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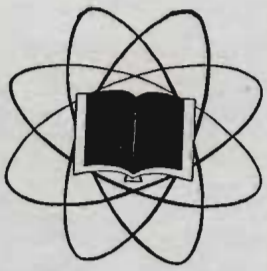

The fear of the Lord is the beginning of wisdom. Psalm 111:10

Vol. 9 **SEPTEMBER, 1957** **No. 3**

The American Scientific Affiliation

(INCORPORATED)

The American Scientific Affiliation was organized in 1941 by a group of Christian men of science. The purpose of the organization is to study those topics germane to the conviction that the frameworks of scientific knowledge and a conservative Christian faith are compatible.

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The Journal Of The American Scientific Affiliation

Vol. 9 SEPTEMBER, 1957 No. 3

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The Journal of the American Scientific Affiliation is published quarterly, March, June, September, and December by the American Scientific Affiliation. The publication office is located at 214-9 Halsey Drive, West Lafayette, Indiana. The subscription price is $2.00 per year. Single copies may be obtained at a price of .50 each. Copies of back issues may be obtained at the price of $2.00 per volume. Send all communications regarding editorial matters to the editor, Delbert N. Eggenberger, 620 Lincoln Street, Downers Grove, Ill. Entered as second class matter January 23, 1952, at the post office at Goshen, Ind., under act of March 3, 1879, as amended by the acts of June 11, 1934, and October 30, 1951.

NEW MEMBERS

George C. Bush, 421B Graduate House, Mass. Inst. of Tech., Cambridge 39, Mass., has earned a B.A. degree from McMaster University and a S.M. degree from M.I.T. He is presently a graduate student and teaching assistant at M.I.T.

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Frank Walmsley, 809 North Fulton Street, Salisbury, North Carolina, has earned a B.S. degree from the University of New Hampshire. At present he is a graduate student at the University of North Carolina.

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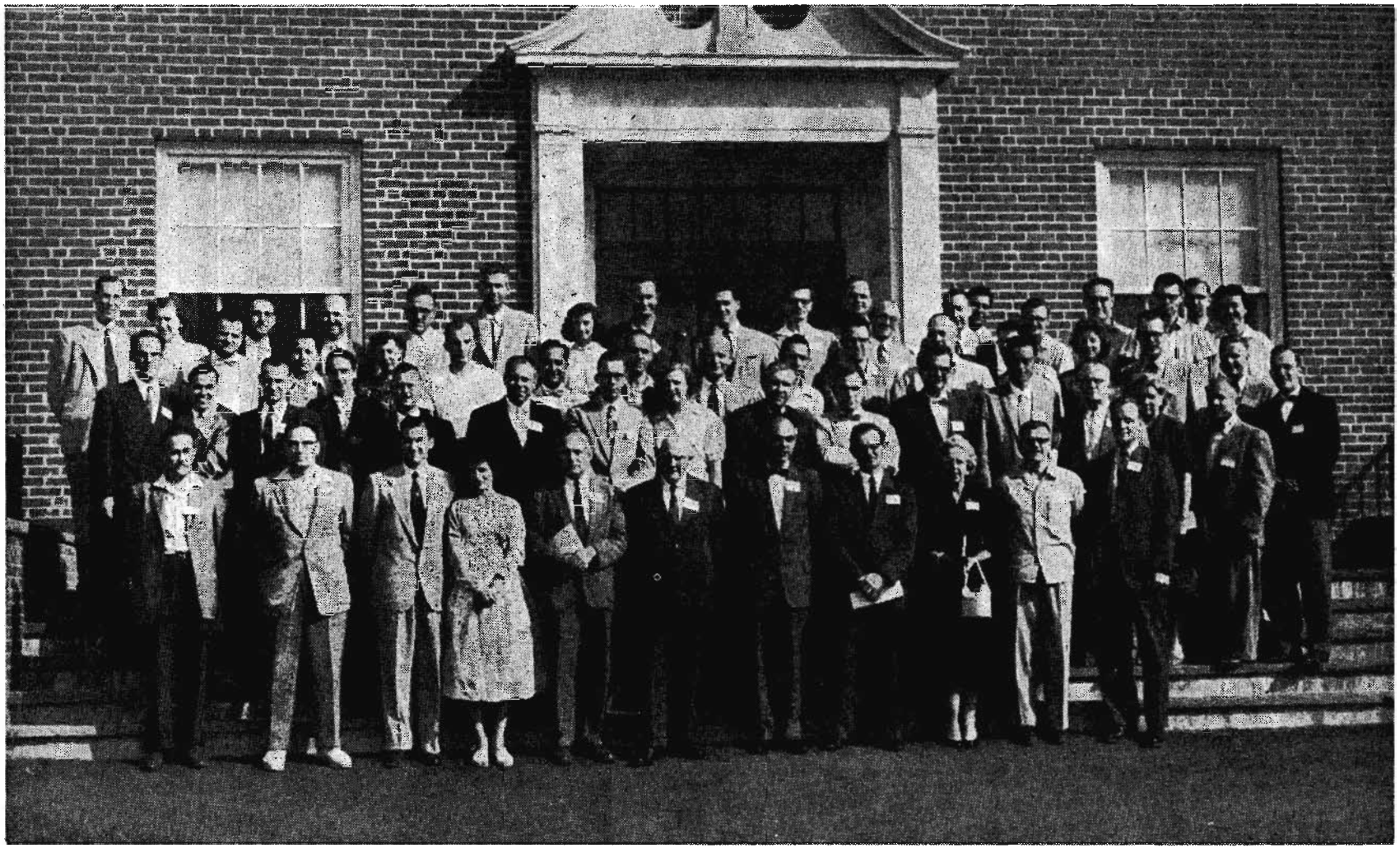

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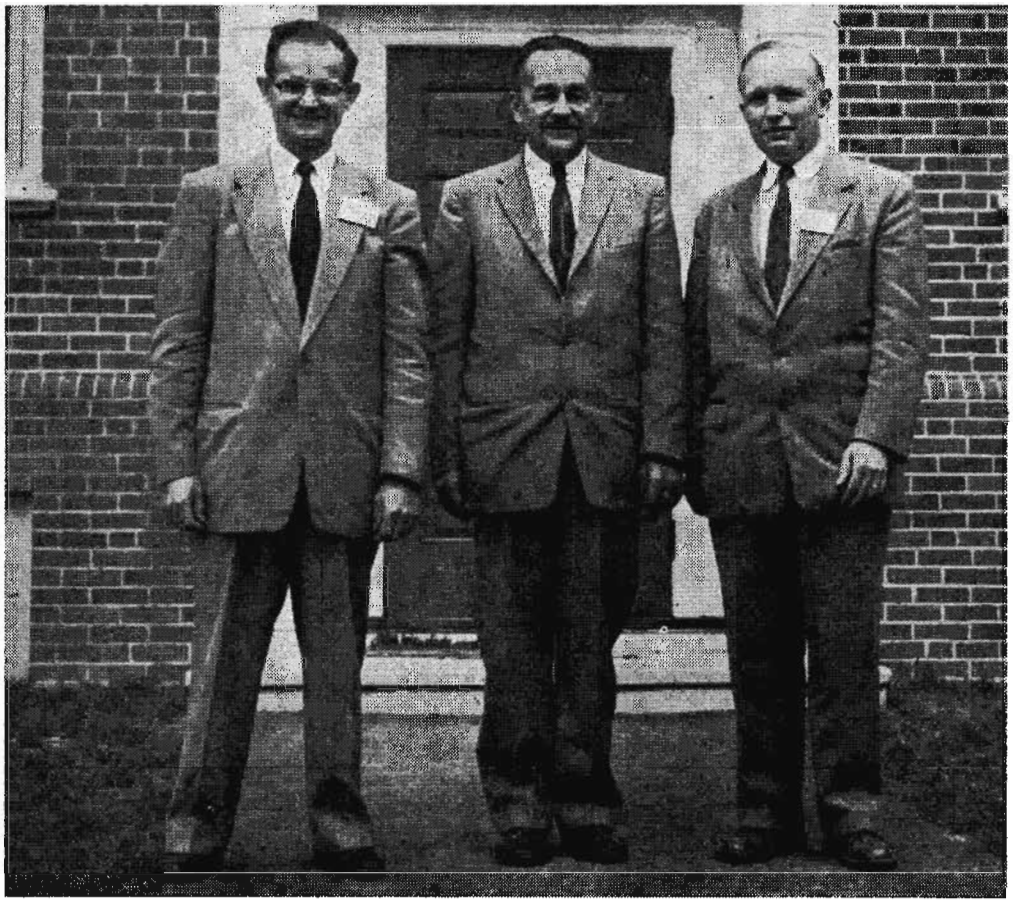
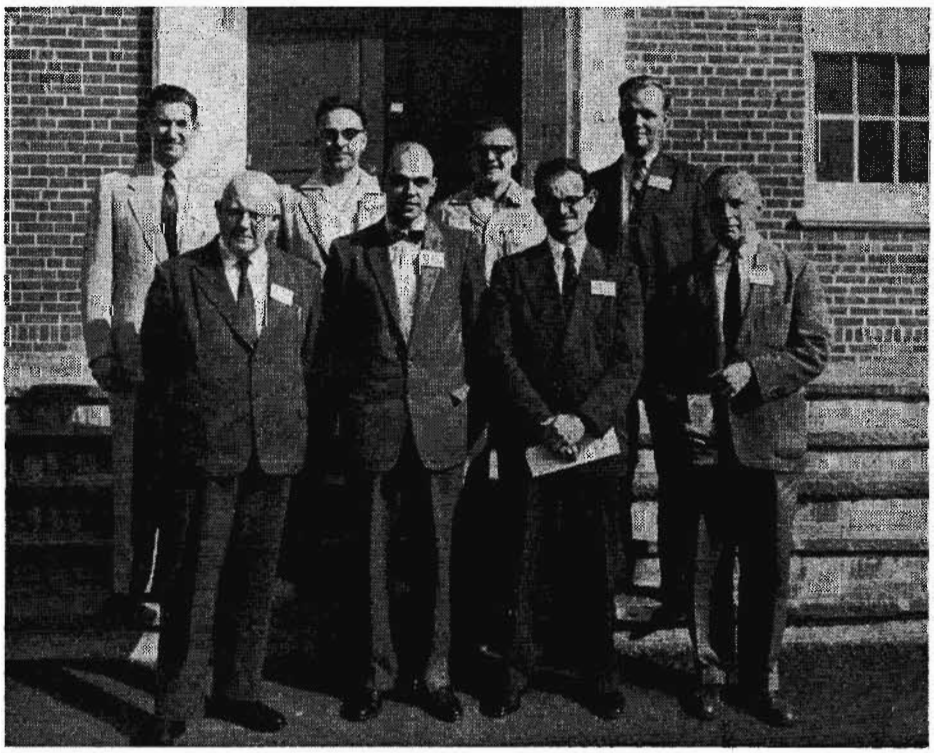


Three members with perfect attendance records at A. S. A. Conventions, 1946-1957. Left to right: H. Harold Hartzler, Philip M. Marquart, Irving A. Cowperthwaite.



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Dating With Radioactivity

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The fascinating impressiveness of vigorous mathematical analysis, with its atmosphere of precision and elegance, should not blind us to the defects of the premises that condition the whole process.—T. C. Chamberlin, Science, June 30 (1899).

A. Introduction

Human nature has almost always driven man to ask the question: "When?," and therefore the establishing of dates of past events is of great interest. Man has been concerned with the dates of the universe as a whole, this and other galaxies, the solar system, the earth, the moon, and things on the earth. Numerous methods have been applied to attempt answers, and these include: (1u) velocities of galaxial recession, (2u) galaxial cluster densities, (1g) star cluster densities, (2g) separations of binary stars, (3g) distribution of kinetic energy among stars, (4g) distribution of stars among stellar classes, (1s) energetics of solar system, (2s) developmental characteristics of planets. (1e) recession of the moon, (2e) cooling of earth's crust, (1t) salinity of ocean, (2t) sedimentation, (3t) paleontological index fossils, (4t) orogenic cycles, (5t) non-conformities in strata, (6t) tree rings, and a number of others. The second designation in the parentheses indicates the applicability of the method, (u) universe, (g) galaxy, (s) solar system, (e) earth, (t) things on earth.

