of the amino acids). In the case of very large molecules, such as the proteins and nucleic acids, steric factors as well come into the picture. Thus, with a molecule of sufficient size, forces such as those due to van der Waals attraction or hydrogen bonding may become *intra*-molecular, and their combined strength may impart considerable stability to a particular configuration of the molecule. Pauling and others have demonstrated this in the case of helical structures for certain proteins[11], and the Watson-Crick double helical structure for DNA (desoxyribose nucleic acid) is an even more striking example[12].

It is not so much these theoretical considerations, therefore, as it is our practical experience which leads us to believe intuitively in the instability of complex molecules. The phenomena of decay and decomposition are such commonplace experiences with us that I think we often fail to realize how much of this is actually biological. The earth's surface and atmosphere today is literally teeming with living organisms whose existence depends on their ability to degrade complex molecules and derive energy thereby. In Pasteur's day, people found it almost incredible that the air they breathed should be swarming with microorganisms and their spores[2], and sometimes even today we forget that we live in such a biologically crowded atmosphere. If we lived under circumstances in which food did *not* spoil at ordinary temperatures and mold did *not* grow on our protein solutions in the laboratory, we might not have such a strong feeling that complex molecules are intrinsically unstable. But, if the theory of chemical evolution is correct, complex organic compounds *were* synthesized and *did* accumulate in just such a "sterile" or "a-biological" atmosphere.

Now, the third factor which has led to the extension of the evolutionary concept into the pre-biological realm, and the one which I wish to emphasize in this paper, is our rapidly increasing understanding of biological processes at the molecular level. By "understanding" of such process I mean our ability to make precise enough measurements to lead us to mathematical generalizations, which may be tested for validity by comparison with quantitative data from other experiments. I do not mean to imply that we now fully "understand" life, or that we ever shall; however, it is true that whenever the complex inter-relationships of metabolism have been susceptible to quantitative investigation, the ordinary laws of thermodynamics and kinetics have proven adequate to account for the phenomena observed. For a profound discussion of the relationship between the laws of physics and biological phenomena. I recommend Schrodinger's essay, *What is Life?*[13], or for a slightly whimsical account, Gamow's *Mr. Tompkins Learns the Facts of Life*[14].

In general terms, what is it that we are seeking to understand about life in terms of the laws of chemistry and physics? It may seem strange that it is actually quite difficult even to define "life" or "living" satisfactorily. This difficulty has been emphasized by Pirie[15], who pointed out that any definition of life which would exclude all obviously non-living systems would probably also exclude some obviously living systems, and vice-versa. Pirie has set up what he considers generally acceptable criteria for a system to be regarded as "living" as a sort of ground-rule in lieu of a precise definition, in case someone claims to have produced such a system artificially [16]. If we cannot say precisely what a living thing *is*, we can at least specify some of the things it *does*. We might say in the most general terms that living systems are systems which are able to utilize a flow of energy through the system to maintain a higher degree of molecular order than their surroundings (or in thermodynamic terms, to "extract" negative entropy from the energy sources utilized by the system). In addition, although a system without the ability to reproduce may be regarded as living (a castrated animal, for example), at least the *possibility* of self-duplication must be present under certain conditions for a system to have much significance in evolutionary considerations. We should also keep in mind that if the Darwinian idea of variations plus natural selection is applicable to the pre-biological realm, variant systems of metabolism may have arisen and become "extinct" just as variant morphological

forms seem to have done in the biological realm. In fact, the possibility exists of discovering such variant systems, possibly even as "vestigial remains" in modern organisms.

The standard procedure for studying any complex system is to resolve it into simpler components which can be studied separately, or perhaps to construct a model of similar but less complicated design and to study the model first before attempting the more difficult study of the system itself. Thus, we might resolve living things into systems for obtaining energy and systems for utilizing this energy (or the entropy deficit accompanying it) for synthetic purposes; in addition we might investigate the way these two systems are "coupled," and ways in which the entire complex is held together or reduplicated. In practice this is what biochemistry has been doing in recent years, with varying degrees of success in elucidating the details of the different systems. It must be admitted that we do not as yet have a complete picture of any of the isolated systems, but we do have a partial picture of each of them. What is most significant here is the fact that it has been possible to study such isolated systems in this way at all. Now, let me sketch in a broad outline of those metabolic processes which may be said to have had the greatest "survival value," and then we shall look at some possible ways in which they might have developed from less complex processes.

There seem to be three major processes by which living things obtain energy. These are oxidation, fermentation, and photosynthesis. Actually, if we limit ourselves for the moment to energy-yielding processes, the latter should really be called "photodecomposition," since the synthetic part of the process actually utilizes the energy thus obtained.

Oxidative metabolism makes use of molecular oxygen to give final products of carbon dioxide and water in the usual scheme in which organic compounds are oxidized. In a series of steps, hydrogen atoms are removed from the substrate, with or without a preliminary addition of a molecule of water, and eventually made to react with oxygen. The carbon dioxide is liberated when the substrate has been rearranged to form a carboxylic acid with unsaturation on the beta-carbon atom, a type of compound which readily decarboxylates. To oxidize a two-carbon compound such as acetic acid, the compound is first condensed to a "carrier" molecule in order to have enough carbon atoms to form the beta-keto acid analog; in the course of the subsequent oxidations and decarboxylations, the carrier molecule is regenerated, giving a cyclic process. The energy-yielding part of such a cycle, the Krebs citric acid for example, is the oxidation of the hydrogen to water. In all cases of oxidative metabolism investigated, this is a stepwise process in which the hydrogen atom, or an electron accompanied by a hydrogen ion, is transferred from one oxidation-reduction system to another, each of higher oxidation potential, until finally two hydrogens combine with an atom of oxygen. There are some strictly anaerobic microorganisms which apparently do not make use of this process at all, and there are also autotrophic chemosynthetic bacteria which oxidize sulfur, iron, or hydrogen principally rather than carbon compounds[17].

Fermentation, an anaerobic process, consists basically of the oxidation of one compound by reducing another compound other than oxygen, so that the presence of oxygen is not required. In some cases, this oxidation-reduction may be intra-molecular, as in the dismutation of glucose to lactic acid in the familiar Embden-Meyerhof scheme. In this case, which also involves a cleavage into two smaller molecules, it might be said that one end of the molecule has been oxidized (the carboxyl group of the lactic acid) while the other end has been reduced (the methyl group). Anaerobic processes are often found in tissues whose primary mechanism for obtaining energy is oxidative, such as mammalian muscle.

In photosynthesis, the energy involved is derived from sunlight, which is absorbed by certain pigments and used to break down water to hydrogen and oxygen, the hydrogen then being used to reduce carbon dioxide to yield compounds of the state of oxidation of carbohydrates. The oxygen may be released as a gas, as in higher plants, or may oxidize other compounds, as in the photosynthetic bacteria[18]. It is interesting that the green plants apparently make use of all three types of metabolic scheme, synthesizing carbohydrate by photosynthesis, rearranging it by anaerobic glycolysis, and then oxidizing the glycolysis product (lactic or pyruvic acid) to carbon dioxide and water.

Of synthetic pathways in various types of organisms we now have a considerable body of knowledge, and a general similarity of these pathways is evident even in the most widely differing species. We can trace the chemical steps involved in the conversion of simple one-, two-, and three-carbon compounds into porphyrins, steroids, amino acids, carbohydrates, nucleotides, etc. The chief interest at the moment is in the biosynthesis of the most complex and specific compounds of all, the proteins and nucleic acids. Indications are that the mechanisms will probably be similar to those involved in the synthesis of the simpler compounds, but the way in which order or "information" is built into the molecules is a complicating factor. This "coding" of biological macromolecules has become a quantitative study itself[19].

Of the mechanisms involved in coupling these synthetic processes to the exergonic ones, we have varying degrees of knowledge. We have come to realize that the only possible way such coupling can take place is through the raising of a specific chemical compound to a higher energy state by the rearranging of the electronic configuration of its constituent atoms.

In some cases we know what the compound is, and how the rearrangement takes place. In many cases there is an intermediate compound which can serve as an energy "carrier" because it is thermodynamically unstable but kinetically stable; such a compound transfers its energy only when a suitable catalyst is present to speed up the reaction. Perhaps the most common example is that of ATP (adenosine triphosphate), which has at one end of the molecule two pyrophosphate groups which show this property of thermodynamic instability (*i.e.*, "high energy") but which are not hydrolyzed at an appreciable rate at the ordinary temperatures and pH's of living cells and tissues. When a suitable catalyst is present, ATP is rapidly hydrolyzed, and we have a rather definite picture of how the catalyst accomplishes this[20]. ATP seems to play a role in all types of metabolic processes, and in some cases we know exactly how it works. For example, in the anaerobic fermentation of glucose we know exactly how the energy is used to synthesize ATP, and exactly how many molecules are synthesized. In the case of oxidative metabolism, we know that ATP is synthesized, and we know approximately how many molecules must be synthesized for every hydrogen atom that eventually combines with oxygen, but we do not know in this case the actual chemical details of the synthesis[21].

As for mechanisms by which metabolic interrelationships are preserved and duplicated in reproduction, it must be said that we have probably just discovered the most important clues but have not yet had time to solve the mystery. The identification of the molecule that actually carries the hereditary pattern as DNA[22], and the elucidation of the major features of its structure[12] have certainly given us hope for the first time of understanding heredity at the molecular level. It is interesting to note that DNA is made up entirely of molecules of the same general type as ATP minus the high-energy pyrophosphate, and that the structural features of the molecule already account beautifully for many of the properties of the hereditary carrier, such as stability in thread-like form and ease of exact duplication.

Now, extrapolating backwards, what can we say about the sequence of events leading to the accumulation of these systems into what we know as living things? In the first place, if the original atmosphere was really a reducing one rather than an oxidizing one, it is highly probable that oxidative metabolism was *not* the original exergonic process utilized. A number of authors have regarded anaerobic fermentation as the most likely original pathway; Kirkwood points out that it may be regarded as possibly more "primitive" than oxidation or photosynthesis because the anaerobic enzymes are usually soluble, while the others are usually intimately connected with cell structure[23]. If the atmosphere gradually became more oxidizing, due to the photolysis of atmospheric water and the loss of the lighter hydrogen resulting, then oxidative metabolism may have developed. Oxidation is capable of yielding much more energy than fermentation; with the large quantity of organic compounds available from prebiological synthesis, this would have been a very advantageous scheme—until, of course, the supply of organic compounds ran out! The oxidation of iron and sulfur may have been resorted to, but such schemes would also be heading up a blind alley. There may have occurred crisis after crisis, but eventually the atmosphere would have become too oxidizing to replenish the supply of reduced molecules; some other scheme must have developed, in this case, photosynthesis. The energy of sunlight could then be used to reduce carbon dioxide resulting from oxidative metabolism, and the familiar carbon cycle of nature as we know it today was underway.

Is it reasonable that metabolizing systems should arise spontaneously and persist? The systems we know today are much too complicated to have appeared suddenly, but there is yet the possibility that the system might have evolved by the continued modification of only slightly advantageous chemical reactions. Several suggestions have been made along these lines. In a general sense, any chemical reaction which produced a compound with even slight catalytic power to stimulate the reaction by which it was produced would have "survival value" over competing reactions. Calvin[6] has pointed out that iron-porphyrins are catalysts which will promote certain steps in the synthesis of porphyrins from succinic acid and glycine, two compounds already known to be synthesized under model "prebiological" conditions; furthermore, since iron itself has very slight catalytic power to do the same thing, we have a good example of a synthetic reaction which would be expected to "evolve" from very simple precursors. It might be mentioned that the further combination of the iron-porphyrin compound with a specific protein increases its catalytic power many thousandfold, but this elaborate refinement probably came much later in the development of this system.

It has also been pointed out that inorganic pyrophosphate itself has the same properties of thermodynamic instability plus kinetic stability as ATP, which may be regarded merely as pyrophosphate with an organic "handle" on it. Therefore, pyrophosphate could have served as one of the first molecules capable of transferring energy from exergonic reactions to endergonic synthetic reactions. Kirkwood[23] suggests that pyrophosphate probably accumulated from thermal reactions along with the pre-biological supply of organic compounds, and Calvin[6] has even suggested a very rudimentary coupling reaction for the synthesis of pyrophosphate from orthophosphate, linking the dehydration of orthophosphate to the squeezing out of a molecule of water from the coordination sphere of

iron or vanadium ions when they are oxidized. It is thus possible to devise fairly reasonable models for "primitive" metabolic schemes, a stimulating hobby of growing popularity among biochemists.

We do know from recent studies on enzymes and co-enzymes that simple molecules may often have enough catalytic power without combination with a specific protein to make such primitive metabolizing systems seem reasonable. Some attempts have already been made to design a "mathematical model" of the evolution of primitive metabolizing systems by making various assumptions about possible effects the products might have on the catalysis of their synthesis[24]. For example, a compound would not have to serve as a specific catalyst in order to promote its own synthesis over that of other compounds: if it were a macromolecule it might serve just as well by adsorbing the reacting molecules or even by forming a prototype of a cell wall to hold the system together. It is probably too soon to assess the validity of the various mechanisms proposed[5,23,25,26,27] but the general principle does seem valid in the light of our present knowledge of biochemistry[28]. The difficulty of obtaining conclusive data will no doubt produce a great deal of speculation, such as the argument over whether the assembling of metabolizing systems most probably began by adsorption on inorganic clays, as proposed by Bernal[29], by aggregation in quiet waters of ocean depths, as proposed by Pringle[30], or in water-logged soil or layers adsorbed at air-water interfaces, as proposed by Haldane[31]. However, the concept of pre-biological evolution results not only in speculation but also in the stimulation of specific lines of research[32], such as the investigation of "primitive" types of organisms, of variant pathways of metabolism, and of model enzyme systems.

Continuing biochemical research on "sub-vital" systems may be expected to lead to further explanation of biological mechanisms at the molecular level. Further research on cell nuclei[33,34], on crystalline DNA which "transforms" bacteria to other genetic types[35,36], on bacteriophage which inject DNA into bacteria and bring about replication of the phage[37,38], on TMV (tobacco mosaic virus) protein and RNA (ribose nucleic acid) which recombine to form an infective virus particle [39,40], on the "electron transport particle" of mitochondria[41,42], on chloroplasts which photosynthesize[43,44], on protoplasts which synthesize induced enzymes[45], and so on, will probably intensify the conviction that the living cell is an already highly developed system, a milestone perhaps, but not the starting point, of evolutionary processes.

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*The Cultures of Man and the Communication of the Gospel**

WILLIAM A. SMALLEY

The problem of "The cultures of Man and the Communication of the Gospel" is as old as the history of God's dealing with mankind, if we assume that man has had culture ever since God began to communicate with him. We have a long history of a part of the problem in our Scriptures. This history takes some odd turns—odd to us that is, in the light of our own culture and in the light of the more common acts of communication in the Bible. In the Bible we find peculiar acts of revelation as when God commanded Hosea to marry a temple prostitute, or Abraham to sacrifice his son, or, strangest of them all (as C. S. Lewis puts it), when God was nursed by a peasant woman in a Bethlehem stable and died as a criminal thirty-three years later.

