

# JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION



*An evangelical perspective on science and the Christian faith*

(US ISSN 0003-0968)

PSY**C**HOLOGY

AST**R**OPHYSICS

MATH**E**MATICS

BOT**A**NY

EVOLU**T**ION

CHEM**I**STRY

ANTHR**O**POLOGY

GE**N**ETICS

*"The fear of the Lord is the beginning of Wisdom."*

Psalm 111:10

VOLUME 29, NUMBER 2

JUNE 1977

**Editor**

RICHARD H. BUBE, Chairman, Department of Materials Science and Engineering, Stanford University, Stanford, California 94305

**Book Review Editor**

STEPHEN W. CALHOON, Jr., Department of Chemistry, Houghton College, Houghton, New York 14744

**Art Editors**

DARWEN and VALLY HENNINGS, Rt. 2, Box 135, Arlington, Washington 98223

**Consulting Editors**

Jerry D. Albert, Mercy Hospital Medical Research Facility, San Diego, California

Donald C. Boardman, Department of Geology, Wheaton College, Wheaton, Illinois

Dewey K. Carpenter, Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana

Gary R. Collins, Trinity Evangelical Divinity School, Deerfield, Illinois

Owen Gingerich, Smithsonian Institution, Astrophysical Observatory, Cambridge, Massachusetts

John W. Haas, Jr., Department of Chemistry, Gordon College, Wenham, Massachusetts

Walter R. Hearn, 762 Arlington Avenue, Berkeley, California

Russell Heddendorf, Department of Sociology, Geneva College, Beaver Falls, Pennsylvania

D. Gareth Jones, Department of Anatomy and Human Biology, University of Western Australia, Nedlands, W.A., Australia

Robert D. Knudsen, Westminster Theological Seminary, Philadelphia, Pennsylvania

T. H. Leith, Atkinson College, York University, Toronto, Ontario, Canada

Gordon R. Lewthwaite, Department of Geography, California State University, Northridge, California

Russell Maatman, Department of Chemistry, Dordt College, Sioux Center, Iowa

Russell L. Mixter, Department of Biology, Wheaton College, Wheaton, Illinois

W. Jim Neidhardt, Department of Physics, New Jersey Institute of Technology, Newark, New Jersey

James A. Oakland, Graduate School of Psychology, Fuller Theological Seminary, Pasadena, California

Evelina Orteza y Miranda, Department of Educational Foundations, The University of Calgary, Calgary, Canada

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

Bernard Ramm, Theologian-in-Residence, First Baptist Church, Modesto, California

Harold F. Roellig, Department of Earth Sciences, Adelphi University, Garden City, New York

Claude E. Stipe, Department of Sociology and Anthropology, Marquette University, Milwaukee, Wisconsin

Mary Stewart Van Leeuwen, Department of Psychology, York University, Downsview, Ontario, Canada

Edwin M. Yamauchi, Department of History, Miami University, Oxford, Ohio

Davis A. Young, Department of Geology, University of North Carolina, Wilmington, North Carolina

Concerning SUBSCRIPTIONS, changes of address, requests for back issues, and other business requests, address: Executive Secretary, American Scientific Affiliation, Suite 450, 5 Douglas Ave., Elgin, Illinois 60120. The SUBSCRIPTION PRICE: one year \$9.00, two years \$17.00, three years \$25.00. *Students*: \$4.00. *Gift subscriptions*: one year, \$4.00. Single copies may be purchased at \$2.00 each. Second class postage paid at Elgin, Illinois and at additional mailing offices. Postmaster: Please send POD form 3579 (change of address) to American Scientific Affiliation, 5 Douglas Ave., Elgin, Ill. 60120. Published four times a year in March, June, September and December by the American Scientific Affiliation. Telephone: (312) 697-5466. Back issues: \$2.00 per issue from 1974 to date; \$1.50 per issue from 1963 through 1973; \$2.00 per volume or 75¢ per single issue before 1963; *Supplement 1* 1976: \$3.00.