With the discovery of radioactivity and the development of nuclear science, another very general and widely applicable chronological method has been made available. An absolute chronology is one that is based on a process which has been active throughout the existence of the entity (universe, galaxy, earth, etc.) and which has produced measurable results at a known unchanging rate. Radioactive decay is the phenomenon which comes the closest to meeting this requirement.

Radioactive decay of a given nuclide (nuclear species) may be described by the relation

$$P = P'\exp(-kt), \qquad 1$$

where P is the number of atoms after time t, P' is the number of atoms at time 0, and k is known as the decay constant. Suppose that this parent nuclide P decays to a stable daughter nuclide D, then the production of D will be described by

$$D = P'\,[1-\exp(-kt)], \qquad 2$$

where D is the number of atoms after time t, no atoms of D having been present at time 0. These relations assume that the decay constant has not changed during the decay process. Several direct and indirect evidences indicate that in most applications to dating that this is a warranted assumption.

Among the long-lived elements which are useful for dating are the following, their decay constants, half lives, and modes of disintegration being affixed.

Nuclide (Z-A)	Half life (billions of years)	Decay Constant (100 billionths per year)	Mode of Decay
U-235	0.7	97	7a,5b,g ——— Pb-207
K-40	1.2	58	b(89%) —— Ca-40
			EC,g(11%)— A-40
U-238	4.5	15	8a,6b,g ——— Pb-206
Th-232	13.9	5.0	6a,4b,g ——— Pb-208
Rb-87	62	1.1	b ——————— Sr-87
La-138	70	0.99	EC(94%) — Ba-138
			b(6%) ——— Ce-138
Lu-176	75	0.93	b ——————— Hf-176
Sm-147	100	0.69	a ——————— Nd-143

Since the range of applicability of a radioactive dating method is approximately 10 half lives, these are the most usable because the age of the universe is now considered to be about 6 billion years. In addition to the above nuclides, two relatively short lived ones are of importance for dating: H-3, a beta emitter with a half life of 12.4 years; and C-14, a beta emitter with a half life of 5568 years.

The numerous individual methods for ascertaining dates from nuclear phenomena may be classified under several general headings: (1) parent-daughter methods, (2) parent-parent methods, (3) daughter-daughter methods, (4) parent methods, (5) daughter methods, (6) prodigal daughter methods, and (7) daughter damage methods.

B. Parent-Daughter Methods

If equation 2 is divided by equation 1, the following results:

$$\frac{D}{P} = \exp(kt)-1 \qquad 3$$

This relation is applicable to a calculation of age or time t in a material bearing a parent nuclide and its decay product D provided: (1) the decay constant is known, (2) the determination of the ratio D/P is accurate, (3) if a series is involved equilibrium has been

obtained, (4) none of the daughter or any of the intermediates between the parent and the daughter were present at zero time, and (5) no gain or loss of the parent, daughter, and/or any intermediates has occurred. Sometimes when conditions 4 and 5 have been violated, corrections can be made, but more often than not, they are inapplicable. Equation 3 has been applied to igneous rocks containing U-235, K-40, U-238, Th-232, and Rb-87. In general, determinations of the nuclides are made mass spectrographically and/or by radioactivity.

In the *lead methods* (U-235, U-238, Th-232), the nuclides Pb-207, 206, and 208 are the products. The lead present at the time of the formation of the earth, called original lead, is composed of four isotopes 204, 206, 207, and 208, the first one not being derived from any long-lived element. Thus the presence of Pb-204 in a uranium or thorium mineral indicates that it originally bore some original lead and that all the lead was not of radiogenic origin. Sometimes a correction can be made, but obviously, much more accurate results are obtained if all the lead is radiogenic. Another possible error in this method is that each of the three decay series contains a gaseous nuclide (Rn-219, Rn-222, Rn-220), which might escape.

In the *helium methods* (U-235, U-238, Th-232), the measured product is the He-4 which arises from the alpha emission in the various series. This requires equation 3 to be altered by a factor of 7, 8 or 6 corresponding to the alphas emitted in the different series. In rare cases, there is helium other than radiogenic helium present, but in most instances the amount of helium is low, due chiefly to escape by diffusion. Corrections can be applied by virtue of investigations of helium retentivities of minerals, but the degree of success varies over a wide range.

In the *argon method* (K-40), equation 3 must be adjusted by a factor of 0.11, since that is the percentage of K-40 decaying to the inert gas. Difficulties similar to those in the helium method are encountered.

In the *calcium method* (K-40) equation 3 must be adjusted by a factor of 0.89. The major difficulty in this method arises from the presence of non-radiogenic Ca-40, which isotope make up 96.97% of the atoms in naturally-occurring calcium. Correction is possible by consideration of the Ca-40/Ca-44 ratio in original calcium.

In the *strontium method* (Rb-87), a difficulty similar to that in the calcium method is present. However, since Sr-87 makes up only 7.02% of strontium, it is not quite so serious. Correction can be made from the Sr-87/Sr-88 ratio.

Other methods which have not been tested might involve La-138, Lu-176, Sm-147, and the production of xenon from the spontaneous fission of uranium.

C. Parent-Parent Methods

Consider an element which has two long-lived isotopes (such as U-235, 238). Writing equations similar to equation 1 one arrives at $L=L'\exp(-kt)$ and $H=H'\exp(-k't)$. Division of the second relation by the first results in the expression

$$\frac{H}{L} = \frac{H'\exp(-kt).}{L'\exp(-k't)} \qquad 4$$

The present day ratio U-238/U-235 is about 139 and assuming that it was about 1 at the origin of the elements, the value of t which is obtained runs about 6 billion years.

D. Daughter-Daughter Methods

When two long-lived isotopes of an element (like U-235, 238) decay to stable daughters (like Pb-207, 206), two equations similar to equation 3 may be written, $D/P=\exp(kt)-1$ and $D'/P'=\exp(k't)-1$. Dividing the second by the first relation, one obtains

$$\frac{D'P}{DP'} = \frac{\exp(k't)-1.}{\exp(kt)-1} \qquad 5$$

Conditions similar to those in Section B are required. Several errors are frequently recognized in this method, including loss of the two radon isotopes, uncertainty about the presence of original lead, uncertainty about the presence of old radiogenic lead, and re-distribution of elements by geological activity.

E. Parent Methods

It is interesting to take notice of the nuclides which are radioactive and have half-life values greater than a million years. They may be divided into 3 categories: (1) those which do not occur naturally, including Zr-93, Np-237, Be-10, Pd-107, I-129, U-236, and Sm-146; (2) those which are present in small amounts, including W-178, U-235, and K-40; and (3) those which are present in sizable amounts, including U-238, Th-232, Lu-196, Re-187, Rb-87, Sm-147, In-115, Nd-144, and Bi-209. Those in the first category have half lives less than 100 million years; those in the second have half lives between 500 and 1500 million years; and those in the third have half lives greater than 4000 million years. Thus the age of the elements may be said to be of the order of a billion years.

Secondary neutrons from cosmic rays form C-14 and H-3 in the upper atmosphere by the reactions N-14(n,p)C-14 and N-14(n,t)C-12. The newly born C-14 reacts to produce carbon dioxide which mixes with the carbon dioxide of the atmosphere. All living matter comes into equilibrium with this gas, and the specific activity of the carbon in both the atmosphere and the living matter is about 15 disintegrations per minute per gram of carbon. When living matter dies, it is removed from the cycle with atmospheric carbon dioxide and thus the C-14 activity decreases. Hence a measurement of the specific activity will allow an estimate of the time the material has been out of the life

cycle. Several assumptions are made in this method: (1) the C-14 was uniform in the entire earth during the last 40,000 years, (2) the samples have remained unaltered since their removal from the life cycle. Difficulties inherent in the radiocarbon method are: (1) the half life is known inadequately, (2) the measurement of low activities is beset with many pitfalls, (3) certain forms of life may take up C-14 selectively, (4) bomb tests since 1945 may affect the results. However, it has been shown that none of these difficulties affects the method to more than a few percent. Calculations are made with equation 1.

Using the ideas, of the C-14 method, some dates have been ascertained with H-3. However, these are of limited value and applicability due to the relatively short half life and the very low rate of production.

F. Daughter Methods

Most attempts to determine dates by considering all or part of certain nuclides to have arisen from radioactive proccesses (like He-3, A-40, Xe-129, 131, 132, 134, 136, Pb-207, 206, 208) are burdened with so many difficulties that they are impracticable at the present time.

G. Prodigal Daughter Methods

In the decay of U-235, U-238, and Th-232 into stable lead there are numerous intermediate nuclides. In order for equation 2 to be applicable, equilibrium must have been established in the series being used. About 1 million years are required for the U-238 series, about 100 thousand for the U-235 one, and about 100 for the Th-232 one.

One of the intermediate nuclides in the U-238 series is Th-230 which has a half life of about 80,000 years and decays to Ra-226 which exhibits a half life of about 1600 years. It is known that in sea waters Th-230 is removed from solution (and thus from the U-238 to Pb-206 chain) by adsorption upon iron and manganese hydroxides which fall to the bottom as sediments.

Thus one should be able to measure the ages of sediments by the amount of Th-230, or by the amount of Ra-226 after equilibrium has been established. Several suppositions are inherent here: (1) the rate of Th-230 deposition has been constant per unit time and bottom surface, (2) the Th-230 has remained in place along with its daughter Ra-226, and (3) the deposition of other members of the series has been negligible.

H. Daughter Damage Methods

The major portion of the energy caried by the radioactive emissions is expended in crystals by ionization and dislocation of the constituent atoms. Numerous changes are produced in the crystals, and if the changes can be measured along with the rates of change, then the time elapsed since the initiation of the damaging process can be estimated. The value of such estimates is, of course, determined by the constancy of the rate of damage.

Alpha particles discolor a number of minerals, and in fewer cases, beta particles do so. When the radioactive substance is homogeneous with respect to the mineral, the coloration is evenly distributed. When the radioactive substance is a small piece of material included in a crystal, a spherical pleochroic halo is formed around the included substance. These haloes contain various rings which are accounted for by the ranges of the alpha particles involved. Theoretically the age of the mineral may be calculated from the intensity of the coloration and the amount of radioactive substance present.

In some minerals, the structural arrangement of the constituent entities will suffer dislocations causing the material to become more amorphous in character. The degree of this may be determined by X-ray diffraction, changes in specific gravity, and alterations in the refractive indexes. Another way is by differential thermal analysis in which the mineral returns to the crystalline state at a given temperature with an evolution of heat, this heat probably corresponding to the amount of energy produced by bombardment with the emissions.

Electrons released from atoms by the action of radioactive emissions on crystals become trapped and stored in the structure. This results in an increase in the potential energy of the crystal. By slowly heating the material, the displaced electrons will fall back into position releasing energy in the form of light. By using known standards and by making radioactivity determinations, the results may be coupled with the amount of light energy to permit estimates of mineral ages.

In minerals containing UO_2 (or ThO_2), when a uranium atom disintegrates, two oxygen atoms are liberated. These may react with UO_2 to give UO_3. If the content of UO_2 and UO_3 in a mineral is known, the number of disintegrated uranium atoms may be calculated, which leads to a method for dating the substance. This method assumes a number of things which are somewhat open to question.

In uraninites and thorianites, a shrinkage of the unit cell occurs as a result of the smaller lead atom taking the place of the uranium or thorium atom. In addition, more shrinkage is produced by the oxidation of U(IV) to U(VI) by the oxygen atoms liberated in the decay of uranium. The shrinkage may be measured by X-ray methods.