On the other hand, *some* of the turns which this communication took in the Biblical record are not so strange to *us*, but *were* highly revolutionary to the people to whom they *first* came. Such was Peter's vision when he was told to eat animals which were repulsively unclean to Jews, and such was the whole ministry of Paul, or Peter—(and of the Holy Spirit) —among the Gentiles, in the eyes of those Judaizers, among the Jewish Christians. The preaching of the gospel turned the Hellenistic world upside down.

Part of the tragedy of modern missions, however, is that in our narrow ethnocentrism we refuse to allow the Spirit of God that liberty that has always been His prerogative in dealing with men. We bind Him to what is right and proper in our own eyes—and our field of vision is sharply constricted to a narrow slit by the tightly-strapped blinders of the habits which our culture bequeaths us.

It is hard to illustrate this point, because we have only history to study. We do not know what might have been. Let us try, anyhow, if we can loosen our blinders enough to see something of how other people look at things.

One of the major forms of communication in Africa is the dance. Africans dance to gain power and to appease the dead, to celebrate, and to mourn. They seem to us to dance for any excuse whatsoever, and if there is no excuse they dance for the fun of it. Last April in the Camerouns I was riding with Dr. William Reyburn through a village in the evening just as the moon was coming up. We heard drumbeats—and believe me, I know of little else that has the fascination of the intricate, complicated rhythms of African drums on a moonlight night. We stopped and walked to the open square where young men were tapping out the beat. A few others were beginning to get itchy in their feet. A couple of fellows were trying out a few steps (Africans dance individually, of course, and not in the Western manner of ballroom

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dancing). We asked what was going on. The bystanders were delighted with our interest and told us that a woman had been buried a year before, the period of mourning was over, and now the family was about to celebrate.

We did not stay to see the celebration because supper was waiting for us at the Reyburns' home. But that evening we again heard drums, this time down over the hill from the mission station in the quarters where teachers and students lived. The Reyburns and I rushed down, and this time the dance was a game. The fellows were in a circle, dancing and singing, while one in the center acted the fool to make the others laugh. He would then point to someone in the circle who would take his place and try to outdo the previous dancer.

Along with these and many other functions of the dance in Africa is its relation to drama and to other forms of communication. The dance is a major instrument by which Africans transmit values, ideals, emotions, and even history. It is a medium which the African understands. But more than once the African has been rebuffed by the missionary when he attempted to worship God in dance—or, for that matter, even to tell the Good News in this most natural form of communication. For example, a foreigner, an important church lady, was visiting the mission and church. Because it was a lady visitor the African women of the area wanted to put on something very special for her, and so they worked out a dance-drama in which they portrayed the history of their contacts with Christianity. This was to be an expression of their appreciation for the fact that the missionaries had come to them.

They started out by portraying themselves naked—a bunch of leaves in front and another behind as their only clothing. This is the way they often dress in the fields and in out-of-the-way places where they are not likely to be seen by outsiders. Then the missionaries came. There was an elaborate, intricate story unfolding and quickening in tempo until they ended up by going to church in their brightest-colored new cotton finery.

But the sight of these African women—nearly naked—dancing so enthusiastically, their whole bodies jouncing with every violent step, and their breasts flapping, was too much for the visitor. She berated them for this "heathen" display, unworthy of Christians. Unfortunately, a missionary who should have known better interpreted for her. The poor Christian women were stunned, hurt, crestfallen, ashamed. This offering of thanks, this testimony of their gratitude to God and the missionaries, this act of worship—far more real, far more deeply felt than most of our perfunctory acts of worship—had been so cruelly rejected by the distinguished visitor.

Fortunately, this sort of thing has not always been the case. There have been instances of missionaries who have been perceptive to the power and function of African dance and drama in communication, and who have encouraged them to splendid advantage. But let us go on to another illustration of the limitations which we put on the Holy Spirit because of the narrow outlook defined for us by our culture.

I am referring to the problem of polygamy. I think it is safe to say that most missionaries have condemned polygamy in one way or another. In some areas some rather bizarre rulings are made. A man can be a Christian (because he has been reconciled to God through faith in Christ) but not a church member (because he has more than one wife); his wives, on the other hand, may be both Christians and church members because they have only one husband! Some missionaries require that the husband relinquish all wives but the first. If the husband does this legally, it is divorce, (something to which the missionary is also opposed), and if he does not do it legally it is desertion without support in the eyes of the community and in actual fact.

But the biggest problem in our understanding what is really involved here is the tremendous difference in emotional attitude toward plural marriage on the part of the African and on our own part. Except for the objective fact that a man has more than one wife, we are not talking about the same thing at all. What does plural marriage conjur up to us? With our heightened emotional orientation toward sex, we think of it in sexual terms (here is a man who is not satisfied with one sex partner). It strikes us as being illicit, abnormal, subhuman, revolting—even something on the level of homosexuality. Perhaps some of you have heard remarks made about Mormons of the past.

But how does the African feel about it? He may have been told it is wrong, and may accept what he has been told, just as he accepts much of what the missionaries tell him and parrots it back. He may see the genuine difficulties in it, but what does he *feel?* To him (and to his wife or wives, and to his children) polygamy means not sex but security, comfort, respect. It means having the community look up to him. It means a family large enough to work the farm and still take care of the household needs and the children. It means many children—and many children are an African's great pride and comfort. It means not abnormality, but the good life. Not illicitness, but morality.

In many parts of Africa it is immoral to have sexual relations with a woman who is nursing a child. Relatively prolonged nursing is essential on a continent without the services of Gerber's prepared baby foods. Plural marriage is an important safeguard to morality, and the common missionary pattern of many small children of the same mother may be really shocking—proof of immorality in the African eyes.

Perhaps we can make the point by taking a contrasting situation in our own culture. We have been told that materialism is wrong. We believe it. We have heard that it is a sin. We agree. But somehow we do not feel it. We say that all sin is sin in God's sight, but this sin does not hold a candle to rape, murder, theft, or even gossip, so far as we are concerned. I am buying a house. The money I spend each month in payments to the bank would support a whole village of Khmu people in Laos where I was a missionary. I do not consider that house big. It has five rooms, including the kitchen. I spend a lot of time thinking about that house. I read magazines about fixing up houses. I am buying several items for my home on the installment plan. I spent most of my vacation this summer fixing up the house and yard.

I also have a seven year old Plymouth which works perfectly well, but I feel as though I would like a newer car, and I presume that before long I shall be looking around for one, even though I do not have any money.

Even though I am a Christian and believe with all my heart in full commitment to Christ, I am a materialist and spend a large part of my time and energy on material things. It somehow seems normal, respectable; it means security, a proper home for my family. I would feel that I were failing them if I could not provide them with a good part of this.

This is how much of Africa feels about plural marriage. Two wives in every household to them is symbolically something like two cars in every garage to us. The difference is that we can sell the second car without any serious injustice to the car or the community. The divorcing of wives is no such small matter.

We have been trying to illustrate the statement that the Holy Spirit is more bold to deal with men on their own cultural level than we are. In fact, more than one missionary has refused to translate the Old Testament because he did not want to have people read about David dancing before the Lord,[1] or the Lord slaying Onan because he refused to have sexual intercourse with his brother's wife (so that his brother would legally have children).[2] or Nathan quoting the lord, "Thus saith the Lord . . . 'I gave you . . . your master's wives into your bosom.' "[3]

But in spite of the mistakes of His human instruments, God has from His first dealings with men chosen this incarnational form of communication. He has encoded His infinite message in the finite human codes of human cultures and human languages. In His *supreme* act of communication God encoded Himself as a human being from birth to death. In doing so He had to select one race from the many races of earth, one culture from many cultures, one language from the many languages. Our difficulty comes when we try to identify that race, that culture, that language with the *message* to be conveyed. We should think of it instead as the *semaphore*.

God's incarnational means of communication is not restricted to that single, supreme, historic Incarnation alone. From the beginning, God's message has come to men through the code of their language and culture. As the Holy Spirit indwells the messenger and as he expresses the gospel in language and life, the message is once more incarnate, encoded in human forms. Of course, there are many differences between these many encodings of the message and that one supreme one which we call Incarnation. We are not Christ. But more than this, where God was encoded in Christ Jesus he was encoded in Jewish code, Jewish culture—the culture *of the people to whom the message came.* But, when the Good News is encoded in us as missionaries it is encoded in *our* culture much more than in the culture of the people to whom we are the bearers of the message. It is what the gospel means to *us* that we are preaching. It is the implication of God's word in *our* value system on which we dwell. This is a fundamental difference between most of the acts of communication recorded in Scripture and those of the modern missionary movement.

There have been a few notable exceptions to this. Like the Apostle Paul, who was bicultural and bridged the cultural gap between the Jewish world and the Hellenistic world of his day, there have been national Christian leaders who have interpreted the message to their own people in their own terms. There have been many such. But I am speaking of that movement we call missionary—that breed of cultural expatriates of which I am one, that host of men and women who pack up their values as well as their refrigerators in their outfit and preach the great American cultural doctrines of rugged individualism, profit motive, materialism, and the atomization of society—in the name of that indigent prophet who had nowhere to lay his head.

But this is the way God chose to do it. He chose to have the Good News spread from person to person, from culture to culture, from generation to generation in a span from Adam to us, in spite of the bewildering array of cultural forms, of languages, of value sysems in which it has had to be encoded.

That really places on the thoughtful missionary an obligation to think seriously about the question of what is cultural form in Christianity (that is, what is the normal product of this encoding of the message, this incarnation of the Holy Spirit in the lives of people in a society), on the one hand, and what is supercultural (what transcends all cultures and all time), on the other. And while he is deciding that, he must also decide how he can communicate that supercultural faith in terms of the culture to which he is ministering rather than in terms of his own, just as Jesus did. And the Christian leader in any society, including our own, must decide how to

interpret that which comes in a foreign cultural garb, such as that of the Scriptures, in terms of the society of which he is a part.

Of course, there have been many scholars who have thought profoundly about these problems. Many theologians have done so. But, as an anthropologist who is relatively illiterate in theology, I would like, nevertheless, to pass along the observation that it seems to be those Christian thinkers who are also missionaries who best come to grips with this problem. I am thinking of such splendid Christian scholars of the ecumenical movement as Hendrick Kraemer and Lesslie Newbegin. And it seems to me, also, that other, non-missionary, theologians within the ecumenical movement have been forced to give attention to these problems by the very nature of their attempt at ecumenical intercourse.

There have been many missionaries who, to one degree or another, have worked out their own combination of practical theology and applied anthropology as they have wrestled with the problem of preaching the gospel to their neighbors. Some have become outstanding, serious anthropologists who have made important contributions of theory and factual information to the field. Such, for example, are Edwin Smith of England and Maurice Leenhardt of France. We do not have their counterparts in the United States. This does not mean that American missionaries have not also wrestled with the problem, but they have not risen to make the same great contributions to anthropology as a result.

In the United States, however, there is a movement which is typically American. Instead of moving from missions to theology and anthropology it moves from anthropology to missions, and then in some cases on to theology. What is so typically American about it is that it is a technological approach. It got a major part of its original impetus from the important attempt of the Summer Institute of Linguistics to apply structural linguistic science (which is a specialized branch of anthropology) to the missionary problems of reducing languages to writing for the purpose of translating the Bible. There are probably at least a thousand individuals who as missionaries have done linguistic analysis in their missionary work. Some of these know far more about linguistics than they do about theology or about the Bible they are translating. A few have risen to prominent place as linguists in this country. More than a dozen have their Ph.D.'s from departments of linguistics or anthropology, and an equal number, I would judge, are close to it. Thus the technology of linguistics is being applied to the mission situation.

The majority of missionary "linguists" are purely technicians, and they are applying techniques of language analysis more or less by rote. There have been, however, during the course of this development, others who have begun to face up to the problems of communication, which are cultural as well as linguistic. These, while still using their linguistic techniques, have become interested also in cultural dynamics and have been looking thoughtfully into cultural anthropology.

Concurrently, at Wheaton College, at the Kennedy School of Missions, and at other Christian institutions there have been courses in anthropology, and a few individuals have gone into anthropology there and at universities. This small group of people, some of them missionaries and others not, anthropologically oriented by training, Christians by conviction, has found its principal leadership in Eugene A. Nida of the American Bible Society. It finds its voice principally in a little journal, *Practical Anthropology*, which appears six times a year.[4]

The people who best illustrate what is being done in this field are Dr. and Mrs. William D. Reyburn. Mrs. Reyburn is the former Marie Fetzer, coauthor with me of the anthropology chapter in the second edition of the ASA symposium, *Modern Science and Christian Faith*. Dr. Reyburn is a Ph.D in linguistics turned cultural anthropologist. He is doing the most perceptive, creative work in this field of action anthropology in missions of anyone I know.

The Reyburns have been in the French Camerouns of West Africa for about a year. Before that they were in Latin America for several years. In Latin America they worked on several "trouble-shooting" assignments where missionary work had bogged down in one way or another, and they performed their assignments with brilliant success, as will be seen below. Now, their project is the organizing and developing of an adequate Bible translation program among the several languages of the southern Camerouns. This is a program in which Africans almost exclusively are employed as translators under the Reyburns' supervision. By telling you about the Reyburns' work I think that we can illustrate some of the basic features of this anthropological approach to this age-old problem of the cultures of man and the communication of the gospel.

Dr. Reyburn's career has been spent, for the most part, living in out-of-the-way villages on a very simple scale—not just because it is necessary for his work, but because he would rather be that way. The Bulu people of a village in the Camerouns tell delightedly about how Dr. Reyburn would sit in the men's palaver house with all the other men, and how his wife would bring him his dinner just like all the other wives. Never had a foreigner joined in their activities like this before. Mrs. Reyburn was pregnant, and these foreigners were forever stumbling into pregnancy taboos—learning about them the hard way—often unwittingly violating them.

Once, when there were wild elephants in the vicinity,

the village met to decide who would go out and shoot an elephant with Dr. Reyburn's gun. He could not go because his wife was expecting and that made the elephants taboo to him. As he said when he wrote up the account in *Practical Anthropology,* "I wandered into the . . . palaver house . . . and found out that the speeches were about whether or not 'our family' was going to lend 'our' rifle to get an elephant for our village . . . . I sat tight and tried to forget that I was W. D. Reyburn and remember that I am supposed to act like Obam Nna now."[5]

When he was in the Andean area of Latin America, he used to dress up as a half-breed, a cholo, with a big hat, several days' growth of beard, and a large poncho. With an Indian and a burro he would trudge the mountains, playing the role of the lowest class of society and receiving the status that such a class occupies. He would sit among the Indians in the market place and hear their complaints, their bitter, bitter cursing of the landowners. He said you cannot imagine what it is like to be cursed as a cholo, as the scum of the earth, to have people who always maintain a barrier of respect to the upper classes talk to you as an equal.