INDICES to back issues are published as follows: Vol. 1-15 (1949-1963), *Journal ASA* 15, 126-132 (1963); Vol. 16-19 (1964-1967), *Journal ASA* 19, 126-128 (1967); Vol. 20-22 (1968-1970), *Journal ASA* 22, 157-160 (1970); Vol. 23-25 (1971-1973), *Journal ASA* 25, 173-176 (1973); Vol. 24-26 (1974-1976). *Journal ASA* 26, 189-192 (1976). The *Journal ASA* is indexed in the CHRISTIAN PERIODICAL INDEX. Present and past issues of the *Journal ASA* are available in microfilm at nominal cost. For information write University Microfilms, Inc. 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Concerning MANUSCRIPTS and COMMUNICATIONS, address: Editor, *Journal ASA*, 753 Mayfield Ave., Stanford, California 94305. Manuscripts should be typed double-space on good quality 8½ x 11 paper, with references collected at the end, and with an Abstract of not more than 200 words. Duplicate copies of manuscripts are requested. Manuscripts longer than 15 pages will experience delays in publication. Figures or diagrams should be clear, black and white line ink drawings or glossy photographs, with a caption provided separately. The pages of the *Journal ASA* are open to any contribution dealing with the interaction between science and Christian faith in a manner consistent with scientific and theological integrity. Papers published in the *Journal ASA* do not necessarily reflect the position of the American Scientific Affiliation.

Concerning BOOK REVIEWS, address: Book Review Editor, Dept. of Chemistry, Houghton College, Houghton, N.Y. 14744. To avoid duplication in reviews, prospective reviewers should notify the Book Review Editor of their intentions at an early date.

# JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

JUNE 1977

PRINTED IN THE UNITED STATES OF AMERICA

VOLUME 29, NUMBER 2

---

## IN THE BEGINNING . . .

### I

In the end Man created the heaven and earth,  
For the spirit of God was asleep in the void;  
There was nothing awake to put life in the deep  
Until oceans and chemists began to conceive.  
And the day came to pass, through the workings of years,  
That the waters were fruitful with algae and slime.  
Man pondered creation, and knew it was good,  
Though the process had barely begun to produce  
Every animal and plant that he knew would result.  
So Man let the years pass.

*He remembered a god  
He'd known living in darkness before earth became  
More than chaos, before life was made for the void;  
He decided to seek him, and give him a name—  
The one Man knew best, and none else but his own.  
Thus the god Man created was made in Man's image,  
Most immanent, gracing the earth he had made  
With his presence, for the god was a product of Man:  
But a creature himself. The creation made the god  
And consented to keep him.*

II

With the increase of Man  
Came an increase of knowledge, and science made known  
That with diligent study, experiments and theories  
Would produce all the details of how Man had done it  
And Man-god, creator, would be proven king;  
Though the pleas of some people rang out through the labs  
In defense of a God not asleep, but forgotten,  
Of a God who'd not only made earth and her fruit  
But had also invented the concept of man,  
And created all beasts.

*But their wisdom was lost.  
The Man-god retained his position of dominance  
And plants, beasts, and birds all accepted his rule.  
Cast out all pretenders, he ordered his followers,  
Allow them no voice in affairs of this world.  
And resuming his lordship of gametes and zygotes  
He continued the process of multiplication.  
In the way of all kingdoms which legislate statutes,  
He governed their fruitfulness, and recorded as law  
Thus: Only the fit shall survive.*

III

In violent revolution,  
Coup d'etat, and dissolution, several subjects conspired  
To impeach this, their king. Setting forth martial strategy  
They built a theology based on eye-witness account  
Of a man who had seen all creation in visions,  
A man, one of few, who had loved an old God.  
They consulted their Bibles, interpreted Genesis  
(The name of the book the eye-witness had written),  
And they left Man-god's kingdom forever to live  
In a country called Christian.

*They commenced to hold meetings  
And drafted up armies armed with doctrine, theology,  
And books of King James; they waged bloody battle  
Backed by literal readings, fundamentally sure  
Of the truth of their cause. But the Man-god joined arms;  
He struck back at the Christian defectors and traitors  
To his creaturely rule over plant, beast, and bird.  
Though the Christians fought brave with their weapons of straw,  
Stout of heart and sincere, they were lost in the war:  
The Man-god had won.*

IV

In true manly fashion  
The Man-god considered his foes, the weak Christians,  
A threat of the past. He reigned in the confidence  
That this minor variant of man that was Christian  
Would have to succumb to the law of his land:  
And only the fit would survive. He continued to rule;  
But the Christians weren't dead. While their forces regrouped  
And the wounded were healed, came the reckoning sought  
By the creature called Man: and only the fit had survived  
This first battle.