Almost all of these damage methods are beset with so many sources of error that they are accurate in only very few, if any, cases.

I. Conclusion

It can be seen that nuclear science which had its discovery couched in the field of geology (Becquerel and uranium minerals, 1896) has begun to pay back the debt by making sizable and important contributions to its parent.

Almost since the beginnings of science as we know it today, men have attempted to develop suitable methods for the measurement of ages. Many approaches have been proposed, but only relatively few have had any degree of success. Nuclear science has now made a contribution which may be said to be a major one, in fact, the most reliable results come from its hand. In short, nuclear geology has come of age. But it has just barely passed 21, and thus the field stands wide open for development after development, which are certain to come to pass.

Bibliography

(1) F. Faul, editor, *Nuclear Geology*, Wiley and Sons, Inc., New York, 1954.

(2) K. Rankama, *Isotope Geology*, McGraw-Hill Book Co., Inc., New York, 1954.

(3) F. Zeuner, *Dating the Past*, Methuen and Co., Ltd., London, 1952.

(4) W. F. Libby, *Radiocarbon Dating*, University of Chicago Press, Chicago, 1952.

(5) T. P. Kohman and N. Saito, "Radioactivity in Geology and Cosmology," *Ann. Rev. Nuclear Sci.* 4, 401 (1954).

(6) R. A. Alpher and R. C. Herman, "The Origin and Abundance Distribution of the Elements," *Ann. Rev. Nuclear Sci.* 2, 1 (1953).

(7) *Report of the Committee on the Measurement of Geologic Time*, National Academy of Sciences, National Research Council, Washington, issued annually, 1924 to present.

Illustrations of Spiritual Truths Using the Phenomena of Luminescence In Solids

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In the course of preparing talks which would have both a scientific and a theological content, the author has found in the phenomena of solid-state luminescence a number of effects which illustrate spiritual truths in a striking manner. It must of course be emphasized that the effects to be discussed in this paper are simply *illustrations* of spiritual truths, and have no direct connection with the truths whatsoever.

An appreciation of these illustrations must be based on an elementary grasp of the mechanism of solid-state luminescence. We shall first therefore very briefly outline the pertinent information concerning luminescence for those who may not be familiar with it. Then we shall show how the basic phenomena of luminescence may be used to stage a pageant, as it were, with each of the phenomena illustrating a spiritual truth, and at the same time maintaining a consistent picture on both the scientific and the theological level.

A luminescent material (frequently called a *phosphor*) is a material which is capable of transforming invisible radiation, which it absorbs, into visible radiation, which it emits. Luminescence differs from incandescence in that the latter involves the utilization of high thermal energies to excite electrons at random throughout a material, whereas the former involves the conversion of absorbed radiation into emitted radiation at particular special sites in the material where electron excitation and de-excitation to produce emission occur exclusively. Thus incandescence involves heating the material and the emission spectrum obtained is characteristic of the temperature of heating, but not of the material; luminescence involves no heating and the emission spectrum is characteristic of the material.

Luminescent materials are in essence very simple. Ordinary table salt, for example, can be a luminescent material if treated in the proper way. The best luminescent materials consist of a highly purified major constituent with the properly chosen minor or impurity constituent (present in proportions of 1 to 1000 parts per million), which provides the sensitive special sites where luminescence can occur. These sites are frequently called *luminescence centers*.

Let us consider a typical luminescent material like zinc sulfide. Pure zinc sulfide (pure, that is, to the limit of spectroscopic detection) containing essentially only zinc and sulfur atoms, is practically non-luminescent. Small proportions of silver incorporated in this zinc sulfide, however, produce a material which emits blue light when excited by ultraviolet, electrons, or nuclear particles (that is, by any excitation of sufficient energy to excite or ionize luminescence centers). Copper impurity produces a material emitting green light, and manganese impurity produces a material emitting orange light. The color of the emission is a characteristic both of the impurity and of the material into which it is incorporated. The impurity disturbs its neighboring atoms in the crystal, producing localized regions where electrons can be excited to higher energy states and

can then return to their ground state at a later time, giving up a portion of their energy as light when they return.

After the exciting radiation is turned off, the luminescence emission will decay to essentially zero in time ranging from microseconds to days or even longer. The actual decay time depends on the lifetime of excited electrons in metastable states before returning to the ground state of the luminescence center. There are two general types of metastable states: (1) the electron is not freed from the center but remains in a metastable excited state of the center; (2) the electron is freed from the center and may be temporarily captured at other places in the material called *trapping centers,* which are able to hold the electron for a length of time until the electron is freed again from the trapping center by using thermal energy present in the crystal vibrations.

In luminescent materials in which the electrons are free to move about through the crystal between the process of excitation and the process of emission, it is possible that the electron may be captured by other centers than the luminescence centers, which are able to dissipate the electron's energy as heat rather than as light. These *poison centers* are in competition with the luminescence centers for the free electrons and they reduce the over-all luminescence efficiency by transforming the energy of some of the electrons into useless thermal energy rather than permitting it to be converted into visible radiation. Impurities such as iron, cobalt, or nickel act as poison centers in zinc sulfide. They can have a severely deleterious effect on the quality of the luminescent material if present in only the smallest proportion: 1 part per million or less.

We mentioned above that electrons temporarily held in trapping centers can be released by acquiring sufficient thermal energy from the crystal vibrations. Alternatively such trapped electrons can be freed by absorbing the required energy from light of the proper wavelength; usually this wavelength lies in the red or infrared portions of the spectrum. If infrared radiation is allowed to fall on a luminescent material which has been excited and which is relatively free of poison centers, the sudden release of trapped electrons with their return to their ground state, producing emission, causes a sudden increase in brightness; this effect is called *infrared stimulation* of luminescence. On the other hand, in materials with poison centers, it is possible for the infrared to act in such a way that effectively the electrons freed from traps are captured by the poison centers rather than by the luminescence centers. The result is a sudden decrease in emission intensity; this effect is called *infrared quenching* of luminescence,

Thus we have very briefly set the stage for our pageant. It is now necessary for us to introduce the cast and proceed with our illustrations of spiritual truth.

*Research solid-state physicist at the RCA Laboratories, Princeton, N.J.

Dramatis Personae

The Natural Man	Material without luminescence centers, either with or without poison centers
The Study and Preaching of the Word	Exciting radiation; e.g., ultraviolet
The New Man	Material with luminescence centers
Fruit of the Christian Life	Luminescence emission
Sins	Poison centers
Backsliding: Loss of Communion	Decay of emission
Spiritual Strength	Trapped electrons
Times of Adversity	Infrared

Part 1. The Gospel and Natural Man

When ultraviolet falls on a material without luminescence centers, regardless of whether poison centers are present or not, there is no appropriation of the ultraviolet to produce luminescence emission.

[The universal invitation of the Gospel goes forth to all men through the preaching, reading, and study of God's Word. But unless the heart of man has been prepared by the Holy Spirit, the invitation falls on deaf ears. Sin blinds the spiritual heart of natural man. Even the natural man who stands in the world's righteousness, free from obvious sin, does not have within himself the power to appropriate the invitation of salvation for himself—to take for himself the "whosoever" of the promise.]

Part 2. The New Birth

When luminescence centers have been properly incorporated within a material, the material can appropriate the ultraviolet to produce visible emission originating at those very centers.

[The Holy Spirit acts in accord with the purpose of God, to give the new birth to God's elect. He forms a new creation within man so that the invitation of the Gospel and the study of the Word are received with joy and turned into service to God. It is the new nature, acting in opposition to the old nature which still remains, which is the source for all Christian service to the glory of God.]

Part 3. Christian Service

Different luminescent materials have different emissions, varying in both color and intensity from material to material. Materials with a high proportion of poison centers present will have a much lower brightness than they would have if the poison centers were absent. For all materials the emission intensity increases as the excitation intensity increases.

[The Holy Spirit gives different gifts to different men. All who receive the new birth receive salvation, now and forever, but they are endowed in various ways for particular places in the work of the Kingdom. Such endowments vary both as to type and as to the degree of ability, but regardless of this, each man's service grows in both quality and quantity as his communion with God and his knowledge and application of the Word increase. Just as surely, the presence of sin in his life will detract from his service and testimony; as long as the sin remains unrepented and unconfessed, he will fall short of the place in God's service which he should be filling.]

Part 4. Backsliding

If the ultraviolet is turned off, the luminescence emission will decay until finally there will be no emission left. If the previous exposure to the ultraviolet has been short, or if the ultraviolet intensity is weak, or if the material does not have many trapping centers, the decay will be fast. If the material has many trapping centers and has been excited for a long time by high intensity ultravioliet, the decay will be slow and appreciable brightness can persist for some length of time. But, in either case, the emission intensity starts to decrease when the ultraviolet is turned off and continues to decrease until there is nothing left.

[Maintenance of a healthy Christian life of confidence and service requires unbroken feeding on the Word of God and communion with God in prayer. If regular meditation and study of the Word is discontinued, the quality of that Christian's life will start to decay. If the Christian has only a superficial knowledge of the Word and has not built up any reserves of spiritual strength within himself, it will not be long before his Christian testimony has completly disappeared. If the Christian has for a long time been a consecrated student of God's Word and has developed a reservoir of spiritual strength upon which to call in time of need, some semblance of testimony and service may persist for a long time. But, in either case, the quality of Christian service starts to drop as soon as separation from the Word is caused, and will continue to drop to nothing unless the Christian turns again to God in repentance and follows the guidance of the Holy Spirit back into a healthy spiritual life.]

Part 5. Effects of Adversity

When infrared falls on a luminescent material relatively free of poison centers, the sudden increase in electrons freed from trapping centers causes a sudden increase in the emission intensity. But when infrared falls on a luminescent material containing an appreciable proportion of poison centers, the trapping centers are drained free of electrons whose energy is wasted in the form of heat at the poison centers. Such effects of infrared stimulation and infrared quenching are particularly noticeable during the decay of emission.

[When adversity comes into the life of a Christian who has been in close communion with God and His Word, and who has built up a reserve of spiritual strength from this communion, the effect of adversity is to call upon those spiritual reserves in order to bring forth even greater service to God. But when adversity comes into the life of a Christian whose communion with God has been weakened by persisting in some favorite sins, the experience of adversity drains away whatever reserves of spiritual strength were present and leaves the Christian in a weaker position than before.]

A fitting Epilogue to the previous drama is provided by considering the entire field of scientific research as an illustration of Christian research in the understanding of the ways of God. This illustration is summarized in the following Table:

	Scientist	Christian
Search for knowledge of	nature	God and His purpose
Develops hypotheses about	nature	God and His purpose
Tests his hypotheses by	physical experimentation	study of God's Word
Hypothesis good if	confirmed by experiment	confirmed by the Word
Carelessness leads to	errors in measurements and calculations	errors in interpretation and exegesis
Carefulness leads to	closer understanding of nature	closer understanding of God and His purpose

As the goal of the scientist is to learn about the laws of nature, so it is the purpose of the Christian to learn about the laws of God.

Being human, both the scientist and the Christian are limited in the extent to which they can adequately conceptualize; in developing their understanding they will each be led to construct hypotheses in their own minds which seem to be good.

They both then desire to know—is my hypothesis really a good one?

The scientist tests his hypothesis by contacting the source of his information concerning nature; i.e., he performs a physical experiment. If the results of his experiment agree with those of his hypothesis—his

hypothesis can be accepted as a good tentative one. To establish its reliability further, the scientist must show that his hypothesis and the results of many different pertinent experiments continue to agree. In the same way, a Christian tests his hypothesis about God and His purpose by contacting the source of his information about God, the Revelation given to men in the Bible for that purpose; i.e., he studies the Scriptures. He must not be content to confirm his hypothesis with one or two Scriptural "experiments," but he must demonstrate that the whole of Scripture, interpreted in the light of Scripture, confirms it.