At night they would put up at an inn along the way. These inns were for such people. For next to nothing they could get a supper, feed their animals, huddle by the fire, and sleep under a shelter. In the evening, as everyone would be around the fires talking, Dr. Reyburn would pull his poncho up over his head as he crouched in a sitting position, pretending to be asleep. With his flashlight under his chin, he would take notes on the day's activities and on the conversations around him.

Sometimes he was caught. One night, without saying a single word, he walked into the inn courtyard in the darkness, took his place by the fire, and started to cook supper, when out of the darkness came a voice: "Senor, why are you traveling with that Indian?" Dr. Reyburn does not know what gave him away. It must have been something about his walk or some gesture or other. He had to learn to slink along city streets in a manner befitting a cholo in the presence of his betters.

Another time, he slipped out of role when, on a very hot day, he bought a cheap bottle of soda from a wayside vendor. The vendor looked at him suspiciously. "Why don't you take a bus?" he said. But often Dr. Reyburn got away with it, and it was for him an avenue into an understanding of the thoughts and aspirations, the fears and hatreds, the values of the ordinary people who are taciturn, uncommunicative, hostile, suspicious of everybody outside their own small world. When Dr. Reyburn was asked to go to Africa for his present assignment, one of his great regrets was, "I can't be a cholo in Africa."

But there in Africa, too, he is finding new avenues of contact with people. Actually, it is not as difficult where he is now, because the people are outgoing, friendly, willing to accept him. But in either case, the point I am emphasizing is that he wants the companionship of people, wants to understand them, makes them a part of his life—so different from the usual missionary who very effectively insulates himself from those around him.

Dr. Reyburn's unusually fine sense of cultural dynamics, of the ways in which societies operate, their stresses and strains, their consistencies and conflicts, their stabilities and changes, and the relation of Christian faith to all of this, may be seen in much of his writing.

The fullest single published example of this is the small monograph *The Toba Indians of the Argentine Chaco.*[6] It tells an utterly fascinating story. The Tobas are a tribe of Indians who have undergone extensive culture change due to the inroads of Latin-American culture in the form carried by their mixed Spanish-Indian neighbors. One of the important innovations which has come into Toba life is Pentecostal Christianity. Here I quote from Dr. Reyburn:

> The past fifteen or twenty years have seen a phenomenal spread of this expression of Christianity in Argentina, Chile and Brazil. Its growth has outstripped anything dreamed by Protestants in Latin America. For the most part it embraced the poorer classes of people and has divided, split, fused, and fragmented; and with each division it has been self-developing, facing its problems without the inhibitions of preconceived missionary methods and ideals. While it is not an ideal movement to many, the overwhelming fact remains that it is "movement" and has proclaimed the gospel in a prodigious fashion. The international Pentecostal movement is dominated by no ecclesiastical authority laying its plans in a systematic step-by-step procedure. It is characterized by a strong emphasis on gospel preaching and the visible manifestations of the Holy Spirit. These manifestations are not everywhere the same, a common point of dissension among these churches. It is largely unconcerned with the relation of Christianity to culture. It places a strong emphasis on healing the sick by prayer and anointing with oil. It likewise uses whatever musical mediums are available as an integral part of its worship services. Such is the form of Christianity which came to the Toba. It did not come by Pentecostal missionaries going out and living with the Tobas and learning their language. Rather, the Tobas went to it in the cities along the Parana River. They heard the gospel preached and experienced the Pentecostal *cultus.* Those who heard began to preach among their own people. The results: Pentecostalism soon sounded a new key for the lives of several thousand Toba Indians.[7]

The missionaries living in the Toba area were not Pentecostals, but Mennonites. And here two different value systems were put in contrast. Pentecostalism fitted the Toba way. It was strong on group participation, emotional, identification, sharing, and dramatic ritual. The missionaries were sober, individualistic, reserved, hard-working, thrifty, and staid.

Like most culture-blinded missionaries everywhere, these missionaries reacted to Toba Christianity in

terms of their own value systems, and did not like it. They could not understand it, and had no fellowship with it. With all the talk we do in missionary circles about an "indigenous church," the fact is that when one shows up we usually do not like it. We do not like it because if it is indigenous to another culture, it is not like we are, and we do not understand it.

After a visit by Dr. Nida into this complex situation, and at his suggestion, the Reyburns were invited in. They moved into a Toba community and started studying the language, writing a grammar of it, preparing literacy materials, and giving the mission guidance into the beginning of a literacy-literature program. At the same time, the Reyburns were studying the Tobas themselves—their ways of doing things, their ways of organizing life, and of interpreting life. They also studied the nature and function of Christianity among them.

Then began a long series of discussions between the missionaries and the Reyburns as they worked through some of the problems together. Dr. Reyburn was able to unfold to them the basic characteristics of Toba behavior and to point out their implications in Toba Christianity. A role for the missionary in this situation was gradually developed. I cannot go into detail: the report is available. But I would like to quote a few lines from what Albert Buchwalter, of that mission, has written:

> We are now committed to an appreciation of Toba culture. Therefore, we no longer attempt to force the Toba into the Western materialistic mold which seemed to us, unfortunately, to be the most Christian way of life. Furthermore, we are committed to a willingness to work within the framework of piety of the indigenous expression of Christianity . . . We will no longer expect the Toba Christians to approximate "good North American Mennonites," but we will do our best to give them the Word of God in an understandable form . . .
>
> One of my colleagues refers to that day as Victory Toba Day when we as a staff sat down and together outlined the principles to guide our new approach. In God's sight, the Toba believer is just as acceptable as anyone else who has come to Him. What right have I to make the message of life difficult to grasp by dragging in my own culture trappings and giving them divine sanction?
>
> God bless the Tobas, and God bless the Reyburns. I now have a burning desire to give my all to the Toba Church in a way that is intelligible to them. Before, I could see nothing but frustration and futility: now, it is limitless possibilities for God. Before, it was wishing to get away from it all; now, it is a desire to be right there taking part in what God's Spirit is so marvelously doing.[8]

What is the purpose of such culturological investigation as Dr. Reyburn makes? Clearly the reason is that of all science. It is to *know,* and to *understand.* As Christians and as anthropologists we are searching for an understanding of culture and of society as the gospel is communicated there.

And, like most other science, it has its by-products. This knowledge, this glimmering of culture and of communication, helps us to strip off our blinders (or maybe I should say open them wider) and makes us able to see the Holy spirit moving in other milieux than our own. It enables us to co-operate in His movement by staying out of the way, for one thing, and by actively seeking those forms of communication which are revelant in the new situation. It helps us to have fellowship once more with our brethren. As we realize that the Holy Spirit works as fully through their culture forms to make them children of God as through ours, the realization finally comes that all culture is as filthy rags—yes, even ours! And we stand before the Incarnate Son of God naked, ashamed, repentant that we have substituted these tatters for bread and have passed them out in His name to the ends of the earth. We stop amazed, and supremely grateful, that the Holy Spirit worked in spite of us and through us anyhow. The Church around the world is often festooned in a bizarre way by these unlovely rags, but the Church is there. We resolve that the God whose means of communication through His Spirit was to encode His message in us will not so often find us in the way of His encoding it again in the lives of others.

Bibliography and Footnotes

1 2 Samuel 6:16.

2 Genesis 38:8-10.

3 2 Samuel 12:7-8.

4 The editors will be glad to see that sample copies are sent to anyone who may be interested in subscribing and who will send his name and address to *Practical Anthropology,* Box 307, Tarrytown, N. Y.

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*Some Thoughts on a Christian Philosophy of Science**

T. H. LEITH

In every age the most comprehensive thinkers have desired to encompass all that gives depth to life and provides universal application to their system. One has but to glance, however, at the history of such ideas-on-the-large-scale to see that this yearning to find significance has been of many hues and that the cry for profound meaning beyond the triteness and over-simplification of the day has ever been lost in the rise of other voices seeking interpretation in another fashion in a later generation. The plea to evaluate anew carries with it the demand to assess aright, but the impatience of the human leaves the imperative to later re-evaluation and revision.

It is as part of this play, this flux, that the Christian apologete finds his lines. He colors, and is colored by, the issues and struggles of the mind in his day. To whatever extent this blending may occur, it is inevitable. Man is not an isolated thinker; his values, his problems, his desires, and his motivations are part of the spectrum of thought in his contemporary world. Asking, as he does, for all to recognize the eternal significance of his message, the Christian thinker must see himself in this light. An apologetic for Christianity is always a plea with the concepts at hand, that is with the problems and ideas of the contemporary scene. Whatever may be the timeless values involved, an attack on the compartmentalizing of experience or thought must be seen in turn as incomplete and hasty in the defence of the *future* apologete.

The Christian as a scientist should view himself in this light in at least the following several ways. He must first grant the present limitations of his discipline and seek to ascertain, as far as he is capable, their extent. Thereby, his defence of science to the critic within and without the church will be shored with the proper bulwarks and emphases. Next he must see the philosophy of science as a varied thing, a method and a set of results not universally agreed upon as to meaning or epistemological derivation. To the extent that this is understood, the Christian researcher in nature cannot fail to place himself, at least roughly, within certain streams of philosophical thought and to understand his outlook on the relationship of science to his religious beliefs so much the better. Then it is necessary to attain a feeling for the past and the future. Neither philosophy nor science is unchanging in scope or significance. Whether gaining new knowledge or simply clarifying insight and meaning, neither leaves any man or generation with the final axiological orientation. Just, then, as humility demands that we grant what is tentative explicitly, it asks us to show care in giving finality to what may implicitly and covertly need re-assessment. But it asks more: it hammers home the need to restate ancient problems, to clarify old solutions, and to examine the credibility of the arguments of the apologete for the faith in whose steps we now tread, just as ours must be examined by our contemporaries and future friend or foe.

It is in the shadow of these points that I should like to turn to the remainder of this paper. I hope it is unnecessary to remind ourselves that in so attenuated a scope one can but be both audacious and timorous; audacious in suggesting on the small scale what needs study in the grand manner as part of a whole and timorous in requesting a hearing for a tentative Christian evaluation of what is itself tentative - science and its philosophy.

Our problem begins with the late medieval period for it is here that modern science is born. Bringing together the Greek and Christian ideas of a rational universe capable of being, at least imperfectly, reflected upon by the human mind, the necessary presuppositions for the study of nature under the sustaining of a creator God appeared to be provided. But at once strains implicit in Aristotelian metaphysics as well as in earlier church thought showed up explicitly in the tensions developing around systematic attempts to correlate nature and the revelation of Scripture. One has but to recall the Arabian neo-Platonic interpretations of Aristotle, which so color the thought of the period, to see the germs of strife. The Averroists had taught an eternal creation by an eternal God. Thomas Aquinas replied that since the essence of things in the universe is independent of time, logic cannot show that God necessarily willed it in time rather than in eternity. While holding that revelation showed a temporal origin to the universe, his views on matter as pure potentiality brought to actuality by secondary causes is basically one with the Arabians in a continuous creation. Too, in the doctrines of distinct philosophical and theological truth in Albertus Magnus, the superiority of the will to the intellect in Duns Scotus, and the sharp distinction of faith from experience taken as the only source of knowledge in Occam we see the roots of the later divi-

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sion of science from theology. We are told today that science has returned from antagonism to dwell in peace once more with Christianity. One may well wonder if it ever has lived in actual harmony.

Three roads lay then, and lie now, open in the realm of science and its relation to the church. One may reject the spiritual (or at best dichotomize it) and after Francis Bacon's claim to a new key to knowledge, a multitude of great minds and lesser have followed this road. On the other hand, one may react as did St. Bernard in feeling that spiritual satisfaction lies in a neglect of nature as a source of truth. He did this to the point of divorcing the spiritual from nature and atrophying the senses. This led to a Manichean misapplication of ascetism in treating the body and nature as evil and the spirit alone as good. Neglecting Augustine's polemic against this travesty of God's creation, the strain grew into pietism and its refusal to take the beauties of nature seriously save as part of a doomed creation. Leaving the "old nature" became the avoidance of *all* nature! As with the first road in the secular realm, this road is frequently followed in the Christian church.

The third way is rather obviously a synthesis or transcendence. This is the way of the great systematic theologians, of the antideistic writings of a century and more ago, of Catholic philosophers in the grand manner, of Descartes and Berkeley, and of contemporary Protestants such as Tillich, Heim, Reinhold Niebuhr, Tennant, and the personalists in the more liberal wing and Dooyeweerd and the Dutch school with varied British and American writers of note in the more conservative camp. Reflecting for a moment on the great diversity of opinion encompassed in these attempts, it is soon apparent that unity of science with theology must be variously construed and resolved, and that the solution of one man or school may not be the resolution of contemporary or later apologetes facing the same task. The roots of this diversity in developing a coherent world view are complex and difficult to clarify, let alone overcome. Of course, they cannot be explored here, but rather, let us look at a contemporary challenge to all who would synthesize and, by means of suggestions as to its resolution, provide thought for subsequent discussion on future possibilities of unification.

In the 20's a new spirit (for it refuses to be called a school) arose asking for serious analysis of syntheses of the type mentioned above. At first flush, it claimed to show that the metaphysician, Christian or no, could no longer stand in profundity and truth at once. His debates in the past were construed as profound nonsense and his speculative systems construed only as possible and not certain at best, or only as consistent speech far from the facts of experience at worst. Such a charge, if correct, shakes and topples all past and all future Christian views of God and nature. In logical positivism as represented by Carnap, Feigl, Neurath, Godel, Kraft, and Schlick (along with kindred spirits such as Reichenbach, Popper, and Wittgenstein) the synthesizer became a mere verbalizer and statements of faith and revelation became meaningless since not empirically based. Surely this is a truly scientific philosophy - but if it is, it leaves no room for the Christian.

Today there are hardly any old positivists of this strictly empirical tendency of thought, but while it lasted, it exerted a tremendous and continuing influence on what James called the "tough minded." Its progeny still refuse truth to other than that based on sense but they do allow meaning to the theologian and the traditional philosopher, but a meaning only as imperative or emotive. To state that God is creator means only that this is what I like to believe or that it is what I would like you to believe or God to be. Propositional truth in revelation and truth in systematic theology and Christian philosophy are negated. Starting as an attempt at understanding rather than as an explicit attack on Christian belief or as an attempt at another philosophical system (neither of which it allows as the task of philosophy), it turned at worst to a hidden enemy masked as a neutral questioner and at best to the removal of prejudiced ideas and attitudes and the unfolding of new realms of discussion.