*The leaders of Christians  
Saw the need of new weapons to replace swords of straw  
That the literalists had used. So in place of their shields  
Made of cardboard, were issued bright Bibles of steel.  
No more would the faulty interpreters cause  
The destruction of Christians by making straw weapons.  
Understanding was great—the most fit had survived,  
And adapted to training with the thought and intent  
Of their God, who had meant to give principles, not  
Cardboard-clad fundament.*

V

When the Christians were ready  
And strong in their faith, no Man-god's interpreter  
Could challenge their weapon; with the power of the God-man  
No Christian could fail. The soldiers warred fiercely,  
The Man-god was mighty; but mightier still  
Was the Sword of the Lord of the Christians, who found  
That no Man-worshiper could tarnish their bright Bibles' steel,  
But must fall before the image of God found in Christ  
As revealed by the followers of God, the Creator;  
Their creaturely king

*Could do nothing but fail.  
The Creator has always been stronger than creature;  
No matter that creaturely mind has forgotten  
The truth of the eye-witness account found in Genesis  
Of one who had seen all creation through vision.  
The image of Man found in Man-god is tinsel;  
Thus, rightly dividing the Word of the Lord  
Leads to victory for Christians, who glorify the God-man,  
The Christ who is named Jesus who rules over all.  
Interpretations are made out of straw.*

**Valerie L. Mossman**  
Gordon College  
Wenham, Massachusetts

# The Unity in Creation



RUSSELL MAATMAN

Department of Chemistry

Dordt College  
Sioux Center, Iowa 51250

*Man has always wanted to relate observations and put them under one logical roof. Thus, man tends to believe that the natural laws we formulate are themselves related to each other, and that the events in, and the properties of, the physical world can, in principle, lead either to a single natural law or to a small set of complementary natural laws. Man's tendency to accept a model of the physical aspect of the universe in which there can be uncertainty but no chaos, no incoherence in ultimate physical law, is consistent with the scriptural view of man and the remainder of Creation. When it is observed that the trend of events in the history of the physical sciences is just what God's people would expect, several conclusions follow. It is shown that one can make some decisions on how to teach physical science; that time, space, and matter as far as we are concerned are unified, that is, they must be thought of as existing together and not separately; and that there can be a Christian approach to the subject matter, not just the applications, of physical science. Other conclusions are also discussed.*

Man has never been satisfied merely with making observations of the events in, and the properties of, the physical aspect of Creation. The universal desire to relate observations and put them under one logical roof is, during this scientific era, carried out by correlating observations to formulate natural laws. Man also has the tendency to believe that natural laws, like the observations upon which any one natural law is based, are not isolated from each other. Thus, all the events in, and the properties of, the physical aspect of Creation might, in principle, be related either to a single natural law or to a small set of coherent, complementary laws.

## The Unification Principle

If one accepts for the physical aspect of Creation a model in which there can be uncertainty (in the Heisenberg sense) but no chaos, one is consistent with the scriptural view of Creation. God's people have always known the central principle of physical science: *A single power is the cause of whatever man observes in the physical aspect of Creation.* There is a unity in whatever man observes in the physical aspect of Creation, and therefore the central principle may be called the Unification Principle. Because of the gen-

eral thrust of Scripture as well as the obvious interpretation of specific passages of Scripture, God's people have always known these things. God did not create chaos:

For thus says the Lord, who created the heavens (he is God!), who formed the earth and made it (he established it; he did not create it a chaos, he formed it to be inhabited!): "I am the LORD, and there is no other. I did not speak in secret, in a land of darkness; I did not say to the offspring of Jacob, 'Seek me in chaos.' I the LORD speak the truth, I declare what is right." (Is. 45:18-19; all Scripture quotations are from RSV)

Everything is ordered because God upholds that which He has created:

For ever, O LORD, thy word is firmly fixed in the heavens. Thy faithfulness endures to all generations; thou hast established the earth, and it stands fast. By thy appointment they stand this day; for all things are thy servants. (Ps. 119:89-91)

It is no accident that man can observe and formulate natural laws. Man was created so that he can carry out scientific work:

Then God said, "Let us make man in our image . . . . and let them have dominion. . . ." (Gen. 1:26)

This passage indicates that one consequence of man's creation in the image of God is man's ability to function as the head of Creation. As man exercises this dominion, he analyzes Creation and discovers how the forest of observations which he makes is ultimately related to the power of God. Both the Christian and the non-Christian bear the image of God and therefore both are capable of carrying out work in the natural sciences. Paul taught that all men know the power of God:

Ever since the creation of the world his invisible nature, namely, his eternal power and deity, has been clearly perceived in the things that have been made. So they are without excuse; for although they knew God they did not honor him as God or give thanks to him . . . (Rom. 1:20-21)

Thus, all men know of God, even though some have distorted ideas of Him. Man knows God because he knows the eternal power of God. Therefore, all men have knowledge of the integrating power which is the reason for the order which makes scientific work possible. Our humanly-formulated natural laws point to the ultimate power Paul refers to. Even though not all men are conscious of this knowledge, Paul says that they have always had this knowledge. In acting upon this knowledge, all men have the urge to relate the forest of seemingly unrelated observations to the simpler and more general laws which point to that ultimate power.

In Paul's speech to the Athenians on Mars Hill he said that men who did not acknowledge God did, however, have knowledge of His power:

So Paul, standing in the middle of the Areopagus, said: "Men of Athens, I perceive that in every way you are very religious. For as I passed along, and observed the objects of your worship, I found also an altar with this inscription, 'To an unknown god.' What therefore you worship as unknown, this I proclaim to you. The God who made the world and everything in it, being Lord of heaven and earth, does not live in shrines made by man. . . . (Acts 17:22-24)

Paul knew that God is the Creator, the Sustainer, the Ultimate Causer. He says in this passage that *this* God, the God whom Paul knew, was also the God that the Athenians knew, even though they said he is unknown and they worshiped Him in ignorance. *They knew Him because He displayed His power to them.* They could not escape this knowledge of God. In the same way today, the non-Christian tacitly admits that there is a God whenever he carries out scientific work, work that would be impossible were there no ultimate, coherent power in Creation.

An unusually clear picture of the meaning of coherence in Creation is given in the following passage:

In [the Son] all things were created, in heaven and on earth, visible and invisible, whether thrones or dominions or principalities or authorities—all things were created through him and for him. He is before all things, and in him all things hold together. He is the head of the body, the church; he is the beginning, the first-born from the dead, that in everything he might be pre-eminent. (Col. 1:16-18)

All things hang together because their very existence depends upon Him Who is both God and man. He created everything, including the things the natural

*Physical scientific activity is Christian when the physical scientist knows that the physical aspect of Creation with which he works is a manifestation of the power of a creating and upholding God.*

scientist analyzes, and He gives them continued existence.

### Further Explanations

The relation between man, his observations, and ultimate law which is being suggested here calls for certain further explanations.

1. Kuhn exhibited keen insight when he showed that the scientific community moves from paradigm to paradigm, with "normal" science carried out only when the scientific community accepts a paradigm, a picture of how things are or a fundamental set of laws describing the physical world.<sup>1</sup> Kuhn claims, however, that as we move from paradigm to paradigm we are not necessarily moving toward a "true" picture of the universe. It is contended here, however, that we *are* moving toward a better and better understanding, that physical knowledge is unifiable, and that ultimately what we see is a reflection of the coherence in God himself.

Thus, the basic set of principles used to tie physics together in the nineteenth century was not the same as the set used in the twentieth century. We move to new levels. The twentieth century principles developed for physics have changed chemistry from a science in which the fundamental principles were dimly seen, if at all, to a science which is coherent. The new principles have both aided development within each of these two sciences and have brought these two sciences closer together.

2. The ideas suggested here do not improperly elevate the reasoning ability of man. Sometimes man can by deduction predict correctly observations which will be made, but often predictions are not borne out. The important fact for this discussion is that *after* observations are made they are usually shown to be related to earlier observations and natural laws already known. Also, our ability to predict is not useless: using Newton's laws, the scientific team that sent the first men to the moon predicted where the moon would be when the men arrived—and the moon was there.

3. When our observations lead us to conclude that there is a unifying power, we do not thereby prove the existence of God. What we do is *confirm* that which—according to Paul—all men know already, namely, that there is a God with eternal power.

### Consequences of the Unification Principle

1. If work in physical science is fundamentally possible because of a characteristic which all men possess, then it should be possible to demonstrate to men in general the logical relation between seemingly unrelated observations. Practically, such a demonstration

can be made in teaching young people and adults of normal intelligence. Such a demonstration can be carried out if it is shown (a) that a certain experimental observation is precisely what one would expect, assuming the validity of certain elements of the student's prior knowledge, and that (b) a seemingly unrelated observation can be shown to be what one would expect given the same prior knowledge. The two observations will then have been shown to be related.