A careless scientist will overlook vital factors in his experiments or permit preconceived notions to affect the observations he chooses to consider; thus he may reject good hypotheses and cling to poor ones. A careless Christian will overlook vital passages in the Scriptures or will be blinded to unifying interpretations by traditional prejudices; thus he also may miss the good hypotheses and hold to poor ones.

A careful scientist will proceed from questioned hypotheses, to good tentative hypotheses, to accepted theories about nature; in so doing he will bring his understanding of nature ever closer to a reliable description of it. A careful Christian will grow in his understanding of God and His purpose, and by possessing a sound knowledge of the teachings of God, will go on to applying these teachings in his life; in so doing he will grow in sanctification and in useful service to the glory of God.

Of course there is one very important difference between the two types of this illustration. Nature does not exist betwen the covers of a book; the scientist's data are always reaching out to reveal new and unforeseen facts about nature. Because of this, all of the scientist's theories, based on his good hypotheses of the past, are only temporary, and may be proven only fair approximations or basically incorrect in concept after all. The data of the Christian, on the other hand, are in essence complete in the Bible, available for objective analysis by the best methods of consecrated scholarship. There may yet be some changes in interpretation on minor issues, but the hypotheses which the Christian proves to be good become his doctrines and they have an eternal validity. They have this eternal validity because they are based on the complete and perfect revelation of God, Who does not change and Who knows the end from the beginning. That is the essential characteristic of the Christian data: that they are not based on the knowledge which man has obtained about God by his experience (as do his scientific data) but rather upon the knowedge which God has given in completeness.

Tranquilizing Drugs

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In 1847 Sir James Y. Simpson introduced ether as obstetrical anesthesia. Shortly he found chloroform to be more acceptable. Since the introduction of obstetrical analgesia and anesthesia, controversy has flowed between the two extremes. At first it encountered great opposition from physicians, clergy and laymen. Ideas have changed since then. Today there is no out-cry against man's interference with a Divine edict—"in sorrw thou shalt bring forth." Genesis 3:16, now historically accepted even by most devout Christians, if but by default. The subject is simply that of obstetrical anesthesia and analgesia.

In 1847 the first known use of a drug, ether, was used to lessen the pain and stress of childbirth. Since the dawn of the obstetrical anesthesia-analgesia field, medicine has been enlightened, and many women's lives have been made brighter, not alone from the freedom from pain but also by aiding in the prevention of the psychic trauma that develops in human female minds from traumatic childbirth. Many homes have experienced more love and harmony because of the lack of fear of childbirth and the prevention of frigidity in the female that follows the psychic and physical trauma during this physiological act.

Yet are we contrary to Scripture, for as we know, God pronounced a curse "that in pain thou shalt" Genesis 3:16? Do we orthodox (fundamental) Christians err in accepting this Obanesthesia? The majority of even staunch Christians accept this as routine, (that is, Obanesthesia) never even considering the philosophical conflicts. Wherein do we stand, in error or in pity, or as God put Adam asleep when he took the rib from his side to make the woman, are we justified in anesthesia-analgesia in childbirth? There has been a great change in medicine since 1847, for in 1956 many children are born alive because of anesthesia. Can we as Christians assign them to death by opposing the revealed gift that allows them to live?

This paper has as its purpose the removal, or prevention of additional misunderstandings between fundamental Christianity and Science, specifically dealing

with complex problems of psychiatric nature, and biochemical association as they directly affect Christian problems of today.

In Christian circles it has obviously been difficult to accept scientific material. Perhaps not so greatly in the physical science as it has been in biological, physiological, medical and allied fields. This rejection was undoubtedly aided substantially by introduction of the conflict of evolutionary hypothesis with Christian principles, and the great tendency on the part of men of science to wage open warfare against Christian teaching. During the past twenty years, as science has advanced, many conflicts have dissolved; scientific principles have been more readily accepted.

The drugs to be discussed are generally known as tranquilizing drugs. These drugs have opened many new fields of investigation and are involved principally with the psychic, emotional, life and the alteration that they bring forth. This new field involved is that of chemopsychiatry. The drugs have several cources. that is, sources or derivation from distinct chemical or pharmacological analogies. Most all of the drugs are not related to barbituric acid derivatives. They have pharmacological properties distinctly different from them.

Although some of the drugs involved in this discussion have been known for many years, their use and understanding of the pharmacodynamics have been largely associated with the post World War II years and the atomic-hydrogen age. Many drugs are under investigation—many are in use today, and undoubtedly more will be found and used. Some drugs possess remarkable qualities for producing hallucination, reducing fear, calming emotions and dulling sensations. Thus the field of Chemopsychiatric Therapeutic mingles with the fiel dof Philosophy and Religion. Concurrent with these discoveries were great advances in nuclear physics and chemistry, resulting in the Atom and Hydrogen bomb. A great insecurity began to develop when values of peace and safety, protection, distance, etc. melted away. The resultant general tension brought on stresses in the human personality and its integrative qualities that heretofore had never been known.

The effect of the tensions is evident in all walks of life. Coincidental, perhaps it is providential that the Author of our Faith allowed in His permissive Will, the uncovering of tranquilizing drugs. But we have here a problem, a crossroad of decision, especially pointed at the one who accepts the Christian faith and its associated philosophical theology. The great question exists—Is Christ enough for the Hydrogen age? The only answer that is valid is yes, for Col. 1:16—"we know that it is He that causes all things to consist." What then can we say about these drugs, and the use of them by Christians and non-Christians? I believe we have an issue that encompasses about all phases of human endeavor. I propse now to explore this realm from medical philosophy, perhaps superficially because of lack of time, or perhaps because of the unknown ramifications associatcd therewith.

In this field the Christian finds himself in a peculiar place—and likewise the philosopher and the Theologian, perhaps uncomfortably so. We are of a dual nature and are under pressures of the world and its conflicts constantly. As Paul wrote, "Oh, wretched man that I am, who can deliver me." The Christian may have a severe over-use of the alarm reaction mechanism; he may be anxious; over-anxious about the conversion of another soul to the extent that he may become useless or ill because of such great anxiety. He may be made useful again by application of tranquillizing drugs without being a failure or falling into great self-condemnation. The Christian has not been promised freedom from stress, illness, conflict and frustration, but has been promised victory in spite of them through Christ's strength.

The issue of psychosomatization is held under consideration at this point. For the sake of completeness, we must understand that the stresses of the Hydrogen Age release a physiological mechanism in some people—the so-called alarm reaction of Hans Selye. Briefly, his is the organism's response to a challenge to or assault on its integrity; that is, if a person is attacked by a man with an axe, he will prepare to fight or will undertake flight. This reaction is a complex phenomenon mediated by the pituitary adrenal axis, and is again illustrated by the cat frightened by a dog. If the dog is big, the cat will run. If the dog is judged small, or the threat to something great then the cat fights. This is exhibited by humped back, claws out, eyes dilated and tense muscle system, caused by the elaboration of epinepherine and the functioning of the autonomic nervous system. In humans, whether Christians or non-Christian, this alarm reaction functions, in some more so than in others. We may not have a man with an axe after us but it may be a verbal attack, yet it is still an assault upon us. If we over-work this alarm mechanism, we may become ill, even incapacitated or useless even to the cause of Christ. Yet, if under proper treatment an anxious, tense, useless individual may be rendered useful—not tense, not anxious—then we have performed a great service.

The abuse of the alarm reaction is thought to be the cause of many psychosomatic illnesses. To make a correlation at this point in our thinking, as far as Biblical interpretation goes—I know of no promise which involves complete transformation in this life, that is, alteration of human physiology contrary to normal human physiological processes. Christian women bear children in the same manner as non-Christians and the adaptation of alarm mechanisms are the same in

Christian as in non-Christian. For the Christian the ultimate end of life will be changed, the stress of life will be met with different attitudes. The Christian life does not promise freedom from stress but help in spite of the stresses of life.

Also it must be understood that psychosomatic disease, neurosis, anxiety states, mesenchymal diseases, etc., are not intended to be classified with psychosis, but perhaps are of a similar nature, that is possibly a biological defect or metabolic disorder of a biochemical system not yet understood, or as yet uninvestigated. They have a common ground of being effectively treated by tranquillizing drugs. It has not been established why two people under similar tension will break down in different ways, nor why some may not break down in any visible way. There cannot be any clear cut separation of the organism from his environment for we have biological, chemical, physical forces operating in all organisms in any environment.

Tranquillizing drugs have produced several noteworthy points of interest:

1. Their calming effect without sedation.
2. The central nervous system site of action, and its enlightening effect on the cause of mental and emotional illness.
3. Secondary effects or some staunch supporters of the evolutionary hypothesis.

Among these drugs we will consider three which are representative of distinctly different drug families.

The Rawolfia group had an interesting history, having been known in India for 2500 years. Steeped in mystery and sorcery, it had been used for legions of illnesses from infantile colic, dysentery, to madness. In the 16th century Leopold Rauwolf brought the snake root out of India to Europe, and gradually it had its natural course of investigation until 1948 when it was introduced to the United States and Europe for its antihypertensive qualities, and simultaneously its action on the mentally disturbed was studied. Finally in 1950 to 1952 it was released for use as an anti-hypertensive agent and in 1954 released for psychiatric treatment.

Since the use of Rawolfia in hypertension and on psychiatric problems, greater interest has been shown in basic research into the central mechanism of emotions. The Department of Neuropsychiatry at Tulane University under the direction of Robert G. Heath has directed investigation of the Septal region of the Corpus Callosum (the Rhineceptalic region below the knee of the Corpus Callosum.) It is his impression that emotional reactions are largely initialed by memory, and that painful emotion is the nuclear factor of disordered behavior in man.

By placing electrodes deep in the brain (Septal area) the Heath group has recorded changes in behavior, body chemistry, EEGS and motor function accompanying or following stimulation in this area. H. E. Himwich investigating the mesodiencephatic activating system with electrodes has established criteria for arousal and depression of the activating system. Rawolfia derivatives stimulate arousing effect of the activating system, and its depressing effect on the Hypothalmus is offset by this stimulation. A side effect of the arousal is evidenced by the Parkinsonism with heavy doses of reserpine.

Work with LSD the Hallucinogenic drug, (related through the indole nucleus to Epinepherine) has shown that LSD inhibits or impairs the function of Serotonin, (5Hydroxytryptamine) (5HT) which is a normal constituent of nerve and brain tissue. Evidently reserpine facilitates this substance's utilization or manufacture. We can correlate Serotonin to the function of the autonomic nervous system.

Interesting information derived from these investigations has produced two schools of thought. One school is impressed by the fact that 5HT is necessary to normal brain function. The Hallucinogenic substances (LSD) impair the action of 5HT and an excess of 5HT produces mental disease. Biochemical investigations into mental disease would bring much work of Freud-et al to naught.

This reference to Freud, etc. is by no means bias, but for years men of analytical minds have questioned some of his interpretations, for they were based on observed, information, circumstantial subjective evidence, etc. Now we have observed the onset of a more concrete approach to mental and emotional disease. The use of drugs in psychiatry is not new, and this is not an attempt to throw psychiatry back 100 years like some think, but an effort to utilize the new approach of the Ataraxtic Drugs and resultant avenues of research to the advantage of those mentally or emotionally ill.

More pronounced in Christian thinking are the enlightening facts brought about by this investigation, for Freud expressed definite antagonism to God, and religion in general. Now his dogmatic interpretations are tottering, when viewed under the light of biochemical, pharmacologic research.

If mental and emotional disease is a biochemical, metabolic, developmental or combined disease, then the behaviorism, analytical, schools of phsychiatric methodology have been weighed in the balance and found wanting. For these illness are then to be interpreted in a similar manner as Diabetes Mellitus, Addisons Disease, Hemophilia, etc., and not just mal-adjustment state or frustration of libido.