Modern analytic philosophers construe a statement as an assertion if it has factual meaning, that is, if some possible sense experience could bear evidence against it. Only thus can a statement be weighed as to truth or falsity. However, though this ends the task of science, philosophy can go beyond to clarify what sense experience has given us to know and to show us what is meaningful and meaningless in the way we write and talk about it while, as mentioned above, it can study *other* uses of language such as for ethical or religious purposes. But if the Christian believes that God has spoken to him in Scripture and through the Spirit to reveal truth beyond the senses and about creation as a whole (both areas analytic philosophy refuses to countenance) his criterion of truth *cannot* be sense. Are not other experiences, however, implied as giving truth or at least tending to count for it? It is true that much study is needed here on the distinction between inspiration and illumination and on public checks for such truth, but the Christian says that only the eyes cleared by God can see, and one need not define them *a priori* out of existence on the challenge of the apostate.

Yet there are items of faith, axioms if you will, which are not readily obviated by experience. We pray, but regardless of the consequences, we state that God answered. We say God is good and somehow feel no amount of apparent evil can weigh against this. We say God created, but we cannot prove that the universe ever began and have no idea what an *ex nihilo* creation

could be like. I suspect it is about time theologians in the conservative camp began to sound less like they thought that when God speaks to man He speaks just as man to man though with different content and to realize when they talk about creation and miracle they deal with the unique and that statements about them are not like other historical or observational remarks. Theology is not natural theology and faith is not philosophy. Christian dogma demands that one realize it is not just sanctified rationalism and to this degree the neo-Orthodox has had a salutary influence when he tells us that religious experience and statements about it have not identical truth content or validity.

Here, to my mind, lies the heart of the problem of a Christian philosophy of science. Supposing I ask not just that one get some inner satisfaction from doing what he thinks is the will of God in pursuing a scientific career, but that he make sense when he says that he sees the design of God in nature and from the fruits of his labors he get actual intellectual satisfaction as he better understands the greatness of God. Does he really see God as good, rational, and powerful in the human sense? Does nature have implicit in its glories the hand of God for all to see and can they see when it is pointed out to them? Or, is he rather saying that, believing as he does that God created and sustains nature, what he sees must be illustrative of what God means when He says He is good, rational, and potent? Is he saying that nature has glories the Christian cannot neglect for God gives them to man but that all cannot see and hence, miss the thrill of being a God-illumined scientist?

I am sure that these questions are as old as the Bible. Common grace, natural theology, and mystical illumination are old issues in the church. Apparently the breaches are still wide. However, I will show some of the audacity mentioned earlier and in timerity place them in contemporary colors. As mentioned above, the Christian claims that all men have experiences beyond sense and that *he* has additional ones. Is it not apparent then, that truth for him can be more broadly conceived than it is for the unregenerate, and does not this imply that, say as a scientist, he thereby conceives of his task and its results differently than his fellows? Is he not also saying that his belief *in* God contains religious elements of experience beyond his beliefs *about* God? But what about these? The former is the notoriously difficult area of religious crisis, though unlikc the neo-Supernaturalist, I conceive it as having intellectual content. It also has elements of will, apparently moved by God, and at this point it lies beyond truth and falsity.

As to the latter beliefs, one may inquire whether in a sense they are not presuppositions in the eyes of the unbeliever, that is, prejudices deciding how assertions are to be set up and interpreted. I think that they are attitudes and that they are axiomatic and there is no skeptical argument that cannot be so interpreted by them as to lose its power. Here is where the Christian scientist says that as sinner his fellow simply cannot see as he does, hence cannot appreciate why his challenging problems lose their weight to the Christian. But one must remember that much weighs in favor of these axioms also. They are not the product of blind faith - they are the result of the peculiar experiences of the Christian. Hence, we may say that, for example, nature in general reveals God clearly to him who already believes because particular experiences within the totality of God's creation give credence to such belief.

Of course, all is not yet clear. To say to the skeptic that his arguments can never change us since, as far as he is concerned, our beliefs are axiomatic is not to say that in the totality of our experience, inclusive of those of which he knows nothing, they do not enter in. Experience of apparent evil and imperfection in nature will always carry weight along with other experience in trying to make coherent God's goodness and His omnipotence. The non-Christian simply has not all the factors and tools of value judgment that we do. He can, with his lights, theoretically have a coherent evil universe. But one may ask again whether the evidence *should* ever change the Christian's belief. I think not, if God cannot change. It is a hypothesis one may ignore. However, whether it *could* change it is obviously answerable in the affirmative as some later claim to disbelieve. The value judgments have changed, possibly because of change in the will. Into this problem of the securtiy of the believer and intellectual carnality I cannot go.

Let us then sum up by saying that at one level (to the world) our belief is axiomatic and fundamental. At another level (in our personal life) belief *has* partly an element of will and *is* a value decision. Here lies the risk which makes it faith. Here lies the area in which our statements of Christian belief remain assertions capable of verification of falsification. They not only have meaning but truth also. "God creates and sustains," "nature reveals God's goodness" and so on, are statements capable of being true and believed to be so. They may be analogical and such terms as "create," "good," and "sustain" may change somewhat radically in talking about God or as He reveals Himself in Scripture. But the demand for some univocal element between our concept and God, necessitated by the fact that otherwise, any word could equally well be used to describe God, leaves science with the capability of studying, in part at least, what God means when He talks in Scripture about nature and His relationship to it. The question of the univocity, the adequacy of the analogy, is a task, on the other hand, for the philosophy of science on the grand scale. It is a challenge, but then that is the spirit of science and of the life of the intelligent Christian.

The Concept of "Kinds" In Scripture☆

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There is a need today for clarification of evangelical thought about the Scriptural statement that God created various forms of life "after their kinds." Russell Mixter has said, "Creationists of today are not in agreement concerning what was created according to Genesis;"[1] and it is not difficult to add to the clear examples he cites. On the one hand, Byron Nelson, in his apologetic work, *"After Its Kind" The First and Last Word on Evolution,* has said, "While the Bible allows that new varieties may have arisen since the creative days, it denies that any new species have arisen."[2] On the other hand, Mixter himself has said:

> One should not insist that "kind" means species. The word "kind" as used in the Bible may apply to any animal which may be distinguished in any way from another, or it may be applied to a large group of species distinguishable from another group . . . there is plenty of room for differences of opinion on what are the kinds of Genesis.[3]

Neither writer, however, presents exhaustive evidence on the matter, though the latter's stand has been accepted, apparently without further investigation, by creationists such as Bernard Ramm[4] and Wilbur Bullock.[5]

The purpose of the present study is to define the concept of the word *min* in Scripture, using an inductive and, it is hoped, an objective a method as possible: that is, avoiding the explanations of lexicons and other ready-made definitions, except to illustrate conclusions otherwise reached, to examine the etymology, form, and contexts of *min* in the Hebrew Bible. This is, however, done with two basic principles of approach in mind. (1) Scripture must not be forced to say more that raises questions with secular science than the text actually requires. To establish as close a harmony as possible between science and Scripture is the desire of us all. (2) Scripture must be treated as important, and indeed determinative, for evangelical scientific thought, once its irreducible contribution has been determined. We cannot dismiss as uninspired or irrelevant such conclusions as we may be able to reach from its study. Nelson seems correct, in his approach at least, when he says,

> The Bible is not a textbook of science. In the first chapter of Genesis, however . . . the Bible speaks clearly *and finally* on a matter of biology,[6]

namely, the created kinds. It is the feeling of the writer that Ramm, in his recent revision of *Protestant Biblical Hermeneutics,* has sacrificed the essential authority of Scripture when he allows that "The Bible is errant in historical, factual, and numerical matters, which do not affect its faith and morals," and limits its infallibility to matters of these latter categories.[7]

I. Etymology

Two etymologies have been proposed for the word *min,* "kinds." Some suggest a root meaning to "think out, invent,"[8] with which is connected the noun, *temuna,* meaning "form". Derivation from this root, however is generally rejected;[9] and there is preferred the root found in the Arabic meaning to "split (the earth in plowing)."[10] This is favored, first, by the meaning assumed by *min* in the post-Old Testament Hebrew: in the inter-testamental Hebrew Apocrypha and in the post-Christian Mishna it means sub-division or species of animal,[11] and in the Talmud it describes a schismatic, a (Christian) heretic. Second, in the related Syriac, *min* refers to "family." or "tribe"; compare in this regard how *min* in Gen. 7:14 has at its parallell in 8:19, *mishpaha,* "family." The etymological meaning of *min* appears to be that of a split, a division.

II. Form

The word *min* occurs 31 times in the Old Testament, as noted in Col. 1 of the accompanying chart, sufficient to provide a fair sampling of forms. Furthermore, assuming the Mosaic unity of the Pentateuch, one finds 30 of these instances to be the product of one author, Moses, while the last is by Ezekiel, a Biblical writer whose style and spirit closely parallels that of the Pentateuchal codes.[12] An investigator is here in a position to draw valid overall conclusions.

Three observations immediately appear. (1) *Min* is always used with the preposition le, "to" or "in respect to, according to." It's purpose is to provide specification, as Driver notes, in "technical enumeration."[13] (2) *Min* always occurs in the singular in respect to the type of life it describes. This is significant because in some cases the life described is plural, for example, Ezek. 47:10, "Their fish shall be after their kinds, as the fish of the great sea, exceeding many." Since the fish of the sea are varied, *min* must be translated in the plural, "according to their kinds," even though the form of the noun is singular. It must, in other words,

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be a collective noun,[14] cf. Eccles. 43:25, "all kinds of living things." It is because of this collective nature of *min* that lexicons may insist upon the generic character of the life in each case described;[15] and Keil, in commenting on Lev. 11:14, states, "The use of the word [leminah, 'after its kind'] shows that the [da'a, 'kite'] is intended to denote the whole genus."[16] (3) *Min* is always followed by a suffixed pronoun, five kinds of which appear: (a) the regular, short masculine form, "his (its) kinds," marked "(Ms)" in Col. 2 of the chart, for example, reference 1; (b) the longer masculine form, unusual in most nouns, its appearance with *min* being classed as an "isolated case,"[17] but with no distinctive significance as to meaning; it is marked "(M1)" in Col 2, for example, references 2 and 3; (c) the regular feminine, "her (its) kinds," marked "(F)", for example, reference 6; (d) the feminine with the letter he, with raphe instead of mappiq, but with no distinctive significance, reference 31; and (e) with the masculine plural, "their kinds," reference 4, a difficult form because of the séré connecting vowel, *leminehem*. Kautzsch-Cowley hesitates between two explanations: "orthographic omission of the [yodh] before suffixes"; which would make *min* a true plural but then he refers to an earlier paragraph, "The *kethiv* perhaps intends the singular, but the Masora require the plural with defective e. which would keep the original text, as elsewhere, singular."[19] But even if the former be the explanation, the fact that the word describes a series of two generic groups, Gen. 1:21, still allows *min* in the singular to be considered as a collective. The consistent appearance of these pronoun suffixes further substantiates Driver's conclusion that the purpose of *min* is to provide specification, in a formal "document-style."

From the study of the etymology and the forms of *min* the following conclusion appears: *min* must refer to subdivisions within the types of life described and not to the general quality of the types themselves. This latter is the error of H. W. Clark, who paraphrased "the things after their kind" into, the things "as He had created them,"[20] "the idea in God's mind of what each type of animal should be."[21] But as indicated above, "fruit trees after their kind," Gen. 1:11, for example, cannot mean "fruit trees in their general class of Dicotyledones," but, from the nature of the term *min,* must mean "fruit trees in their various subdivisions that make up the class Dicotyledones." *Min* in this paper is therefore translated "kinds" (plural), and the chart is entitled, "Forms of life, the *subdivisions* of which are called 'kinds.' "

III. Context

The forms of life in Scripture that have *min* subdivisions are listed in Col. 3 of the chart, with their translation according to Koehler, the latest Hebrew lexicon,[22] in Col. 4. The assignment of species in references 18-27 are also those given by Koehler, though in no case does more than genus seem to be intended by the Hebrew word. Reference 27 is unknown; and some of the others are not certain. Also, scientific classification is not wholly settled. It is hoped, however, that the chart approximates modern thought and may clarify the usage of *min*. At certain points the translation in Col. 4 has been supplemented from Driver's standard commentary on Genesis,[23] because the same Hebrew word may have different meanings in different contexts: behema, for example, in references 6a, 9, and 15 means cattle; but in reference 12 the same word must include the larger wild animals as well.

References 1-10 concern God's creative activity and are therefore of primary importance. The scientific classification of each form, as best this can be determined,[24] is given in Col. 5 and following. Both biological kingdoms are defined by the term *min*, but mostly animals, zoology. *Min* defines the distinct divisions of phyla and also classes. Mixter has observed, "The herbs [reference 2] are set off from the grasses which are also members of the same class . . . Angiosperms"[25]; but with the distinction between Monocotyledones and Dicotyledones, it appears that "herbs" may refer to the subdivision of the latter class. This accords with Mixter's tentative conclusion: "It is conceivable then that the 'orders' of the paleontologist correspond to the 'kinds' of Genesis."[26] But it should also be noted that *min* appears to refer to the subdivisions within orders too. Reference 4a, the large serpents, tempts one to suggest the extinct order, Dinosauria; but in any event they can hardly be the whole class of Reptilia. Likewise the cattle, 6a, and the wild beasts, 6c, whether their exact orders be as noted, are still divisions within the class Mammalia, and each in turn has its subdivisions, the *min*. The conclusion to this study of the use of *min* in Genesis 1 is therefore as follows: while *min* does not here require the separate creation by God of each species, it does require at least the separate creation of families within orders. But it would seem to allow for evolution within a family, such as Equidae, "horses" and thus agree with part of Mixter's conclusion: "Within the orders and families, there appears to have been descent with modification, as in the series of horses."[28]

But there remains to be considered Moses's use of *min* in the rest of the Pentateuch. References 18 and 20 refer to divisions within the one order of Falconiformes, yet both of these families have subdivisions called *min*. Similarly, the forms of life in references 22-25 all belong to the order Orthoptera; and three of these, 22, 23, and 25, to the family, Acridiidae, each of the three genera having subdivisions called *min*. No two references, however, concern the same genus, as though species had subdivisions called *min*. Driver has therefore come to this conclusion to explain the use of *min* in the Bible:"The addition calls attention to

the number and variety of the different species included under each head."[29] Thus to say that *min* means "species" creates no problem for a liberal like Driver, who is not committed to the truth of Scripture in any event. But neither does it seem, necessarily, to create insuperable difficulties for Bible believers who would yet be respectable scientists, and for two reasons. (1) Creations by God do not have to be unique. Carnell has stated, "God may have elected to create man and the higher animals with similar forms",[30] and Ramm's position, as he has stated it, is: "We accept progressive creationism, which teaches that over the millions of years of geologic history God has been fiatly creating higher and higher forms of life."[31] (2) From the separate creation of species there does not have to follow Linnaeus's fixity of the species. Clark has developed this thought at some length:

> Naturally, it should be taken for granted that God intended all kinds to propagate as He had created them, but there is no fiat forbidding, biologically, a perversion of His plan . . . Evidence supports the conclusion that a perversion of the original plan did take place.[32]

One final question remains, namely, granting that Moses intended *min* to represent something corresponding to species in Leviticus and Deuteronomy, did he have the same thought in mind in Genesis? Moses did not use terms with modern scientific precision; and Edwin Brewster has postulated that, " 'after its kind,' is only the way of saying 'all kinds of.' "[32] So then "birds after their kind" would mean simply "all kinds of birds" and signify little if anything about the creative unit. But Moses does not seem to be using this "shotgun" technique: he specifies "*every* winged bird after its kind," Gen. 1:21; and, although he probably could not have given a water-tight definition of "species," he seems to be intending every different type of bird ordinarily distinguished. References 18-21 show that Moses' thought about the *min* of reference 5 extended at least to genera. Furthermore, *min* has been shown to be a term for technical enumeration; and it is used in no other, more conversational, way in Scripture. Hebrew lexicons unite in stating that *min* in Scripture has one, and only one meaning, namely "species."[35] If the Bible is indeed God's words it would appear that serious, consistent thinking is needed in respect to the extent of His creative activity.