Phenotheozine derivatives are drugs possessing remarkable activity in the field of Chemopsychotherapeutics. The physiological sight of action is that of blocking the sub-cortical areas. Large doses produce sleep—small doses produce detachment from environment, relative indifferences, etc.

First studied in Europe then introduced to this

country for use in pain control, nausea, etc. These drugs do not change the cerebral oxygen consumption in usual doses. The drug inhibits the alerting mechanism of the reticular formation as previously introduced. These drugs act immediately and are the drugs of choice in the acutely disturbed patient and anxiety reactions, somatic disturbances, surgical preanesthetic medication, OB analgesia, alcoholics and agitated psychotics. Observation of patients under their influence is nothing short of amazing. Children lose their fear of tonsillectromies. The use of narcotics in preanesthetic medication is cut in half or eliminated. Obstetrical labors are less turbulent, and hostile parents are more accessible.

In 1946 Myensin was investigated by Berger et al. From this analogue mephenesin was derived and utilized initially for muscle spasm. Finding a great calming effect in 1952, popular articles appeared advocating its use in calming nerves before speaking and flying. The next step was the development of (Mephrobametes) Miltown and its respective relatives, and the first association with the laity's knowledge of "Happy pills".

The pharmacological action of Meprobamates is a blocking of internunicial circuits between cortex and thalmus, inhibiting electrical activity in that region. These drugs have little or no effect on the physiological patterns of the body. The body temperature, metabolic rate, emetic center, blood pressure, pulse, intestinal functions, are not changed, however sleep induction is moderate, and muscle relaxation is a prominent feature of their action.

As a tool in the attack on chronic anxieties, the meprobomates have proven to be exceptionally usable. It might be pointed out here that misuse, abuse or indiscriminate use, improper use is not advocated. Diligent, discriminating selection of patient and drugs have produced desirable responses in Christian and non-Christian alike.

The material covered thus far is not comprehensive nor exhausted, however the more subtle application again must be stressed. The normal or philosophical position of whether these drugs are acceptable or usable must be diligently considered. The application of the information derived, in relationship to its impact on (Biological Hypotheses) as applied in the field of Pharmacology—eg. species reaction or specificity, etc. must be fully investigated. Also, its direct effect on the opening of new understanding in Neurophysiology and the physiology of emotions, which does not support the cause and effect relationship as proposed by the analytical schools of psychiatry, must be considered jointly, and cannot be accepted or rejected separately.

F. P. Gerty in several recent articles, has separately and with totally different approach, expressed dissatisfaction with the Bleulerian) classification of Schizophrensa etc., and has uncovered features in the phosphorilization in R.B.C. which under his investigation has proven 89% accurate in identification of people with this type of emotional problems. Thus he has given support to the suggestion that emotional illness may be a defect or dearrangement in cerebral or total biochemical patterns. Therefore the Christian attitude toward these problems as well as the general attitude must be re-evaluated, and again if these problems are biochemical diseases etc., ataraxties are as applicable as insulin, and the behavior and analytical approach to problems of emotions is as outmoded. Scripturally, the use of tranquillizing drugs must be considered as efficacious as Penicillin. It is still Christ that causes all things to consist. Col. 1:16.

The application of this discussion is best illustrated by a few simple case histories.

I. W/F—age 33, pastor's wife, devout Christian—because of inadequacies of personalitites, and definite psychotic manifestations, ideas of reference, increased psychomotor activities, hallucinations, etc., all but wrecked her home life, the growing church that her husband pastored and all those associated with him. The patient was placed on Chloropromazine and ultimately Reserpine. For the pasts 20 months she has been calm, willing to accept a lesser position, useful in church and community activities. She has been able to accept her family responsibilities, resulting in much less discord, and dissention in the home and church life.

II. W/F—age 43, chronic Alcoholic 2 years, lost her exceptionally good position as an executive secretary in a large office because of alcoholism, instability etc., was placed on chloropromazine and subsequently meprobomate. Since institution of treatment 15 months ago she has been gainfully employed and has been more receptive to Christian teaching.

Lest we understand that these drugs are useful in only severe illness we will illustrate case number III.

W/M—age 42, bank cashier, Sunday school teacher, lay choir director, presented himself with symptoms physically expressed by fear of impending disaster, BP 160/110, headaches, dilated pupils, sweaty hands, etc., and chronic constipation. He was to a point of complete incapacitation. He was placed on Reserpine and after 4 weeks BP 120/80, anxiety symptoms improved, eliminated, constipation corrected—back to full duty with less extra-curricular activity.

In concluding, the Ataraxtic drugs are useful tools in salvaging people from emotional stress and related illness. They produce greater access to those who are in spiritual distress, but confused by the environment surrounding them. The drugs are useful in helping even Christians with psychosomatic illnesses. They are helpful in dealing with problems of stress associated with the Hydrogen age.

On the more subtle side, the drugs in question have opened avenues of investigation into unknown fields and have facilitated much our understanding of cerebral and lower CNS function in health and disease. By this in the future, theories and dogmas of pseudo-scientific approach will melt away. The investigation of pharmacological properties of chemicals, may some day be a key feature in the fall of the ascent approach to developmental biology, etc.

Perhaps for the Christian, we must refer to Peter's vision, where Peter learned that nothing is unclean of itself—and so he ate after giving thanks to God, for like Peter, with thanksgiving to God we accept his gift, even yet Ataraxtic drugs.

Summary

A. A very real moral problem exists for
   1. Consideration of the scientific Christian mind.
   2. Philosophical discussion.
   3. In utilizing a new scientific tool.

B. Turmoil in the world is on the increase.
   1. Hydrogen age . . .uncertainty.
   2. Biblical backing for above - known well by students of scripture.
   3. Resultant effect on Christian whether
      a. Christian worker
      b. Christian business man
      c. Christian men of science

C. With increase of knowledge.
   1. Electronics
   2. Nuclear physics
   3. Medicine
   4. God given or permitted
      a. All things work together for good for those who are the called according to his purpose.
   5. No time for ostrich philosophy, narrow attitude, blind faith
   6. It is by Christ that all things consist.

Conclusion

A. Tranquillizing drugs a useful tool in medical armament that can be utilized to great advantage in
   1. Christian and non-Christian alike
   2. Biblically sound and scientifically acceptable within our limited present knowledge.

Bibliography

(1) *Simpson, On the Employment of the Inhalation of Sulphuric Ether in the Practice of Midwifery,* Month J. Med Sc. 1847, p. 248.
1847, p. 248.

(2) Stander, H. J., *Obstetrics,* Third Edition, Appleton, Century, N. Y., p. 411.

(3) Selye, Hans, *1946 General Adaptation Syndrome and Disease,* J. Allergy, 17:358.

(4) *Serpasil, The Story Of,* Ciba Pharmaceutical Co., 1955, p. 6.

(5) Scope, Upjohn Co., Vol. IV, No. 8, Winter 1955.

(6) Brodia BA, Shore, PA., Pletcher A., *Serotonin Releasing Activity Limited to Rawolfia Alkaloids with Tranglielizing Action,* Science Vol. 123, No. 3205, June 1956, p. 992.

(7) Berger, F. M. and Bradley, W., *The Pharmacological Properties of A:B. Dihyd oxy v (2Methyl-Phenoxy) propane (Myenesin),* Brit. J. Pharmacology, 1:256, 1946.

(8) Berger, F. M., *Meprobamates* (Miltown) *its Pharmacological Properties and Clinical Uses,* Internat. Rec. Med., 169:184; 1956.

(9) Boszormenvi-Nagy
Between the Phosphorus Metabolism of Erythcocytes of Normals and of Patients Suffering from Schizophrenia. The Journal of Nervous and Mental Disease, Vol. 121. No. 1, Jan. 1955.

(10) Boszormenyi-Nagy, Ivan and Gerty, F. J., *Diagnostic Aspects of a Study of Intracellular Phosphorylations in Schizophrenia.* The American Journal of Psychiatry, Vol. No. I, July 1955.

(11) Fazekas, Joseph et al. *The Pharmaeodynamics of Ataraxics, A Rational Approach to Therapy.* Scientific Exhibit, Psychiatric and Medical Services of the Georgetown and George Washington Divisions of the District of Columbia; General Hospital, Washington, D.C.

Revelation, History, And the Bible *

GEORGE E. LADD

At the heart of biblical religion is revelation. The presupposition of biblical religion is that man's predicament is so involved that he is incapable of finding God. Left to himself, man's religious quest leads to futility. However, God has not left man to himself. God has taken the initiative to bring men that which they could not achieve: knowledge of God, and the fellowship which grows out of that knowledge. This divine activity involves both revelation and redemption. God has acted to impart to men, who are in bondage to ignorance and sin, knowledge of and fellowship with God.

What does revelation involve? How is it accomplished? And in particular, what is the place of the Bible in revelation? This last question is vigorously debated in contemporary theological discussion. Orthodox theology has maintained that revelation has taken place in the Bible, that the Scriptures themselves are divine revelation, that the Bible is the Word of God. There has arisen a powerful reaction to this traditional position on the part of some theologians. Such thinkers insist that the medium of revelation is redemptive history rather than a book. The content of revelation is not truth about God to be stated in propositional form,

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but it is God himself, who through revelation imparts himself to men. Revelation conveys not knowledge *about* God but knowledge of *God.*

A vigorous presentation of this modern point of view may be found in John Baillie's American Bampton lectures delivered at Columbia University.[1] Baillie has some excellent passages on the historical character of biblical religion. Other sacred books consist of oracles setting forth timeless truths to instruct man in his conduct and worship. The Bible records what God has done to bring man into fellowship with himself. The Mosiac law is set apart from other legal codes in being based upon a covenant between Israel and God which is conceived as taking place in history. The prophetic oracles differed from other oracles in antiquity in that they are concerned with the meaning of definite historical situations rather than with timeless truth. While the great philosophies offer a new interpretation of old and universal facts and pagan religions attempt to provide man with a new relationship to an old situation, biblical religion has something new to announce. God has done something. New events have occurred which place men in a situation in which they have never been before. The Gospel is indeed "good news."

Through this historical revelation culminating in Christ, God has not merely made himself known; He has given himself that men might enter into fellowship with God. If revelation consisted chiefly of theological propositions, the reaction required of men would be intellectual assent. This, however, is not what God requires; it is rather complete committal, trust, that there might ensue a life of fellowship with and dependence upon God.

There is indeed, Baillie admits, an element of assent; but this intellectual element plays a distinctly subordinate role in man's response to revelation. Only wholehearted trust which responds to God's giving of himself in revelation is an adequate response. In fact, such a response is necessary for revelation actually to exist. Revelation is never complete, i.e., the process of the divine impartation is never consummated without this human response.

In this process, the Bible is not revelation but a witness to revelation. It is both a record of what God has done in revelation and it is the response of men contemporary to the divine act which completes the revelation. As men in subsequent ages read the witness and, led by the Spirit, respond to God's revelatory act in Christ as did the prophets and the apostles so that the prophetic response becomes our response, then revelation becomes a completed reality.

This theology of revelation as recital and response rather than as proposition is offered as a challenge to the traditional view that the Bible is a part of the revelation itself. The traditional view which is no longer acceptable is described as an "ecclesiastical formulation which identified revelation with the written word of Scripture and gave to the action of God in history the revelational status only of being among the things concerning which Scripture informed us."[3] In other words, Baillie accuses orthodox theology of emphasizing the role of the Bible in revelation to the practical exclusion of revelation in historical events.

The "ecclesiastical formulation" as it is described by Baillie is not the only interpretation held by modern theologians who stand in the traditional stream of interpretation. Perhaps there is a type of traditional orthodoxy which has not given adequate recognition to the revelational character of redemptive history. Indeed, Earle E. Cairns in his excellent survey of "Philosophy of History" in the recent volume on *Contemporary Evangelical Thought* rejects the concept of Holy or Redemptive History because of his desire to emphasize that God has exercised a providential control over all of history. The idea that God has uniquely revealed himself in one strand of history or that there is a sacred history which bears a revelatory significance over against secular or general history suggests to Professor Cairns a denial of the unity and continuity of history.[5] "God comes into the historical process in the Incarnation of Christ."[6] However, we do not feel such a denial of special or redemptive revelatory history is an essential element in an orthodox understanding of revelation. On the contrary, the recognition of the historical character of both biblical theology in general and revelation in particular seems essential to an adequate interpretation of biblical religion. However, a cordial recognition of history as the vehicle of revelation does not lead to a denial that the Bible is itself a part of revelation, as Baillie suggests; and the demonstration of this fact is the main thesis of this paper.

The role of redemptive history in revelation is recognized, if not stressed, by Carl F. H. Henry in his essay "Divine Revelation and the Bible."[7] "Special revelation involves unique historical events of divine deliverance. ...The category of revelation is therefore broader than the category of the spoken and written words of Scripture, since it covers special historic events which the Bible normatively interprets.... Revelation cannot, therefore, be equated simply with the Hebrew Christian Scriptures; the Bible is a special segment within a larger divine activity of revelation."[8]

Certainly Henry's view squares with the teachings of Scripture. The Bible is very conscious that God has spoken unto the fathers in the prophets in diverse manners (Heb. 1:1). One of these modes of conveying the Word of God is historical events. We need not be afraid of the affirmation that God has revealed himself in redemptive history. God has spoken in many ways, through more than one medium.

We should agree with Baillie that the historic char-

acter of Biblical religion provides both its distinctiveness and its glory. Theology is not simply a set of universal truths, a system of philosophical concepts. The so-called "Old Liberalism" of men like Adolf Harnack is subject to the criticism that it reduced the kernel of Christianity to a few religious truths of universal character: the Fatherhood of God, the brotherhood of man, the infinite value of the human soul, and the ethic of love. This is not biblical Christianity. The Bible asserts that God does indeed exercise a providential control over all human history, but that in one strand of history God has been uniquely active in special revelation. Revelation asserts that God has done something, that the divine activity is to be seen in the stream of redemptive history as nowhere else, and that God himself has finally entered history in the person of His Son, Jesus Christ, to bring man into fellowship with himself. God is indeed revealed in the Jesus of history. "He that hath seen me hath seen the Father" (John 14:9). The providence of God may be recognized in general history, but God has not revealed himself redemptively to men in the history of Chinese civilization, Greek philosophy, Roman law or Egyptian religion. Only in holy history, in the history of the covenant people Israel, has God made himself redemptively known.

There is indeed one important circle of contemporary theological thought which is embarrassed by the historical character of revelation, for it seems to make theology dependent upon the relatives of historic research. The modern understanding of history is such that many thinkers are offended by the idea that one "piece" or strand of history can contain meanings which are absolute and by which all other history is judged. The effort has therefore been made to free Christian theology from its involvement in history—an effort which has not been successfully accomplished.[9]

While we may cordially agree that the events of redemptive history are revelatory, that God has spoken in the events of the history of Israel and above all in Jesus Christ, we must emphasize that the revelation in acts is not left to speak for itself. Revelation in historical events might not always be recognized as such. Baillie recognizes this fact and, following C. H. Dodd, admits that "history" consists of the historical occurrence plus its interpretation or meaning. It is the total structure of the historical event plus the interpretation which is God's Word to man. The events by themselves are capable of other explanations, but the prophetic interpretation recognizes the divine activity in the historical event, and the prophetic interpretation becomes itself a new event. [10]

This is a correct statement of the biblical pattern, so far as it goes. However, the problem arises at this point: Does the biblical concept of revelation recognize anything that is normative and authoritative in the prophetic interpretation of the revelatory historical event? Neo-orthodox theologians see nothing in this human interpretation which is authoritative. The prophetic interpretation is a purely human response which completes the divine act in history so that it becomes revelation to the person responding. The Bible is the witness to the act-revelation and the record of the human response which completes it. The man who today reads the witness to revelation and responds as did the prophets and apostles enters into the same experience of revelation. God becomes reality to him as He did to them.

This, however, is not the biblical pattern. Rather, the interpretation is not merely a human reaction to the divine act *but is itself a divine act.* The prophetic interpretation is itself the Word of God, which is necessary to convey the divine meaning of the historical event. Redemptive history has a character of once-for-allness. The death of Christ is an unrepeatable event. The apostolic interpretation of the death of Christ also shares this character of once-for-allness. There is a divinely intended meaning in the events of redemptive history which is not always self-evident. This meaning is conveyed in the prophetic and the apostolic interpretation. Therefore, the total event includes the historical act plus the prophetic interpretation; and both share the character of once-for-allness. There must indeed be a human response to revelation as each individual embraces the redemptive act of God for his own experience. This, however, is not revelation but illumination.

We may illustrate this fundamental principle that the revelatory event consists of occurrence plus authoritative meaning at two points. God singled out Saul to be king over Israel. The divine selection was made clear to Saul and the people through the prophet Samuel (I Sam. 10:24). Both Saul and the people accepted this appointment as the act of God. Yet Saul forgot the source of his appointment. He lost sight of the divine hand upon him and assumed that the authority was his own to exercise as he desired. The result was the divine announcement, again through the prophetic voice of interpretation, that God had now rejected Saul and was to cast him aside (I Sam. 15:17-28). Not only was God active in the elevation and subsequent rejection of Saul from the throne; God also spoke through the prophetic interpretation of these events. "Then came the word of the Lord unto Samuel" (I Sam. 15-10). Saul's apostasy was against the Word of the Lord (I Sam. 15:23). The Word of the Lord through Samuel, the interpretative prophetic utterance, is itself a part of the event. God spoke through the events; but these were made meaningful by a further word, the prophetic interpretation, which is also God's act. The revelatory event, therefore consists not in "bare" historical events, nor in an historical event plus a human reaction to it. Revelation consists of occurrence plus an authoritative

interpretation which comes from the Lord. The prophetic word is not a mere witness to revelation; it is itself a part of the revelatory event; indeed, that part of it without which the "bare" fact might not be understood.

We have cited an event which does not convey theological meanings; but the same principle is essential to understand the relationship between history and theology. The death of Christ is an historical event. Paul says that it is the proof, the demonstration of the love of God (Romans 5:8). How do we know that Christ's death discloses the love of God? Were the Roman soldiers conscious of God's love as they watched Jesus die? Were the few disciples who stayed close to the cross drawn there because they realized that in this act God was demonstrating His love for them? Was the love of God in Christ's death self-evident? On the contrary, they thought the end of their world had come. Their reaction was, "We *had hoped* . . . " (Luke 24:21 R.S.V.).

How did the idea that Christ's death revealed the love of God arise? Floyd V. Filson's stimulating book, *Jesus Christ The Risen Lord*,[11] tells us that the early interpretation of the cross grew out of Christian experience. The early Christians became aware that Christ had died for their benefit, that God in Christ had done for them what they could not do for themselves. "Out of their failure had come a realization of the forgiving goodness of God and His Christ, . . .This theology grew out of the personal experience of those who were nearest to Jesus."[12]

As one tries to understand the accounts of the disciples' reaction to Jesus' death, it is difficult to reconstruct the steps or the process by which *their experience* led them to a theology of the love of God in the death of Christ. Nor does Filson attempt this reconstruction. He leaves the reader with serious gaps in the historical reconstruction. He fails to demonstrate the sources of the disciples' experience. Experience produced theology: but what produced their experience?

It is true that the formulation of primitive Christian theology grew out of Christian experience; but the fact seems to be that Christian experience could only arise where there was a given theological interpretation of the meaning of Christ's death. Christ's death at first seemed to be utter, tragic defeat. Only when the Resurrection of Christ reversed the apparent catastrophe of his death, and when the risen Christ himself interpreted for them the meaning of his death (Luke 24:26-27), did it begin to convey new meaning and to become the act of God's love. Experience was based on the death of Christ as interpreted by Christ himself. We know that Jesus' death shows the love of God only because of our Lord's own prophetic interpretation of that event. This interpretation is normative, authoritative. It cannot be displaced by any alternate interpretations, for it is itself revelation which comes from God.

This analysis indicates the role of the Bible in revelation. The prophetic words were sometimes spoken, sometimes written; but they are always necessary. God's revelatory act was consummated in Jesus Christ. He is an historical character, and the Gospel stands or falls with the historicity of His person and ministry. But the event of Jesus Christ is not "bare" event; the meaning of the "Christ event" is set forth in the apostolic interpretation, i.e., in our New Testament. This interpretation is itself revelation. It is a divinely initiated, normative statement of what God did and said in Christ. The events of redemptive history can never be repeated, nor can the prophetic interpretation ever be repeated. Both are normative; both participate in the character of once-for-allness.

The inspired interpretation includes propositional truth. "God is love." This is a proposition, but much more than a proposition. It is a truth which can be understood only through the historical event of Christ's death, *as that event is prophetically interpreted.* Such truth requires the assent of the reader, but intellectual assent is not enough. It demands personal response, commitment, trust. It is true that in revelation and as a result of revelation, God gives Himself. Revelation has a redemptive purpose. But this divine self-giving includes knowledge about God as well as knowledge of God. I must know something about God before I can commit myself to God. The continuing human response to the divine revelation includes both mind and heart: in fact, the whole man. It is the business of orthodox Christianity to defend the truth. Apart from assured truth we have no certain message to proclaim. But it is even more imperative for orthodox Christianity to propagate revealed truth, to proclaim to sinful men the reality of the self-revealed God, that lost men may be brought back to fellowship with the living God.

Bibliography

(1) *The Idea of Revelation in Recent Thought* (New York, 1956).
(2) *Ibid.*, p. 52f.
(3) *Ibid.*, p. 62.
(4) Ed. by Carl F. H. Henry (New York: Channel Pr., 1953) pp. 181-211.
(5) *Op. cit.*, p. 203.
(6) *Ibid.*, p. 208.
(7) In *Inspiration and Interpretation*, John W. Walvoord, ed. (Grand Rapids: Eerdmans, 1957) pp. 253-278.
(8) *Ibid.*, p. 264f.
(9) Cf. Paul King Jewett, *Emil Brunner's Concept of Revelation* (London, 1954).
(10) *Op. cit.*, p. 69.
(11) New York: Abingdon, 1956.
(12) *Ibid.*, p. 124.

ANTHROPOLOGY

James O. Buswell III, M.A.

The science of anthropology for the Christian has many values and practical applications, both for accurate apologetics and for pressing social problems. The data and techniques of prehistoric archeology and human paleontology bear importantly upon the interpretation of portions of the Old Testament. The findings of racial studies together with the increasingly clear differentiation between what anthropologists call "cultural" behavior, and purely racial characteristics, likewise have an important bearing upon the tragic turmoil which has become popularly symbolized as "segregation vs. de-segregation" in our own country as well as in colonial contexts.

But, as Smalley and Fetzer have observed, "The most worthwhile potential area for applied anthropology is in Christian Missions." (*Modern Science and Christian Faith,* 2nd ed., p. 101.) It is a report of one phase of this area that concerns us here.

Institute of Missions Inaugurated

The first session of the Summer Institute of Missions, sponsored by the Evangelical Foreign Missions Association, and the Interdenominational Foreign Missions Association on the campus of Wheaton College was completed on July 19th. Giving either graduate or undergraduate credit to missionaries and candidates, the Institute consisted of four courses conducted within the academic framework of the regular Wheaton Summer School.

Dr. Merrill Tenney, Dean of the Graduate School of Wheaton College, taught the course in Bible Study Methods. The reason for having this course was that missionaries frequently fail to secure, amid all of their preparation in the scriptures, a systematic, efficient method of studying the Bible for themselves. Also, as might be expected, the response of mission executives to a preliminary questionnaire indicated that the greatest *single* need . . . was a knowledge of the Bible." (Tenney, M. C., "Report on Questionnaire on Missionary Education.")