Notes

1 *Creation and Evolution* (Monograph 2: Wheaton, Ill.: American Scientific Affiliation, 1948), p. 1.

2 (2nd ed.: Minneapolis: Augsburg, c. 1927) p. 21.

3 *Op. cit.*, pp. 3, 5.

4 *The Christian View of Science and Scripture* (Grand Rapids: Eerdmans, 1955), p. 288.

5 "The 'Kinds of Genesis and the Species' of Geology," *Journal of the American Scientific Affiliation*, 4, 6 (June 1952), p. 5.

6 *Op. cit.*, p. 19.

7. (Boston: Wilde, c. 1956), p. 182.

8 Ludwig Koehler, *Lexicon in Veteris Testamenti Libros* (Leiden: Brill, 1953), p. 519.

9 John Skinner, *A Critical and Exegetical Commentary on Genesis* (New York: Scribners, 1910), p. 24.

10 Brown, Driver, and Briggs, *A Hebrew and English Lexicon of the Old Testament* (Oxford: Clarendon, 1952), p. 569.

11 Eccles. 43:25.

12 "The parallels with the Holiness Code are particularly striking . . . Ezekiel obviously assumes that these rules of conduct are familiar to the exiles." Robert H. Pfeiffer, *Introduction to the Old Testament* (New York: Harper and Bros., c. 1941), p. 550.

13 *The Book of Genesis* (Westminster Commentaries; London: Methuen, 1909), p. 9.

14 *"After its kind,* rather, *after its kinds*, the word being collective," *loc. cit.*

15 Brown, Driver, and Briggs, *op. cit.*, p. 9, relative to *ayyā*.

16 *Biblical Commentary on the Old Testament* (Translated by James Martin; Edinburgh, T. and T. Clark, 1873), II:361-362.

17 E. Krautzsch, *Gesenius' Hebrew Grammar* (2nd English ed.; translated by A. E. Cowley, Oxford: Clarendon, 1910), p. 255, sec. 91d.

18 *Ibid.*, p. 257, sec. 91k.

19 *Ibid.*, p. 255, sec. 91c.

20 *Genes and Genesis* (Mountain View, Calif.: Pacific Press Pub. Assn., 1940), p. 97.

21 Mixter, *op. cit.*, p. 3.

22 *Op. cit.*

23 *Op. cit.*

24 Moses was not aware of modern taxonomy! The Hebrew words may have less precise meanings than the classification of the chart suggests, cf. Mixter's discussion, "Genesis and Geology," *Christian Opinion*, 3, 4 (July 1946), p. 119.

25 *Loc. cit.*

26 *Ibid.*, p. 120.

27 Also listed as reference 7, for while they appear to be one of the three divisions of the 6th appearance of *min.*, they also have the 7th *min* of Scripture listed with them particularly.

28 "Genesis and Geology," p. 120.

29 *Op. cit.*, p. 9.

30 *An Introduction to Christian Apologetics* (4th edition: Grand Rapids: 1952), p. 238.

31 *Christian View of Science*, p. 256.

32 *Op. cit.*, p. 98.

33 *Creation* (Indianapolis: Bobbs-Merrill Co., 1927), p. 65.

34 F. E. Hamilton's conclusion seems equally invalid, "These original creations were in some cases species (as man, for example), in other cases, genera, in others families, and possibly even orders of life." *The Basis of Evolutionary Faith* (London: J. Clarke, 1931), pp. 92-93.

35 Brown, Driver, and Briggs, *op. cit.*, p. 569; Koehler, *op. cit.*, p. 519.

Old Testament Forms of Life, the Subdivisions of Which Are Called *min*, "Kinds"

	Reference	Translation (Amer. Stndrd. Version)	Hebrew	Subject Kohler's Lexicon	Kingdom	Phylum	Class	Order	Family	Genus	Species
1	Gen. 1:11	Fruit trees bearing fruit after their kind (Ms)	es p'ri	fruit trees	Vegetable	Spermatophyta	Dicotyledones				
2	Gen. 1:12	Herbs yielding seed after their kind (M1)	esev	herbage	Vegetable	Spermatophyta	Dicotyledones		(as oppcsed to grass, v. 12, Monocotyledones)		
3	12	Same as No. 1 (M1)	tannin-	sea monster,							
4a	Gen. 1:21	Great sea monsters (included with next)	gadhol	large serpent creeper (glider,	Animal	Chordata	Reptilia	Dinosauria?			
4b		Every living creature that moveth, wherewith the waters swarmed, after their kind	romeseth	fish, Driver)	Animal (all from here on)	Chordata	Pisces				
5	21	Every winged bird after its kind (M1)	of kanaf	birds		Chordata	Aves				
6	Gen. 1:24	Living creatures after their kind (F)				Chordata					
6a	24	Cattle	b'hema	cattle		Chordata	Mammalia	Artiodactyla		(large quadruped domestic animals, Driver)	
6b	24	Creeping things (of the ground, v. 25)	remes	small animals, creeping rept.		Chordata	Amph., Rept., Mammalia	Rodentia, etc.			
7(6c)	24	Beasts of the earth after their kind (F)	hay'tho-eres	(wild animals, Driver)		Chordata	Mammalia	Carnivora, etc			
8	Gen. 1:25	Same as No. 7 (6c) (F)									
9	25	Same as No. 6a (F)									
10	25	Same as No. 6b (M1)		(So far: references in which the **min** are the subjects of divine creation)							
						(Other references to the **min**)					
11	Gen. 6:20	Birds after their kind (M1) (See above, No. 5)									
12	20	The cattle after their kind (F)	b'hema (as No. 6 a)	(large quadrupeds, wild and domestic, Driver)		Chordata	Tetrapoda	(super class)			
13	20	Every creeping thing of the ground after its kind (M1) (See above, No. 6b)									
14	Gen. 7:14	Every beast after its kind (F) (See above, No. 7)(6c)									
15	14	All the cattle after their kind (F) (See above, No. 6a)									
16	14	Every creeping thing that creepeth upon the earth after its kind (M1) (See 6b)									
17	14	Every bird after its kind (M1) (See No. 5)									
18	Lev. 11:14	The falcon after its kind (F)	ayya	black kite		Chordata	Aves	Falconiformes	Accipitridae	Milvus	migrans-migrans
19	Lev. 11:15	Every raven after its kind (Ms)	orev	raven, diverse species		Chordata	Aves	Passeriformes	Corvidae	Corvus	
20	Lev. 11:16	The hawk after its kind (M1)	nes			Chordata	Aves	Falconiformes	Falconidae	Falco	peregrinus-pelegrinoides
21	Lev. 11:19	The heron (mg: ibis) after its kind (F)	anafa	heron?		Chordata	Aves	Ciconiiformes	Ardeidae		
22	Lev. 11:22	The locust after its kind (Ms)	'arbe	migratory locust		Arthropeda	Insecta	Orthoptera	Acrididae	Schistocerca	peregrina
23	22	The bald locust after its kind (M1)	sol'am	edible locust		Arthropeda	Insecta	Orthoptera	Acrididae	Tryxalis	nasuta
24	22	The cricket after its kind (M1)	hargol	a kind of locust		Arthropeda	Insecta	Orthoptera	Tettigoniidae	Tettigonia	vividissima
25	22	The grasshopper after its kind (M1)	hagav	locusts		Arthropeda	Insecta	Orthoptera	Acrididae	Stauronotus	maroccanus?
26	Lev. 11:29	The great lizard after its kind (M1)	sav	thorn-tailed lizard		Chordata	Reptilia	Squamata	Agamidae	Uromastix	spinipes
27	Dt. 14:13	The kite after its kind (F) note: context opposes the proposed emendation. cf. Lev. 11:14) into	dayya da'a	undefinable bird red kite		Chordata Chordata	Aves Aves	? Falconiformes	? Accipitridae	? Milvus	? milvus-milvus
28	Dt. 14:14	Same as No. 19 (Ms)									
29	Dt. 14:15	Same as No. 20 (M1)									
30	Dt. 14:18	Same as No. 21 (F)									
31	Ezek 47:10	Fish after their kinds	daga	fish (Collective)		Chordata	Pisces				

BOOK REVIEW

Discovering Buried Worlds. By Andre Parrot: New York: Philosophical Library. 1955. 128pp $3.75

The Flood and Noah's Ark. By Andre Parrot. New York: Philosophical Library. 1955. 76pp. $2.75

The Tower of Babel. By Andre Parrot. New York: Philosophical Library. 1955. 75pp. $2.75

Nineveh and the Old Testament. By Andre Parrot New York: Philosophical Library. 1955. 96pp. $2.75.

Reviewed by Richard C. Turner, graduate student at Wheaton College and graduate assistant in anthropology.

These volumes are the first in a series of brief studies in biblical archaeology. Six of the seven volumes are by Andre Parrot, Curator-in-Chief of the French National Museums, professor at the Ecole du Louvre and director of the Mari Archaeological Expedition. Dr. Parrot states that his purpose in writing the studies was to share these findings "because of the powerful light they throw upon the religion and beliefs of a people in search of the supernatural forces which dominate them and on which they depend." (Vol. 1, p. 10)

The introductory volume, *Discovering Buried Worlds*, illustrates the work of an archaeological expedition by reporting the methods and results at Mari on the Euphrates. Then a rapid sketch of archaeological history in the eastern arm of the Fertile Crescent is presented followed by an outline of the ancient civilizations of that area. A final chapter relates discoveries to the biblical record. The author is quite friendly toward the Bible though his theological implications should be treated cautiously.

Holding to the documentary hypothesis of the Pentateuch, the author states in the volume of *The Flood*, that the account found in documents J and P are based on the Mesopotamian tradition revised to a monotheistic viewpoint. The second part of this volume covers a description of the ark and the attempts to find it.

Parrot feels that the Tower of Babel, rather than being an "expression of man's pride" was "a hand stretched out in supplication, a cry to Heaven for help." (p.9) The biblical tower is identified with a ziggurat in Babylon. Ziggurats throughout the Mesopotamian area are discussed, literary accounts from Genesis to Herodotus are investigated and even a chapter on "The Tower of Babel in Art" is included.

Mentioned in Genesis, Nahum, and Jonah, Nineveh, the author claims, is one of the oldest Mesopotamian cities, dating back to around 4,000 to 5,000 B.C. A survey of its exploration is followed by a chronological record from biblical and archaeological sources. Nineveh was the capital of Assyria during Sennacherib's time (7th century B.C.) and housed the voluminous library of Ashurbanipal (7th century B.C.) A difference between the biblical record and Assyrian documents as to the conqueror of Samaria is mentioned. The Bible states that Shalmaneser was the victorious king while the Assyrian documents claim the capture for Sargon II. The siege lasted three years. J. P. Free suggests in *Archaeology and Bible History* (pp. 199, 200), that Shalmaneser might have made the capture at the end of his reign with Sargon, his successor, taking all the credit. There appears to be no mention of this victory in Sargon's earliest records. This is cited as indicative of the suggestion.

The other volumes in this series are *St. Paul's Journey in the Greek Orient* by Henri Metzger; *The Temple of Jerusalem* and *Golgotha and the Church of the Holy Sepulchre*, both by Andre Parrot. All are brief but useful for quick reference or a general outline of their subjects.

Archaeology and the Old Testament. By J. A. Thompson. Grand Rapids: Wm. B. Eerdmans Publishing Co. 1957. 121pp. $1.50.

Reviewed by Richard C. Turner.

Another volume in the Pathway Book series—designed to keep Christians informed on major subjects and problems in contemporary religious thought—has recently appeared. The author, an Australian, has done archaeological work at Jericho and Dibon, been Director of the Australian Institute of Archaeology and has taught in the field of Old Testament Studies in theological colleges.

Short and compact, it is a readable book dealing with Israel from the time of Abraham until the exile into Babylon in 586 B.C. A running historical narrative serves as the basis for archaeological findings which bear on the Old Testament within these limits.

Little documentation or argumentation is given for positions stated, probably due to the size of the work, so only those points the author considers extremely important receive detailed treatment. The date of the exodus is one of these where 1300 B.C. is suggested with arguments presented for the unlikelihood of an exodus earler than 1319 B.C. or later than 1230 B.C. It is a handy book to have for a general survey of Old Testament archaeological findings.

ANTHROPOLOGY

James O. Buswell III, M.A.

I would like to commend to the readers of this column a unique journal, *Practical Anthropology*. Now in its fifth volume, this journal is published by and for Christian anthropologists, and studies "the function of Christianity in a cross-cultural sense." According to its Statement of Purpose, it is "designed, for example, to be of benefit to missionaries and to students preparing for missions in that it discusses the problems related to an effective communication of the Gospel across cultural barriers . . ."

An idea of the growth of *Practical Anthropology* can be gained from the fact that during 1957 alone its circulation jumped from 350 to over 900, and it's still growing. The subscription rate is $2.00 per year (six issues), or $5.00 for three years. Address Box 307, Tarrytown, New York.

Below is reprinted an editorial from a recent issue (P.A., Vol. 4, No. 3, May-June, 1957, pp. 101-104) by the editor, Dr. William A. Smalley. Mrs. Reyburn, mentioned in the editorial, is Marie Fetzer Reyburn who, with Smalley, authored the Anthropology chapter in *Modern Science and Christian Faith*. She and her husband have contributed many stimulating articles and reports from the field to the pages of *Practical Anthropology*.

Proximity or Neighborliness?

By William A. Smalley, Ph.D.

Missionaries talk about "going out to live among the people" (although anyone who has seen a typical mission compound will not take that cliche too literally), but how many have ever thought of being neighbors to these "people" nearby?