In the selection of individual courses suggested by the questionnaire, "Methods and Philosophy of Missions" received the highest number of votes. Mr. Hubert Reynhout, Jr., former missionary under the Ceylon and India General Mission, and, since 1947, Professor of Missions at Providence-Barrington Bible College, taught this course. New and old methods were considered in the contexts of changing philosophies and approaches. Review and study of historic and current trends, and the comparative study and exchange of methods proved of great value to the missionaries enrolled.

Mr. David Woodward, of the Christian Witness Press of Formosa and Hong Kong, conducted a course in Missionary Literature. Problems of field as well as homeland production and distribution of literature were examined. As Production Manager and Assistant Editor of DEUGTA (The Lighthouse), Mr. Woodward was well prepared to present the necessity for, and techniques of good writing, with a unique familiarity with what is needed for new converts and for literate non-Christians on the foreign field. The course also covered the preparation of reports and newsletters, fiction, reviews, articles, and many other forms of literature for which the missionary is regularly responsible.

Communication Stressed

The fourth course was one in Anthropology. In answer to the question, "What are the *greatest general educational needs* of your missionaries?" the questionnaire showed that "there was a heavy stress on practical adaptability to the thinking of the people among whom the missionaries were working." Tabulation of the 38 returns indicated that anthropology was the second choice out of 27 subjects listed by the missions executives for inclusion in the proposed Summer Institute. "Out of five choices given in each questionnaire, by far the largest single interest was Methods and Philosophy of Missions (27 votes), Anthropology (21 votes), and Bible Study (20 votes)."

The anthropology course was built around the principal theme of Effective Communication. A combination of text materials introduced the missionaries and candidates to the normal academic scope of the field, (Herskovits, M. J., *Cultural Anthropology,* Knopf, 1955), a particular orientation of anthropology to missionary problems and attitudes, (Nida, E. A., *Customs and Cultures: Anthropology for Christian Missions,* Harper, 1954; and Davis, J. M., *New Buildings on Old Foundations,* Friendship Press, 1945); and to a consideration of specific cases and field probelms, such as *The Toba Indians of Argentine Chacos: An Interpretive Report,* by William D. Reyburn, (Mennonite Board of Missions, 1954), and a selection of articles from the *International Review of Missions,* and other journals.*

Besides the over-all stress on communication, two other items of emphasis were, (1) Attitudes: considerations of racial equality, and a recognition of cultural relativism consistent with Christian absolutes. (2) Understanding: discovery of the interrelated functioning of native customs and the meaning and values of the native culture; and that the missionary's presentation of Christianity can and must be adapted to the receivers' culture in order to achieve a responsible, indigenous church. This adaptation only happens as the missionary achieves an understanding of the native culture which is *more than a mere knowledge* of their customs.

It is vital to remember at this point, that no matter

how well trained we are, anthropologically or otherwise, our preparation does not guarantee our success in the missionary enterprise. As dependent upon human communicative skills as most cross-cultural dealings are, "the communication of the Gospel...is neither primarily nor ultimately dependent on our human ability to communicate. . . . the primary author of the effective transmission of the message is the Holy Spirit. This demonstrates clearly that communication of the gospel has a quality of its own..." (Hendrik Kraemer, *The Communication of the Christian Faith,* Westminister 1956, p. 28)

Observations and Results

At a session such as the Missions Institute there is an interesting two-fold confirmation of impressions from missionary literature as to why some missionaries have so often disregarded or rejected the value of anthropology. One point of view is that there is nothing in native culture worth preserving. It's all "heathen." The other view is, with reference to the first, that nobody is so stupid as to think that; "everybody knows one must take the native culture into account." *Neither one understands* the native culture, and for both, anthropology is superfluous. Needless to say, attitudes such as these were readily relinquished, due as much to the rich discussions between missionaries from different fields, as to classroom instruction and reading.

One of the rewarding experiences from such a class is to see the plans for direct application to the actual field situation of what is being studied. In this case, before the four-week session was even completed, one missionary in the anthropology class had composed a lengthy letter to her colleagues on the field, urging consideration of an attempt to understand the natives and their culture, instead of seeing how fast they could win them away from it. She brought the impact of this approach directly to bear upon her own field by outlining four detailed, concrete proposals as to how the mission church, (whose native pastor preaches only in English at present), could help to further effective communication of the Gospel to the bulk of the native tribe.

One proposal was an explanation of specific ways to orient the social and devotional program of the church around the interests of the natives.

The second was a strong plea for initiating and extending the use of the native language in songs, services, and home ministry.

The third proposal named certain native leaders as prospects for Sunday School teachers and superintendent.

The last was a suggestion as to the value of certain native leaders as deacons, ushers, and choir director. "In short, the more native leaders, the better."

Thus the obvious implication of the extension of the anthropological approach to missionary methods, when applied correctly with the guidance of the Holy Spirit and not as an end in inself, is the indigenous church, saving literally generations of foreign missionary time, and reaching far more people in the process.

Missionary Institute to Continue

The Summer Institute of Missions will be held again next year. It is planned that perhaps two more weeks will be added so that a missionary on furlough may attend for two, four, or six weeks, completing, respectively, one, two, or three courses in the Institute. Of course an additional four weeks which constitutes the regular second semester of the Wheaton College Summer School, is also available for any who wish to complete the maximum amount of academic credit in the summer months.

For additional information, write the Director of Summer School, Wheaton College, Wheaton, Illinois.

*A course outline and bibliography will be mailed to anyone interested, upon the receipt of a self addressed envelope with 6c postage.

BIOLOGY

I. W. Knobloch, Ph.D.

Chemical Basis of Living Matter Created by Scientists

An international group of scientists has synthesized RNA (ribonucleic acid), the energy-packed cell machinery that manufactures protein. RNA is also found in the genes of cells in another form (DNA of desoxyribonucleic acid) and holds the secret of heredity.

The synthesis of RNA was made possible by an enzyme called polynucleotide phosphorylase, which is able to weld together all the small molecular parts that make up the long-chained RNA molecule. The enzyme was isolated by Dr. Severo Ochoa of the New York University-Bellevue Medical Center.

The synthetic RNA has been formed by adding this enzyme to a water solution of the four bases of nucleotides. These nucleotides, when strung together in a very special way, make up the long RNA molecule. The nucleotides themselves are formed by the combination of sugar (ribose), phosphate, and any other of the four chemical bases (adenine, guanine, uracil, and cytosine). Nature carries on life by transferring energy-laden phosphate groups into, out of, and between these nucleotides.

Numerous other scientists took part in the research which was supported by the American Cancer Society, National Institutes of Health, Office of Naval Research, New York University College of Medicine, and the Rockefeller Foundation.

New Vitamin Discovered

A new vitamin temporarily labeled "Factor 3", probably a member of the family of B vitamins, has been

discovered by Dr. Klaus Schwarz and associates at the National Institutes of Health, Bethesda, Md.

The new vitamin protects the heart, liver, kidney, and muscle tissue against dietary degeneration. "Factor 3" is so labeled at present because two other vitamins, cystine and vitamin E, are known to be essential to the life of liver cells.

The new vitamin is an extremely powerful substance, for extremely tiny amounts accomplish its vital protective function.

Dr. Schwarz reports that even after major degenerative changes have occurred in heart, liver, kidney and muscle cells, the injection of microscopic amounts (10-70 gamma) of the protective substances into the portal vein bring about striking recovery of metabolic function within only 30 minutes.

New Hormone Developed

Development of a new hormone called Medrol, with 12 to 18 times the potency of cortisone and hydrocortisone in fighting inflammatory diseases such as arthritis, but lacking the chief side effects of these drugs has been reported by Dr. E. Miles Glenn of the Upjohn Laboratories, Kalamazoo, Michigan.

Known technically as 6-methyl-delta-1-hydrocorti sone, the new compound has great potential usefulness as an improved agent in the treatment of arthritis and a host of inflammatory diseases including many allergies such as hay fever.

(Above three items from Aminco Laboratory News, Vol. 14 (No. 2) March 1957).

Do Events Have Causes?

When one reads that modern physics has done away with "causes" and when one sees cause and effect relationships every day, one wonders if physics is not trying too hard to get away from reality. A recent book on this matter may be of interest "Causality and Chance in Modern Physics" by David Bohm. Van Nostrand Co. The publisher's comments on the volume follow.

> "Developments in modern physics during the past twenty-five years, especially in the field of quantum theory, have led a great many physicists to the conclusion that in the fundamental laws of the microscopic domain the basic processes are governed only by pure chance, while the causality that appears at the large scale level is regarded as merely the result of a statistical average of chance fluctuations, taken over large aggregations of atoms.
>
> "The work leading to this book arose from discussions with Einstein, and in it the author analyses and criticises the above conclusion, in order to understand more deeply what is the real relationship between causality and chance. It will be seen that the experimental and theoretical data of modern physics do not necessarily imply that the laws of nature are nothing more than the laws of chance. And it is quite possible that below the level of the quantum theory there may be a more fundamental "subquantum-mechanical" level, satisfying new kinds of laws that are more nearly determinate than those of quantum mechanics.
>
> "Reasons are given why such new kinds of laws are likely to be needed to resolve a current crises in microscopic physics. Thus, physics may now be suffering from a kind of dogmatism, in which the possibility of a deeper level of new kinds of causal laws, operating below the level treated by the current theory is refused consideration.
>
> "Here, many new directions of theoretical research are opened up, directions which are of important consideration for the further progress of physics, invaluable to all scientists today."

Scientific Rationalism and Christian Faith—by R. E. D. Clark. Intervarsity Fellowship, London, 1951.

Here is a small book of only 110 sub-standard sized pages, which is recommended reading for all Christians. He deals with the philosophy of such acknowledged agnostics and atheists as Professors Haldane, H. G. Wells, Lancelot Hodben and Julian Huxley and shows that these men have been led to their savage viewpoints by unfortunate occurrences in their childhood and youth or by vain attempts to solve the problems of the world by social rather than religious viewpoints.

Dr. Clark deserves a great deal of credit for his courage in attacking such an array of highly intelligent and articulate talent. He shows that their reasoning in certain matters is not above reproach.

Clark points out that belief in God does not make scientists lazy—they do not lay back waiting for God to reveal himself. Rather they are stimulated to uncover the secrets of the universe—to till the fields of science and to work in the vineyards. Boyle, Faraday, Galileo, Newton and Clerk-Maxwell are a few of the great "religious-scientists" of the past.

Some scientists think that we shall have to lay aside the cause and effect relationship which has guided science these many years. Some are happy to see it go because if the relationship does not hold, then there is no need for a First Cause. This is utter nonsense because in the everyday world, we still see bacteria causing disease and so on ad finitum. Cause and effect still rule the scientific world although one may have to distinguish among a number of causes and among a number of effects. It is no longer the simple thing that it was, but it is still here with us.

Rationalism, to Dr. Clark, is built upon faith in reason, which is, as everyone knows, not so dependable that we can afford to be dogmatic about the products of reason.

Creation—by R. E. D. Clark, Tyndale Press, London, 1953.

This is a booklet of only 72 pages but it is quite interesting reading. It deals with beginnings, design in nature, evolution, evil and agnosticism, all very controversial topics.

Among other things, Clark points out that modern physics is thought to deal with uncertainties although he doesn't mention Heisenberg. It seems to escape certain people that there can be levels of certainty and while it has always been known to people of discernment that the speed and position of a particle could

never be known simultaneously, it is an equally reasonable fact that there is an average certainty in the world —at least I *think* that I am typing this.

Dr. Clark says that the truth about relationships and functions remains as it was but the uncertainty arises when we start to ask questions about the ultimate nature of matter or energy. Thinking about ultimate matters hinders modern physics and so it is considered more profitable to ask questions which can be answered.