In our western world individuals may be thrown into regular contact, even close physical proximity over long periods of time, and not have more than the most superficial social intercourse, if any at all. This is most true of our large cities where people in adjoining apartments may never meet each other, or if they do, may have no more than a formal and polite social interchange. Even in smaller communities, however, the boss who works daily with his men may have no other contact with them (except for the annual Christmas party), and people who bow in church may never meet during the week.

It is not until we reach the very small rural community in the United States that we find a high degree of neighborliness between people in close proximity, where everybody knows everybody else. An indication of the fact that in our culture we do not always put high value on such relationships is that we may add to the previous sentence: and where everybody minds everybody else's business.

In our highly complex society we have built cultural devices for keeping people close by from being neighbors unless for some reason we choose to include them. These barriers provide a protection for us, keep us from having to associate with people who are not compatible, whose race or education or social status is different from ours. We can withdraw within the barriers for security from people and social patterns which conflict with our own.

Some missionaries live in large cities where this urban pattern of proximity without neighborliness may be well developed. If they bring in their insulating mechanism as part of their cultural baggage it is not particularly conspicuous, although even in the urban setting it may be an almost insurmountable barrier to effective communication on an individual level. Such missionaries have to rely on the mechanics of playing church and mass evangelism to do what has historically been most effectively done by the personal contact of one dedicated soul with his neighbor.

It is in the rural mission areas where proximity without neighborliness stands out in such painfully brutal fashion. Typically, the mission builds a compound on a hill a mile outside of the village. A cluster of huts may be built on the least desirable part of the compound for servants and hangers-on. Non-western school teachers and preachers have their quarter, too. It is hard to imagine a more effective physical way of isolating the missionary from the people "among whom he is living."

But the psychological isolation is far more serious. As one missionary put it. "The Africans know to which missionary door they can go." A conversation which was reported to me is not an extreme case. One missionary had learned that a Bible revision committee which included both Westerners and Africans had refreshments served during the morning, and asked, "What do you do with the Africans?" When he learned that they were served too, he asked if butter tins were brought in for the Africans' coffee. When he learned that they were served from cups no differently from anyone else he was horrified, considering it most unsanitary.

Missionaries protect themselves from the people around them by a host of devices. They may never participate socially either in the local culture or through inviting people into their homes. They may not learn the language really well. They may be contemptuous of the uneducated and revolted by the unclean. They are not interested in the things which interest people. They are therefore remote, distant, and terribly cold.

On a recent trip in Africa I saw two examples of missionary neighborliness which I would like to contrast to the above. One was in the home of Dr. and Mrs. Wesley Sadler, Lutheran missionaries among the Loma people of Liberia. (In their case the "among"

is not figurative.) The Sadlers' home is on the edge of a Loma village, just a few yards from the nearest Africans' houses. It is not, however, that close proximity which makes the Sadlers neighbors, but it is their spirit.

During each evening while I was there, anywhere from two to five or six of the villagers, men and women, would drop in. They would come individually, and stay for just a few minutes. They came naturally, without the embarrassment which marks the entrance of an African tribesman into so many missionary homes. They stopped and chatted for a few minutes, and then left. They were at home. The usual barrier was not there. Equally revealing was the Sadlers' reception of their visitors. It was the reception given someone with whom you are on the very friendly relation of frequent contact. The visit was taken for granted, and it was enjoyed.

Sadlers raised their children under that thatched roof in Woozie, the little Loma village. They studied Loma life and language not just as anthropologists and linguists (Dr. Sadler's Ph.D. is in linguistics) but as interested neighbors. They liked their neighbors and wanted to know them better. I have never seen happier missionaries.

The other example of missionary neighborliness which I saw took place when I was visiting Dr. and Mrs. William Reyburn in the Camerouns. We heard drum beats one evening and went to investigate. A group of students were "playing." They had formed a circle, in which they were dancing and singing, while one person danced in the middle. The person in the center tried to perform some antic which was different from what anyone else had done. When he had finished he would point to someone in the circle who would take his place. Reyburn took a few steps so that they would not think we had come to criticize. He made everybody laugh, and then we sat down to watch.

Before long the dancer in the center pointed to Reyburn there on the bench, and he went into the circle to jump up and down. Before long I had been invited too, and we were all jumping up and down to the beat (I was at least trying) for about half an hour. Once I got over being self-conscious it was fun.

The next day word of the Africans' appreciation came through to the Reyburns: "It is the first time anyone (meaning missionaries) ever played with us."

BIOLOGY

I. W. Knobloch, Ph.D.

Having taught various scientific subjects for many years, the feeling has come to me that students leave the doors of colleges and universities without any concept of the real function of college, of liberal education of science, of academic freedom and many other fundamental issues. Many of these items are not spelled out in so many words in textbooks and little attention is paid to them by either the teacher or the student and yet they seem important to me in the training of future citizens.

With this thought in mind, I pass out to my students the material which follows. I realize that there is no agreement among scholars on many points but it seems desirable to me to have the students carefully consider the issues. If they disagree with my interpretation, they will at least have been exposed to the issue. I trust that the thoughts expressed will be of some use to the readers of this column in their contacts with students.

Viewpoints for the Student to Consider—Note that the views may not be the only possible ones nor are they complete due to space limitations.

What is a University?

It is a place where the mind (thinking and reasoning ability) is to be developed.

It is *not* primarily a vocational institution nor is it for the development of the body.

American supremacy will be maintained in direct proportion to brain power.

A University passes on the knowledge of the past, produces new knowledge through research and guides society through its findings.

It is a place where new ideas, controversial or heretical can be discussed. The heresies of the past become the mores of today.

Why study General or Liberal Education?

The advantages are that one will have a broader background, a wider viewpoint, be more tolerant of fields other than their own, have a better sense of values and be more adaptable in their work. General courses frequently help a student to decide upon a vocation. Executives dislike narrow specialists—they demand a breadth of vision.

Why study Natural Science?

An educated person will know quite a bit about the living and non-living things making up his environment.

A person unacquainted with nature will be frightened by the news of certain scientific advances reported in the daily press and magazines.

A study of the sciences teaches a method of clear thinking useful in many problem situations.

Sciences teaches us certain attitudes such as sticking to the facts, being intellectually honest, of suspending judgement until all or most of the facts are in, and of tolerance. These attitudes are important.

Why should I study in College?

The average persons spend very little time in developing their minds after they leave college. They have not developed a thirst for knowledge-their mental habits are poor--college has failed them. Good habits and attitudes learned in college can be carried over and will

help one to be happier, healthier and generally more successful as a human being.

What is Science?

Science, in the traditional sense, is organized knowledge of the physical and biological world and of the relationships of this knowledge. Botany, zoology, physics, chemistry, geology and astronomy are the main sciences. Mathematics is a tool used by science, social studies, engineering and in other fields.

Kinds of Science

Pure science has curiosity as its base and understanding as its goal. Practical applications are not the end sought except the satisfying of ones curiosity. Examples are the Copernican principle, the theory of evolution and early experiments on spontaneous generation. *Applied* science has practical ends in view from the start. A chemist making new carbon compounds to increase our knowledge of them is a pure scientist while a chemist making carbon compounds to cure cancer is an applied scientist. Both kinds are essential but since the former deals more with theories and understanding, it is considered more basic. America's stock of new ideas is low—survival demands more attention to pure science.

Methods of Working in Science

There are two main methods of operation here. One is the empirical method which consists of obtaining facts by observation and experimentation. Organisms are experimented upon by the factors in their environment and those with harmful characteristics are eliminated. Progressive science can hardly be said to exist without coming to grips with reality, the essential goal of empiricism. Theory goes beyond the facts discovered by empiricism. Deductions (what ought to be true or follow if the statement is true) can be made from empirically-derived facts or from theories. Modern science seems to be a happy blend of both empiricism and theory and both are of equal importance. Theories, whenever possible, must be tested by empiricism or we leave the realm of science and become entirely speculative.

(To be continued)

CHEMISTRY

Walter R. Hearn, Ph.D.

Many of you may be interested to know the outcome of the A.S.A. get-togethers announced in this column in the last issue of the Journal. I haven't had a detailed report yet from the dinner meeting held in San Francisco on April 14 in connection with the American Chemical Society meeting, but I gather that it attracted about a dozen A.S.A. chemists who had a fine evening of fellowship together. Dick Ferm performed a real service in making the arrangements. Derek Nonhebel, a post-doctoral fellow from England who has been here at Iowa State this year, attended the meeting and enjoyed it very much. He told me that several chemists he met there said this had been their first opportunity to get acquainted with other A.S.A. members. Derek, incidentally, is a member of the Research Scientists Christian Fellowship in England, an organization somewhat similar to our own; I hope to pass on to you soon some of the things I have learned from Derek about activities of the R.S.C.F.

Our dinner meeting in Philadelphia on April 17 I can report on first hand. Credit for its success goes to a number of people, including Elmer Maurer of the U.S.D.A. lab in Philadelphia and Wes Clayton, Neal Brace, and Art Nersasian of the active A.S.A. local section in Wilmington, Delaware. Elmer had been considering the formation of a Philadelphia or Delaware Valley local section, and the Wilmington group voted to help out by holding their April meeting in Philadelphia as a joint meeting. I think there were probably about ten A.S.A. members attending the meetings of the Federation of American Societies for Experimental Biology, but several were tied up in other group dinners that evening and weren't able to join us. Altogether there were thirty-two of us, including about fifteen from Wilmington and several invited guests. After an excellent dinner, we introduced ourselves around the table, and then I gave a talk on "Some Conflicts Between Christianity and Science," stressing *internal* conflicts which some of us experience within ourselves, and indicating ways in which participation in the A.S.A. can help resolve such conflicts. I may discuss some of these points in this column from time to time. Incidentally, most of those attending the get-together were chemists, and in the course of the lively discussion following my talk, this question was brought up: "Why should there be a special section devoted to chemistry in the Journal, and what role can chemists play in the A.S.A. *as chemists?*" Now *there* is a good question which some of you might like to toss around a bit in future issues of this column. My spur-of-the-moment answer went something like this:

"I agree that the major areas of apparent external conflict between scientific and Christian thought seem to lie in the domain of physics on one hand and of biology and geology on the other hand, sort of bypassing chemistry in between. In the borderline fields of biochemistry and geochemistry, of course, there is obvious need for discussion of theological implications, of which I am personally very conscious as I see evolutionary considerations moving more and more from straight biology into my own field, biochemistry. However, I think that all of us, whatever our field of specialization, have a real contribution to make to the task of the A.S.A. in hammering out a Christian phil-

osophy of science. Each branch of science has its own patterns of thought, its own way of looking at reality, and an adequate Christian philosophy of science must consider all of these. Chemists have a unique contribution to make because it is they, rather than either atomic physicists or biologists, who work daily with a statistical concept of nature. That is, when a chemist thinks of natural phenomena, he is usually thinking in terms of billions and billions of molecular events, in contrast to a physicist who may be thinking of discrete quantum events and individual electrons, or to a biologist who may be thinking in terms of only several thousand living organisms. The laws of molecular behavior are, after all, based on observations of gram-moles of material containing 6×10^{23} molecules; compare this with the problem of establishing laws of human behavior from observations on a much, much smaller sample. (Have there ever been a "mole" or Avogadro's number of human beings on the earth?) In our Christian interpretation of phenomena, we want to maintain the proper balance between the immanence of God in His creation and His transcendence over it, and our statistical view of molecular phenomena has a place in these considerations. What do we mean by "natural" and "supernatural" when we use these terms? In what ways does the Holy Spirit interact with His creation? When we pray about events which involve, at some level, the movement of molecules, how do we conceive of the ways in which God may act? In general, I think that Evangelical theologians have not grappled with these questions to the extent they deserve. The A.S.A. can at least provide a forum for the thoughtful discussion of such questions, and chemists of the A.S.A. have an obligation to contribute to the discussion with those particular tools of thought which the Creator has given us to use for His glory."

Well, maybe this will serve to open up the discussion in this column! I'm sure many of us feel that there is little direct theological implication of what we ourselves do in the laboratory. We learn such insignificant things about such a tiny corner of a restricted area of a specialized branch of only the particular discipline in which we have trained! What do we really know of "Science" even though we work at it day by day? But why shouldn't we, as Christians, be more alert to relate what we are doing to all that anyone else has learned, and to bring these things together in a Christian philosophy of science? Even if our individual contribution is but a partial one, why should we not try to glorify God through making it? Someone else may build upon our ideas, or, by seeing the shortcomings of our ideas, be led to better ones. I must admit, in my own case, that taking this attitude has made my teaching and my own research seem more exciting and has stimulated me to read more widely and think more deeply than I had before. What role can chemists play? Well, there is always a need for scholarly, well-informed papers for our Journal and for our Annual Convention programs. If you feel you are not yet ready to tackle such a major project, why not begin on a smaller scale by contributing some briefer comments to this column? In this way you might pose questions which you think are significant and stimulate others to continue their discussion in later issues. And if you prefer to begin on a still more modest scale, the Editor will welcome your contributions to his "Of Interest" column. These may be very brief comments on articles you have run across in the literature of possible interest to other A.S.A. members in line with the purposes of the Affiliation.

I do think that getting acquainted with each other is a good idea, so I'll continue reporting on your activities as I hear from you, at least until we have all "checked in."

Richard A. Hendry is now Assistant Professor of Chemistry at Texas Technological College, Lubbock, Texas. Dick did his Ph.D. work with me in biochemistry at Baylor Medical School. Part of his thesis problem on amino acid chemistry was published last year in JACS. His post-doctoral year was spent at the U. of Illinois in a study of the structure of some lipocarbohydrate compounds from wheat flour, one of which showed indications of being a plant cerebroside, and which is still being investigated. Now he is starting some research on his own, along lines discussed in his paper, "Physico-Chemical Synthesis of 'Biological' Compounds," in the last issue of this Journal. Dick is experimenting with the synthesis of pyrimidines from very simple compounds under conditions which might shed some light on mechanisms of the original formation of living things. Here is an excellent example of the preparation of a paper for the A.S.A. serving as a stimulus for research, and vice-versa. Dick is a coauthor of the chapter on "The Origin of Life" for our Darwin Centennial Volume. He joined the A.S.A. in 1954 and has attended every Annual Convention since. Dick has participated in IVCF activities on several campuses in the past but is now trying to take a more active part in his local church; in a recent letter he says he has even taken a crack at preaching in a Presbyterian church in a little town near Lubbock.

Edmund C. Kornfeld is a Department Head in the Organic Chemical Division of The Lilly Research Laboratories of Eli Lilly and Company, Indianapolis 6, Indiana. Ed received his Ph.D. from Harvard in 1944 and has been at Lilly since 1946. He kindly sent me his bibliography of some nineteen papers in JACS and J. Org. Chem., mostly dealing with heterocyclic medicinal compounds. The research interests of his department cover most of the fields of medicinal chemistry wth emphasis on antibiotics, alkaloids, steroids, and insecticides. I tried to line him up for a paper on the chemistry of psychopharmacologic agents for our

A.S.A. Convention, since there is so much interest in these drugs among our psychologists and psychiatrists; but unforunately for us, he was already scheduled to attend the Gordon Research Conference on Medicinal Chemistry in New Hampshire this August. Well, maybe next year. Ed hasn't been able to attend an Annual Convention in the five or six years he has been a member, but he did attend the A.S.A. dinner during the A.A.A.S. meeting in Indianapolis last December and enjoyed meeting other members there.

Oscar L. Brauer is Professor of Chemistry and Physics Emeritus at San Jose State College, San Jose 14, California. What a teaching career he has had—forty years in all, including 28 at San Jose State! His degree (U. of California) was taken in organic chemistry, but he has literally taught everything in the book, including engineering physics, radio, general science, math, and even freshman English. He was the author of a high school chemistry text in 1938 and has been an author or co-author of many other texts and teaching aids. Dr. Brauer is now 74 and has been retired for almost four years. San Jose has granted a Master's Degree for some time, but largely as advanced teaching credentials and not on the basis of much scientific research; a research program, "out in the open," is just beginning. I put it this way because Dr. Brauer admits that he used to "bootleg" in a little chemical research!

Dr. Brauer has been a member of the A.S.A. since it was young, and sent me some interesting comments about what he regards as a disturbing trend away from an anti-evolutionary position. He thinks that the wide range of attitudes toward interpretation of the Bible among our members leaves us without a definite stand. What do you think about this? Personally, I feel that the range of opinion expressed so freely at our Annual Conventions and in our Journal is very healthy and keeps us alert to weaknesses in our own individual interpretations. And even if we are not perhaps doing all we could be doing in the field of evangelism or apologetics together as an organization, I am learning from my correspondence with you how much our individual members are doing in these fields. Dr. Brauer, for example, is active in his own local church of the Seventh Day Adventists. And have you noticed how many books on apologetics our A.S.A. members have written? Surely we are making a genuine contribution to such work just by providing opportunities for fellowship and discussion with each other.

Raymond S. Hoisington is nearing his retirement as a high school chemistry teacher in Rockford, Illinois —another of our members with a forty-year teaching career! He writes, "I'm just an ordinary high school teacher—no Ph.D.—no research—no great discoveries, but with a lot of satisfaction in helping to develop high school kids into men and women." However, I doubt very much that he is an "ordinary" high school teacher; from what I know of Ray Hoisington (we have met at several A.S.A. conventions) and from the records his ex-students have made, I have an idea that he is a very "extraordinary" teacher! One of his last year's students placed fourth in the chemistry exam given by the Chicago section of the A.C.S. and is now at Cal. Tech. It would be interesting to know how many of his students have gone on to take advanced degrees or have made outstanding accomplishments. Dr. Stanley M. Olson, Dean of Baylor U. College of Medicine and an outstanding Christian, was one of his pupils years ago. Remember the old proverb? "Anyone can count the seeds in an apple, but who can count the apples in a single seed?" Congratulations on your retirement, Ray. We'll be seeing you in Ames in August.

Roger J. Voskuyl doesn't have much time to do chemistry any more, being President of Westmont College, 55 La Paz Road, Santa Barbara, California. After taking his degree at Harvard in 1938, Dr. Voskuyl taught at Wheaton College until he joined the Manhattan Project, on which he worked at Northwestern, Columbia, and Chicago. Opportunities in administration opened up soon after he went back to teaching, and he has been President of Westmont since 1950. His chemical work was done in the field of mass spectrometry and deuterium analysis. Dr. Voskuyl is one of the chemists who has been elected a Fellow of the A.S.A., which reminds me that I forgot to mention the Fellowship status of several chemists whose activities were reported in the last issue: Donald R. Carr, William J. Schepp, and Henry D. Weaver, Jr., are all Fellows of the A.S.A.

Herbert A. Meyer is Professor of Chemistry at Concordia Teachers College, 800 North Columbia Avenue, Seward, Nebraska. In his twenty years at Concordia, a Missouri Synod Lutheran school for the training of elementary teachers for parish schools (and just recently for training teachers for Lutheran high schools), he has done many things beside teaching chemistry. He has taught math and physics, been Dean of Men, and even coached football! In fact, in his last six years as coach, his teams lost only eight games and he was nominated as coach-of-the-year in Nebraska three times. Who said chemists aren't versatile? Herb has his M.A. in chemistry from the U. of Nebraska and expects to be back there this summer teaching chemistry, with time out to attend the A.S.A. Convention. He has been an A.S.A. member for six or seven years and has attended several Annual Conventions. He is active not only in his local church, but on the Synodical level as well.

Robert E. VanderVennen is now Chairman of the Chemistry Department of Belhaven College, Jackson 10, Mississippi. Bob took his Ph.D. in physical chemistry at Michigan State in 1954, doing his thesis work on the magnetic properties of adsorbents and of ad-

sorbed materials. He then spent several years as a research chemist at the Naval Research Lab in Washington, where he enjoyed fellowship with several A.S.A. members, including *George Fielding* and *Dean Walter*. He has this to say about Belhaven College: "Belhaven is a small liberal arts college affiliated with the Southern Presbyterian Church. Theologically we are oriented to Calvinism, and at the heart of our philosophy of education is the recognition that all knowledge can be understood only when it is related to the sovereign Creator. That is, we recognize that the Bible gives us not only the way of salvation but that it also gives us the basis for a consciously Christian interpretation of all things. I believe that there is a great need for this kind of Christian college education, and that very few people are aware of that need." He hopes that Belhaven students in science will go on to do graduate work at larger universities, perhaps under the supervision of some of our A.S.A. members. We are trying to compile a register of our members who direct graduate research, Bob, which ought to be of help. There is at least one other A.S.A. member at Belhaven, and they hope to start an active local section in the Jackson area.

Robert W. Isensee is Chairman of the Department of Chemistry at San Diego State College, San Diego 15, California. There are fourteen staff members in chemistry at that school of some 8500 students. The department has just recently started granting the M.S. degree and can offer a fairly attractive financial arrangement for teaching assistants. Bob teaches organic and general chemistry, and has been directing undergraduate research in the synthesis of nitrogen heterocycles and the spectrophotometric determination of the dissociation constants of weak acids and bases. He received his Ph.D. at Oregon State in 1948 and has published half a dozen papers in JACS and J. Org. Chem. since then. He has been a member of A.S.A. for about four years, is a member of the College Avenue Baptist Church and currently serving as a deacon.

O. Carroll Karkalits has become Supervisor of Research for Petro-Tex Chemical Corporation, P. O. Box 2584, Houston 1, Texas. His degrees are in chemical engineering, including the Ph.D. from Michigan in 1950, and he serves on the national Program Committee of the A.I.Ch.E. His field of investigation is heterogeneous catalysis, particularly vapor phase hydrogenation and dehydrogenation of organic compounds. He has been an A.S.A. member since about 1950 but hasn't been able to attend an Annual Convention yet; however, he is trying to organize an active local section of A.S.A. members in the Houston area. In addition, he teaches a young men's Sunday School class in the Rice Temple Baptist Church in Houston and helps out with an IVCF Bible study group in one of the dorms at Rice Institute, his alma mater.

Wayne U. Ault is currently at the U. S. Geological survey, Washington 25, D.C., equipping a new geochemical laboratory which he will transport in June to the Volcano Observatory at the Kilauea Crater in the Hawaiian National Park, Hawaii. Wayne is the new editor of the Geology column in the Journal, but since he is a geochemist we will introduce him here to the rest of the chemists. He received his Ph.D. at Columbia last year and has several publications with Larry Kulp on the isotope geochemistry of sulfur. He is taking the whole family with him to Hawaii, where he will spend several years making mass spectrophotometric and other studies of volcanic fluids to get a better idea of the nature of the primary materials escaping from the interior of the earth. We will miss Wayne and Ruth at the Annual Convention in August. He has been an A.S.A. member since 1954 and has attended three Conventions; last year he did an excellent job as Program Chairman, and is serving on the program committee again this year.

By the way, I want to thank those of you who returned the questionnaire about your future meeting plans which I appended to the notice of our get-togethers in San Francisco and Philadelphia. I sent out about 150 notices and received 46 replies. It looks as though we'll have twenty or thirty members attending the A.C.S. meeting in Chicago, September 7-12, and maybe a dozen or more at the Boston A.C.S. meeting next spring. If we add to these the local A.S.A. members, we should surely be able to arrange a couple of fine get-togethers at these meetings, as well as at next year's Federation meetings in Atlantic City. I'll see that a postcard notice of the time and place gets to those of you who have indicated that you might attend the Chicago meeting, since the September issue of the Journal won't be out in time to announce the details. If any of the rest of you decide to go, let me know in time to send you a notice. We will also try to have announcements posted on the bulletin boards at the meetings.

And—oh, yes—to those of you who haven't returned that questionnaire or written to me yet: Why not use that stamped, addressed envelope I enclosed to let me know something about yourself, as a Christian and as a chemist?

GEOLOGY

Wayne U. Ault, Ph.D.

Since the geoscientists comprise a fair percentage of the membership of the A.S.A. it is only fitting that we rejuvenate this column on geology and related fields. This column can serve as a means for you to express your opinions. Your letters or prepared discourses are invited. Also, there is the need for all the geoscientists to get better acquainted. To this end a questionnaire has recently been mailed to everyone

so listed in the current directory. Any new members who are geologists, geochemists or geophysicists and who did not receive a questionnaire can write me through the editor of the Journal. This column can also serve to announce new books in our fields. Since any one of us likely finds time to read only a few new books in his own specialty why not take time to write a paragraph or more on the next new book you read and share your evaluation with the membership. This service can be especially helpful to members in other scientific disciplines.

Now that summer is approaching and our thoughts turn more intently to the annual convention it seems fitting to comment on the perpetual problem of obtaining papers for the program. These desirably would be on subjects of widest possible interest arising from the sciences, current problems such as the emphasis of science in education, or the summary of progress in certain fields which have philosophical implications. And it hardly need be mentioned that it takes those most intimately acquainted with the topic to give an understanding of the whole problem. The symposium or panel technique of presentation has been successfully used to give variety and a cross-section of opinion. With due respect to those who are faithfully active and willing to submit papers it seems on looking over the membership list that there are many men active in their fields from whom we would like to hear. There are many good reasons why some busy men do not volunteer.

This is where the local A.S.A. groups and also the kindred professional groups such as chemists, biologists, etc. working more closely together can be an advantage. It is possible that these groups will undertake to study, discuss and present topics of current interest, thus bringing to the program the benefit of a spectrum of viewpoints, more or less tried, tested and matured. In one's own field on technical and scientific subjects one has the benefit of the criticism of his colleagues and a body of tested principles. He is able to ask for criticism on his paper before he presents it in public. On philosophical aspects it may be more difficult, but it is equally necessary to obtain constructive criticism. Since there is room on an annual program for only a limited number of papers it is not possible for this to serve as a sounding board for isolated untested philosophies which are presented for the first time. It is unfortunate if the local A.S.A. group is inactive such that individuals cannot share their thoughts with one another in discussion.

Attention is called to a book *The Bequest of the Greeks* by T. Dantzig, Charles Scribner's Sons (1955) in which he describes what he calls *"pseudomath"*. Professor Dantzig has written on the history of math for the layman and presents a small group of problems which it can be demonstrated have no solution. These problems (e.g. trisecting an angle, the Fermat problem, etc.) by their very simplicity have always fascinated the amateur. And these individuals though not having any professional training in the field, nor understanding the proofs or all that is involved continue to present their own solutions to these problems which over the centuries have baffled the experts. Dantzig points out from his experience that unanimously they use techniques in common. In their solutions they labor obvious detail and then skip over the critical points and assume that they have proved the problem. The "pseudomath" feels that he has a corner on eternal truth and proceeds to extend himself into solving all problems in all fields of human knowledge and society. Such individuals are not a new phenomena but have been a problem to professional scientific societies since the days of Pericles. Finally, in the last century the reputable scientific societies, followed the lead of the French Academy which announced that it would not entertain any further solutions to problems such as trisection of the angle "or of any machine which lays claim to perpetual motion," etc. Experience of many years had "demonstrated that those who send in solutions of these problems understand neither their nature nor their difficulties, that none of the methods employed by them could ever lead to solutions of these problems, even were such solutions attainable . . . ." "Some of these individuals, being unfortunate enough to believe that they have been successful, have refused to listen to the criticism of geometers, often because they could not understand it, and have finished by accusing the examiners of envy and bad faith . . ."

The folly of such individuals resulted in loss of time and expense to their families. And, "To account for the singular fact that without studying the subject they have arrived at solutions which the most famous scholars have vainly sought—they persuade themselves that they are under the special protection of Providence, and from this there is but one step to the belief that any combination of ideas, however strange, that may occur to them are so many inspirations. Humane consideration therefore demanded that the Academy, persuaded of the uselessness of such examinations, should seek to offset by public announcement a popular opinion that has been detrimental to so many families. . . . ."

Likewise in any field of science it is very disturbing to see anyone offer papers, other than perhaps review articles, which are not in their own fields. It is equally unfortunate when an unprepared individual takes upon himself to synthesize related fields which even the specialists in those fields have not been able to integrate. One can usually detect the areas which such a person understands for there he is more likely to accept and even to use the current data available. But in other areas he will ridicule the conclusions of

the specialists, ignore the body of demonstrated data on which these conclusions are based or select isolated statements from noted scholars to prove his point. Evangelical scholarship will do well to rejoice more over theses which can be demonstrated by experiment and proofs acceptable to all than over conjecture which, conditioned by prejudice, concludes that which one may want to hear. Dreaming is no substitute for research.

One is tempted to make some suggestions on ethical practices. Christian scholars should be the first to label their hypotheses and assumptions as such. For example, the author of a recent monograph which came to my hands accepts the C^{14} dates for man and then slips in the statement that we now have confirmation for pre-Adamic man. What he failed to prove was the date for Adam. It is very detrimental to teach as truth and fact that which is only assumption, working hypothesis, or conclusion. Many are the examples during the progress of human knowledge where the interpretation which gave a best fit to all the data had to give way to a better one when new data became available. One cannot afford to be in a dogmatic position such that he cannot entertain alternative viewpoints or accept a proof when it is given. Often all that is at stake in his own assertions.

Christians ought to be humble enough and wise enough to admit that we do not have all the answers in the physical sciences (or others for that matter). Picture Newton of nearly three centuries ago. Though a Christian and blessed with genius we realize that he did not know of radioactivity, relativity, and many other phenomena for they were not yet known. Likewise, if our Lord tarries, those of a century or two from now may look back on our state of knowledge as we do on that of the Dark Ages. Any synthesis made now in 1958 is based on limited knowledge, to be sure, but it should at least include the available data. And if one doesn't understand the techniques well enough to have confidence in the data then he should not be making the synthesis.