PHILOSOPHY

Robert D. Knudsen, Th.M., S.T.M.

For this issue I requested Dr. Lloyd F. Dean of Gordon College to contribute a column in philosophy. He has responded with a plea for more extensive and clear discussion among evangelical philosophers.

Dr. Dean took the degrees of A.M. and Ph.D. in philosophy from Boston University. He is now chairman of the department of philosophy at Gordon College.

Though the nature and size of this column does not allow it to be a discussion ground between evangelical scholars, there is no reason why it cannot issue an appeal for such discussion. That Dr. Dean has done.—R.D.K.

On the "Now" and "What" of Teaching Philosophy

Almost two years ago Professor Knudsen discussed in this column the difficulty of organizing a course in introduction to philosophy. In pointing out the specific problems, it became clear that the source of the trouble was not only the limited number of modern Christian treatises which could be correlated with an introductory study but also the obvious lack of agreement among Christian philosophers as to exactly what distinguishes the Christian approach.

The present writer has been teaching courses in introduction to philosophy for almost ten years to both large and small classes. During this time certain convictions have grown while others have been set aside. In the beginning I used Edgar Brightman's introductory text, supplemented by outside reading in Clark and the writing of a creative paper. The latter was designed to bring out the distinctiveness of the Christian position. At Gordon College all students are obliged to take nine hours of philosophy: three hours each in introduction, theism, and ethics. This means that all types of students are found in the courses and that certain emphases must be made to reach the dwellers on the periphery of interest and ability. Consequently, I have gradually come around to putting the whole discussion immediately into an explicit Christian context, text-wise. I have found that this makes communication a great deal easier. Thus, I now use Carnell's *Introduction to Christian Apologetics* as the in-class text and assign Brightman as parallel supplementary reading. This means that certain of the technicalities are de-emphasized, but I feel that I can pick these up later for my majors in the thirty-three hours they are required to take in philosophy.

Now, the fact that I am willing to use a combination of Carnell and Brightman for the indoctrination of all Gordon students year after year reveals a viewpoint concerning the nature of the Christian approach to philosophy that is in sharp variance with the positions espoused by men like Van Til, W. C. Young, Kantzer, and probably Vollenhoven and Dooyeweerd. I include the latter two with some hesitation since, after using Dooyeweerd and Spier in my senior seminar for several years, I am still in doubt as to the propriety of the identification of this position with that of Van Til, even in the basic essentials, although there is certainly a similarity. Incidentally, the writer's use of Dooyeweerd, *et al.*, in the course that crowns our philosophy majors' preparation, should suggest that his predilection for a Clarkian type of position does not preclude real appreciation for the value of the work of such a pioneer scholar as Herman Dooyeweerd. I think that this is important in view of what I wish now to say about the distinctives of Christian philosophy.

It seems to me that if the process of teaching (especially of college students for whom philosophy is not only not a major but perhaps not even an interest) impresses nothing else upon the teacher, it makes unalterably emphatic the necessity of clear distinctions and communications. I do not see how a teacher can possibly put across a concept which in the first place is not clear to him as an instructor. Now this is the great difficulty I find in the positions of men like Dooyeweerd, Van Til, W. C. Young, Kantzer, *et al.* Their views appear reminiscent of existentialism, at least in fuzziness of expression. Of course, this is a personal opinion. Possibly the fuzziness is in me and not in them. At any rate, I simply cannot understand what significant thing the proponents of this general position are saying. Perhaps progress will soon be made, since I am presently working on a number of Van Til's writings; but up to the present I remain stuck as firmly as ever in the mire of rationalism and idealism.

I would like this article to stand as a protest against obscurity and a plea for forthright and relevant definitions and explanations in Christian philosophizing. I cannot in this short piece present an over-all treatment of the issue, but I would like to cite a few instances of what I have in mind.

I have mentioned Professor Warren Young, whose *A Christian Approach to Philosophy* (Wheaton: Van Kampen Press, 1954) is probably the only modern Christian introduction to philosophy explicitly dedicated to that end. Here is an example of the kind of thing I simply do not understand. Throughout the volume

Dr. Young operates in terms of a division of philosophical world-views into three group: Naturalism, idealism, and Christian realism. What about Christian idealism? One may not like it, but it has attracted such able minds as Augustine, Berkeley, Edwards, and Clark. What also about realism? In the history of philosophy the term has been classically applied to Aristotle, Descartes, the neo-realists, and the critical realists, to name just a few. None of these are necessarily identified with Protestant Christianity. What can explain Young's use of the term exclusively to denote Christian philosophy? If he desired to use such a designation for his own position, well and good; but to introduce beginning students to the use of such terms as standard is indefensible.

When Young says, in objection to Clark's (or Carnell's) appeal to systematic consistency as the criterion of truth, that it is only the Christian to whom Christianity is consistent, he appears only to state a truism. It might also be said that only the pragmatist accepts pragmatism, that only the subjectivist accepts feeling, that only the positivist accepts the senses, etc. Why is there an emphasis on this tautology? If Young is simply affirming the necessity of regeneration, why does he not say so? Further, have Clark or Carnell ever spoken otherwise? Young also asks who is to determine whether a view is consistent or not? The answer seems obvious—the individual who is doing the determining! Each man must make up his own mind. The fact that others will disagree with me seems to be no valid objection to the criterion of truth I accept, unless the only aceptable criterion is *consensus gentium.*

I am equally baffled by the approach of Van Til and his followers, when they insist that the Christian starting point is absolutely necessary if there is to be any philosophy at all and then interpret this statement to mean that systematic consistency is unacceptable as the test for truth. Why? Can one not recognize the necessity of beginning with the Christian major premise if he is ever to arrive at it and at the same time recognize that the Christian position must be tested by the canons of logic and thus shown to be true? And why must the priority of logic as the criterion imply the priority of the truth of natural revelation over that of special revelation? Logic is not an end but a means, and certainly if there were no position to test in the first place the test would have no standing at all.

In the light of the points I have tried to make above, it should be clear that the writer believes that the situation in Christian philosophy today is rather critical. Further, it is to be noted that it is from the side of those who cry, "No common ground." "The Bible is self-authenticating," and "Away with synthesis philosophy," that the pressure is coming. Such thinkers even say that there never has existed a Christian philosophy worthy of the name until their own day (cf. Dooyeweerd and Van Til). All this makes it difficult, if not impossible (and certainly improper), for one to philosophize as a Christian and ignore the implications of the new apologetic (and in a real sense it is *new* and not classic). I would therefore re-echo Professor Knudsen's plea for a "thorough discussion of the problems" between the opposing camps. Above all, let the requirements for publication be clarity and directness of approach. No cause is really served by carrying on activities in a condition of low visibility.
Winchester, Mass., June 12, 1957.

PSYCHOLOGY

P. D. Marquart, M.D.

Criminal Genius

Christians are interested in books dealing with the problems of crime because that is an extreme degree of that wider area called sin. *Cell* 2455, *Death Row,* by Caryl Chessman (New York: Prentice-Hall, Inc., 1957.) is an autobiographical sketch written by the condemned man himself, prior to his own encounter with the California gas chamber. The writer is a rather remarkable criminal in that his mental capacity is obviously outstripping his formal education. Indeed, it would not be surprising to find that his I.Q. may exceed 140.

Chessman knows that he is diagnosed as a Psychopathic Personality. This term implies a persistently delinquent character. His abnormality consists in lifelong ethical maladjustment. He shows a lack of emotional coloring with respect to his own guilt. In one respect, he is unlike the Psychopath, in that he seems to have been well-behaved until the age of sixteen. In a second respect, his story reveals nothing to indicate that he was ever a rejected or an unwanted child. There is also more of psychodynamic understanding of his case than is usually found in a Psychopath. Otherwise, he conforms to the picture of a Psychopath rather well.

Some of the commonly alleged factors in delinquency may be summed up in this case. He was an only child. He was small of stature and appeared more immature than his years. Discipline was lax and indulgent. Since his mother was bedridden she had little possibility of chastening him effectively. Bad company just before his crime career began, seemed to be of significance.

His criminal genius seemed to find its best expression while he was behaving himself behind the bars. Sooner or later he would spoil it all by wild exploits. He was excellent in so many ways but he had no control over his emotional life. He seems to be perplexed by the fact that he is sure to do the wrong thing sooner or later. He readily admits that "crime does not pay." He feels that most criminals realize that crime does not

pay, but that knowledge does not help him to go straight. He could not have expressed it better had he said "in my flesh dwelleth no good thing." Yes, "all have sinned," but few have sinned and committed crime as Chessman had done. All have fallen human nature, but the psychopathic personality is perhaps the nth degree of fallen human nature.

Not only was Chessman the extreme of fallen human nature, but he was evidently unregenerate, since he writes some statements which express the renunciation of Christ and the blaming of whatever gods there be for his plight. There is also little evidence that his parental home was Christian, but there is some evidence that his mother's adopted parents were Christian. What a difference it would make in the extent of sin and crime, if every child were led to Christ or if he had the privilege of growing up in a Christian home.

SOCIOLOGY

Frank E. Houser, M. A.

When religion affects society religion is considered an independent variable. When society affects religion the latter is considered a dependent variable. Let us consider some contributions being made in sociology which illustrate both situations. We shall begin with functional theory in sociology—an example of dealing with religion as an independent variable.

Following the main emphasis in sociological theory today is the spate of books and articles on religion from the functional perspective. J. Milton Yinger has just had a fine book published in which he presents the sociology of religion using as his main scheme of approach the structural-functional analysis. It is entitled *Religion, Society and the Individual* (published by Macmillan). Here is a book divided into two parts. The first half is Yinger's essay on functionalism, or what religion does for the society and the individual. The second half of the work is composed of selected readings. This column has previously presented in brief form the main tenets of this school. Both the strengths and weaknesses of functional theory are discussed by Yinger. For more extensive treatment of functionalism the reader is invited to look at the chapter on that subject by W. Buckley in Becker and Boskoff's *Modern Sociological Theory* (published this year by Dryden Press).

A brief critique of the integrative function of religion is offered by Allen Eister in his article in the *American Sociological Review* for August this year. Here, Eister points out the difficulties of religion unifying or integrating a complex society. The article is brief and adds little to Robert Merton's excellent constructive critique in his famous work, *Social Theory and Social Structure*. While religion may sometimes be dysfunctional, and even non-functional for a complex society, the insights of functionalism are not destroyed. They are qualified and sharpened.

Just as religion may at times be supportive of society and the individual, and at other times dysfunctional, so we may view society's impact on religion. Religion thus is at times an independent variable, and at other times a dependent variable. To illustrate the latter several articles on aspects of Catholicism in America have been published in the journals lately. A. J. Mayer and Sue Marx publish a study in the January 1957 issue of the *American Journal of Sociology* which reveals how Catholic birthrates in Hamptranck, Michigan (a largely immigrant Polish community) have declined from 1920 to 1950 to the point where they are quite similar to the general birth rate in the U.S.A. Apparently rural origins, foreign birth, low socio-economic status, and Roman Catholicism did not prevent rapid acceptance of control of births.

This whole business of "Americanization" of Roman Catholics ought to be viewed with some objectivity by Protestants. This may be the kind of index which gives empirical light on just how zealous the American Roman Catholic is to obey church over against American heritage. It is interesting to note that the laity are the first to reveal change. Some regard the recruitment of native Americans to replenish the hierarchy of priests as another source of cultural and social invasion which will have repercussions of far more significance than what happens among the laity.

Of course, this is not to deny the contrary evidence. It is to suggest that the Roman Catholic Church in America is undergoing change and therefore exhibiting various tendencies—some even contradictory. Surely, as Catholicism gets more deeply involved in our culture and society, extensive change must be expected. Every other religious group, regardless of form of government, has been both affected and affecting.