When one is so naive as to present new physical concepts which contradict established phenomena it would seem only reasonable that he should present some proof. Physical concepts should be capable of laboratory demonstration. Scripture taken out of context to support such hypotheses in contradiction to basic physics is a most unscholarly approach.

Consider the natural world. It is odd indeed for a Christian to speak disparagingly of the natural world or nature. But too often God's manifestations are only pictured as supernatural as if the natural world detracted from His glory. Nature is God's handiwork; natural laws are His laws! Must we not insist on this? To say that life springing from a seed and the production of more seeds is a natural or ordinary sequence of events does not explain the process or diminish the greatness of the phenomena. The uninterrupted stream of living things is an awesome fact. Let's not dismiss it under the term natural as atheistic. Does God only obtain glory from supernatural events? If this is our attitude then it may be that our understanding is blinded. If we have a proper view of nature, God's handiwork, then it seems we will be more likely to go to the natural world to learn. And if we learn something new or contrary to our concepts let us seek to integrate the new data. Let us be able to change our thinking if necessary. There are some things which we accept on faith: God, redemption, the angels, the soul, heaven and hell—on the authority of the Scriptures even though we have not been able to investigate them with physical means. But the physical universe can be investigated by physical means and since God has allowed us to develop techniques, we ought to be willing to use them to learn.

The aim of the A.S.A. has been stated as reviewing, preparing and distributing information on the authenticity, historicity, and scientific aspects of the Holy Scriptures in order that the faith of many in Jesus Christ be firmly established. Well meaning individuals who are attempting to achieve these aims by explicit analogies presented with the attitude that now we have proof of certain scriptures may actually find themselves destroying faith in the Word. Temporal scientific views or private interpretations should not be tied to the Scriptures. At least one could label them as an opinion. Pastors who feel they have to teach young people that we have all the answers may actually lose the young folk when they enter high school or college and find out that perhaps the age of the earth and mankind is older than they were taught. The body of human knowledge is in a state of change or growth. Likewise interpretation of Scripture changes and contains a human element. Thus it can be destructive to equate in a dogmatic way a temporal, best approximation to the truth from a study of the natural world and a revelation which we hold to be accurate. It does not seem that a humble Christian will try to speak as an oracle when presenting his understanding (interpretation) of Scripture. Opinions stated dogmatically may win people but their relativity to the truth may be no better than the person's understanding or bias. Christian scholarship should be characterized by humility in appraising one's own abilities and truthfulness in presenting his assumptions and conclusions as such. We believe that God is the author of both the physical world and the scriptures and that when both are rightly understood they will be in perfect agreement.

PSYCHOLOGY

P. B. Marquart, M.D.

Mrs. Faith Coxe Bailey has caught the diffused atmosphere of the alcoholic addict in a new book *"Out Of the Liquid Jungle"* (Moody Press, Chicago, 1958). The underworld slang of the drunkard appears even in the title. Each of the sixteen chapters features the case of such an alcoholic. The author reveals her understanding of the skidrow and of the alcoholic problem, in that each of her cases manifest, not mere drunkenness, but true alcoholism, the kind which ordinarily has no cure.

These true stories, however, do not leave the alcoholic in his liquid gutter. Each one is unshackled from his hopeless condition through the living Christ and each tale has a happy ending. Each one features the work of an American or Canadian rescue mission.

What does this volume have to do with psychology? Psychotherapy, as well as all the medical and physiologic helps leave the alcoholic cold. Even though recent literature credits the Alcoholics Anonymous with the most effective of all cures, most of the dry alcoholics who are now Christian, will tell you of their failure to find effective help in the A.A.'s. Regeneration, however, that divinely-bestowed change in individual human nature, brings about such a thorough going transformation in the alcoholics personality, that he seems to be a "new creature." This great transformation, which involves psychologic change, is by no means psychologically produced, coming as it does from the depths of the personality, the *heart*.

The need for great patience in dealing with alcoholics is shown in these accounts. Many of them had numerous backslidings back into the jungle, but the Lord finally conquered them, as well as Jacob at Penuel. Thus the case histories ring true to life. One very effective Christian of my acquaintance had thirty-five such sprees after he professed Christ.

SOCIOLOGY

Russell Heddendorf, M.A.

One of the most recent areas of concentrated research in the field of sociology is the study of professions. In particular, the newest efforts have been in the areas of law, medicine, and education. The significance of this trend is indicated by the fact that the leading departments at Harvard and Columbia are the forerunners in this work.

The particular reason for the study of professions has varied with the understanding in the field. Initially, professional groups were merely looked upon as elites who controlled change in society. At the same time, studies in professions attempted to understand the common denominator of work as it was distinguished in professional from non-professional roles. Later, the concept of professions was analyzed when the legitimization of some professional functions were questioned. This has been a particularly obscure area for two reasons: 1) the requisite specialization of professions prohibits complete understanding of some functions, 2) there is a need for most professionals to be insulated from the public in order to perform their functions. Finally, the more precise concern has been with the functioning of professions, the steps taken by them to see that society's needs are met and whether or not they actually are met.

Since 1948, there have been several studies of the minister's profession. Probably the largest one, however, was authorized in October 1957 by the National Council of Christian Churches and supported by a Rockefeller grant. The uniqueness of this study is that it apparently does not have any of the above reasons as a primary source of interest, though it is being conducted by a well accepted sociologist. Rather, the explicit objective of the project is "to assist the churches and laymen in developing a better understanding of the remuneration needed by ministers to enable them to provide more effective service to their local congregations and communities".* This seems to be an example of the partisan and propagandist views referred to by the National Research Council and discussed in this column's last issue. It is unfortunate when the "popularization" of a discipline requires it to seek immediate data which will confirm the views of an interest group. Nor is sociology alone affected by such corruption of scientific values.

The initial working papers for this project make some statements which could be considered further: 1) as a calling, the minister's role is more than a profession, 2) because of the role's nature, there is no sure criteria of effectiveness or success, 3) raising the salary of ministers does not necessarily increase his effectiveness, 4) the adequacy with which a congregation supports its minister is, in part, an index of the importance it attributes to religion in its own life.

The constant problem to be dealt with in the area of the sociology of religion is the overlapping of sacred and secular. Hence, the "calling" dimension of a minister's role is the sacred aspect while the professional connotation develops a more secular note. The critical line between sacred and secular must constantly be clarified by the religious institution. In this case, it would be the seminary, as a representative of the institution, which should have that responsibility. It would seem necessary, therefore, that seminaries

give a clear picture of the effective minister's role in terms of a compatible understanding of it as both calling and profession.

Perhaps the greatest potential incentive for the secularization of the minister's role is the raising of salaries without emphasizing the calling aspect. The teaching profession has had much of a sense of calling. With the current increasing salaries, however, this will undoubtedly be lost and, instead of the quality of teachers improving, it will probably decrease. A sociological study of the minister's role, therefore, should be concerned with those mechanisms strengthening the calling in the role, thereby allowing for these factors to be stressed while salaries are increased. Simply, it would be necessary to find the common denominators which keep the calling and professional concepts from being entirely contradictory.

The congregation's view of the minister's role will largely depend upon its evaluation of its own need. The congregation may see its need chiefly in secular terms. If so, it may have this need met largely by non-church agencies. In this case, there would probably be less value placed on the minister's role and the accruing rewards. If the view is one of sacred needs, however, the value placed upon the role is higher. Here again, there is probably a great need to study the degree of compatibility between the minister's role and the congregation's view of it.

In conclusion, it may be stated that the goals of this study seem to miss an opportunity to do some worthwhile work in a little studied field. Perhaps this is because it has established its own objectives instead of following the sociological objective of studying the correlation of social facts.

*Working Paper No. 2, Clergy Research Project, Procedural Approach, October 3, 1957, p. 1. (Other references are taken from Working Paper No. 1, Clergy Research Project, May 31, 1956)

Meeting of the A.S.A.-E.T.S. Liaison Committee

The A.S.A. - E.T.S. Liaison Committee met in Wheaton on Friday, February 21, 1958 at 3:20 p.m. for a formulation of policy and preliminary planning for the next joint conference. Those present were: Dr. Merrill C. Tenney, co-chairman, and Dr. Barton Payne representing the E.T.S.; and Dr. John W. Klotz and Prof. James O. Buswell, III representing the A.S.A.

After opening prayer, the proposed functions of the Liaison Committee, as published in the "Report on 1957 A.S.A.-E.T.S. Joint Meeting" (J.A.S.A., Vol. 9, No. 4, Dec. 1957, pp. 3-5) were read aloud for the orientation of the committee. Except for the deletion of the quotations from correspondents, the seven proposals for the planning of joint meetings as well as the functions of the Liaison Committee are attached.

The policies and planning of the previous two joint conferences were discussed. It was decided that the immediate step to be taken by the committee is to solicit from the Regional Chairmen, and the last national convention Program Chairman of each body specific suggestions of topics, papers, or subjects to be put on the agenda for inclusion in the program of the next joint conference, the time (presumably in the summer of 1959) and the place to be decided by the Executive Committee of the two bodies. It was the feeling of the committee that joint conferences should be held in the Midwest if possible, and that such schools as Moody, Trinity, Concordia, Wheaton, or Calvin, among others, might be considered.

A communication from committee-member Dr. J. C. Whitcomb, Jr. (E.T.S.) expressing evidently widefelt queries about trends of thinking apparent in the A.S.A. was discussed at some length.

Committee co-chairman, Dr. Henry Weaver, Jr., (A.S.A.) sent a communication suggesting the area of psychology for thorough consideration at joint conference. Dr. Klotz also reported a high interest from Lutheran circles in Christian psychiatry and psychology. These, and other program suggestions by those present were discussed with interest shown in the direction of examining the treatment of the Creationist position in current scientific literature.

The meeting was adjourned with the prospect of a second meeting as soon as program suggestion from the above-mentioned officers (regional and program chairmen) are received.

Respectfully submitted,
James O. Buswell, III
Secretary

Please send any suggestions to either Dr. Merrill C. Tenney or Prof. James O. Buswell, III at Wheaton College, Wheaton, Illinois.

Annual Convention Being Planned

The 1958 Annual Convention of the American Scientific Affiliation will be held on the campus of Iowa State College from Tuesday, August 26, through Thursday, August 28. The College, located in the small town of Ames twenty-five miles north of Des Moines, is celebrating its 100th Anniversary this year. In that 100 years, Iowa State (not to be confused with the State University of Iowa at Iowa City) has grown from a small demonstration farm to a College with an enrollment of 10,000 students, a faculty of 1,000, a beautiful 460-acre campus, and a physical plant valued at approximately 50 million dollars. It ranks high among technical institutions in its research productivity, and in a single year may now award approximately 125 doctorate degrees and 200 master of science degrees. The College comprises five Divisions—Agriculture, Home Economics, Science, Engineering, and

Veterinary Medicine—and is as famous for its Experiment Stations and extension work as it is for resident teaching and purely academic research. There are many things of interest to see at the College, and the great Midwestern Corn Belt has a charm of its own.

The Memorial Union on the campus is a hotel, restaurant, and recreation center operated as a private club to which all students, faculty members, and alumni may belong. The A.S.A. has reserved essentially the entire facilities of the Memorial Union for the three days of our Convention, including accomodations for about 90 people, meeting and committee rooms, and the 600-seat auditorium for nightly public meetings. We will have the use of the cafeteria line and a separate dining room, lounges, and even a small browsing library and chapel. Individuals may make use of recreational facilities such as bowling alleys and ping-pong tables at nominal charge. This year's Annual Convention should make an excellent way to spend part of your family vacation, so plans are being made to provide for the maximum enjoyment of all members of the family. For example, baby-sitters for the smaller children and some sort of interesting program for the larger children will be provided for at least part of the time, so that the wives may feel free to take part in tours of the home economics departments and the programs being planned for them. The college farms will be of interest to many children, and to their parents, too.

As of May 1, we know of about 130 who expect to attend, including wives and children. Most of the accomodations at the Memorial Union are rooms for two persons, not very well adapted to family groups with small children, so arrangements are being made to be sure of sufficient space in the numerous Motels in Ames to accomodate families. Rates will vary slightly but will be ordinary Motel rates; rooms in the Memorial Union will cost from $2.00 to $4.25 per person per night. It was impossible to use inexpensive dormitory housing because of an unusually early beginning of classes at the College this fall.

At the present time, many details of the Convention Program are still being worked out, but copies of the final Program will be mailed to you along with registration information early in the summer. Meanwhile, here are some features of the Program as tentatively planned:

The most unusual feature of this year's Convention will be in the nature of an experiment. For several years the possibility of sponsoring the Moody Institute of Science evangelistic presentation, "Sermons from Science," concurrently with our Convention, has been considered as a means of letting the public know of the A.S.A. and of our strong Christian purpose. This year we will try it out, with the co-operation of George Speake, one of our members who presents the "Sermons from Science." We will forego our usual evening sessions to participate in these public lecture-demonstrations, which will be held in the Great Hall of the Memorial Union, with wide publicity to invite local townspeople and college students attending the summer session. Many of you have seen the Moody Science Films; this is a "live" presentation of the same type and with the same evangelistic purpose. The usual series lasts a whole week, but a special three-night version is being planned for Ames.

Although we are not planning formal sessions in the evenings, we do expect to have informal group discussions after the "Sermons From Science" presentations on two evenings. On Tuesday we will divide up in small groups by fields of science (geology, biology, psychology, etc.) to discuss trends of current research of interest to the A.S.A.; it is hoped that out of these discussions will grow papers and symposia for future Conventions to keep our members informed on new developments in science. Then on Wednesday night, we plan to divide up in small groups according to various Biblical topics to focus our attention on what the Scripture says concerning these topics (origin of the earth, nature of man, ethical problems etc.) and on any problems or limitations of interpretation. Papers and symposia arising from these discussions should be of particular importance for our joint meetings with the Evangelical Theological Society.

Evolutionary considerations are always of interest to the A.S.A., and an excellent symposium on speciation is being planned for the first afternoon. There will be two sessions for general contributed papers, and we hope to have another symposium, preferably on as current and controversial a topic as possible, for the last afternoon session. A variety of field trips is being arranged, including a tour of the Ames Laboratory of the Atomic Energy Commission, a geology trip to some nearby limestone quarries, a tour of the College cheese-making plant, and perhaps a trip of special interest to social and behavioral scientists. Tuesday morning will be devoted to registration and reports, including news of local section activities and recognition of other organizations whose purposes make them of interest to A.S.A. members. And for those of you who arrive on Monday, we will have a showing of the Moody Science Film on the human heart, "Red River of Life," and a time of hymn-singing, prayer, and fellowship that evening.

An A. S. A. Convention is an opportunity to gain information about the relationship of science to Christian faith, to make new friends who are also interested in these problems, to sharpen your thinking through discussion, to spend time in prayer and fellowship with the same friends, and *this* year to participate in the preaching of Christ through the medium of scientific demonstrations. Plan to attend! You'll be glad you did!

Walter R. Hearn