In the method proposed the demonstration must begin with what the non-scientist student already believes to be true. What the non-scientist believes may actually be incorrect by modern scientific standards (e.g., the non-scientist might hold that energy is conserved, although it is more nearly correct to say that mass-energy is conserved), but this difficulty usually means that the range of problems that the non-scientist can solve is more limited than that of the scientist. Thus, today's non-scientist can handle Newtonian, but not modern physical problems; the situation might be different in a later generation.

An example of how the non-scientist's prior knowledge can be used to predict what one would observe were the experiment performed, even though the observation is startling, follows. The student is asked to imagine that a rock is allowed to fall in a vacuum. Then he is to imagine that a second rock of the same shape and density is dropped at the same time from the same height; he will conclude that they will hit the ground at the same time. He will conclude that they will also hit the ground at the same time if initially there is a smaller horizontal gap between them. The gap can be made smaller and smaller and the student realizes that the result will always be the same. Finally, they can touch and the time of flight should not change; thus, a rock twice the size of the one rock falls at the same rate as does the one. The argument can be extended, by properly subdividing the falling object, to show that the time of flight is independent of shape and density. In all of this, very little prior knowledge is used.

The author has prepared a syllabus for college students with no prior scientific training in which only a very few additional ideas (e.g., energy is conserved, "charged" particles can exist, the earth rotates and has a certain geography) are used for input. The developments in the syllabus are in the following areas: mechanics (Newton's laws of motion, the Law of Gravity, and the motion of projectiles); sound (its nature and some of the principles of music); electricity (static electricity, current, magnetism, generators, and motors); light (its nature, color, refraction, and other properties); chemistry; gases and liquids (nature of heat, condensation and evaporation, vapor pressure and humidity, boiling, and dew point); heating and cooling solids, liquids, and gases; meteorology (seasons, the Coriolis force, world-wide circulation of air, and rainfall and temperature patterns). To summarize, hundreds of diverse observations can be shown to be related because the observations can be predicted by deductions from a very small set of initial assumptions. The world's rainfall pattern, the electric generator, the rocket ship, the reason for paint pigment colors, the prism, and the falling object are in the same network.

2. If it is ultimately possible in principle to harmonize observations, it is then possible to rule out the

possibility of certain observations which might otherwise seem possible. For example, if it is assumed (a) that the universe is three-dimensional, (b) that there is a point source of energy or a point at which lines of force begin, and (c) that the shortest distance between two points is a straight line, then the observed intensity of the force or energy decreases according to the square of the distance from the source. Thus, gravitational, electric, and (under certain conditions) magnetic forces decrease according to the inverse square law, as does light and sound intensity. Therefore, given the assumptions, a new point source of energy or line of force could be predicted to obey the inverse square law also; in the new case, intensity would not decrease according to the 2.1 power or the 1.9 power. Conversely, if intensity did decrease according to some power other than two, it might be suspected that the source is not a point source. Up to now in the discussion of the inverse square law it has been assumed that the Newtonian picture of the universe is correct. If, however, a new source decreases in intensity by some power other than two, it is possible that the basic assumptions about the nature of the universe are incorrect; this conclusion is, of course, the conclusion that has actually been made. Thus, even when predictions fail, new insights into the nature of things are obtained precisely because it is assumed that observations must ultimately hang together.

3. It has been commonly assumed that one unproved law is the law which says that scientific explanations must involve as few assumptions as possible. This law about scientific laws is the Law of Parsimony. If it is indeed true that all men know that the universe is coherent because they know that there is a God Who has eternal power, then ideally explanations should involve as few assumptions as possible. Therefore, the Law of Parsimony is not unproved.

4. In fact, we assume, although we do not always realize it, that where there is no unification possible no natural scientific work can be carried out. For example, if the Uncertainty Principle is assumed valid, then a proposal to determine the time at which a given radioactive nucleus will emit (for example) an alpha particle is not a scientific proposal. The proposal would not be scientific because assuming the validity of the Uncertainty Principle implies that we cannot correlate observations and produce a natural law which will predict the behavior of a single atomic nucleus. Here is a case where unification is not possible, and therefore scientific investigation is not possible.

5. Some men have postulated the existence of several gods who are at least partially independent of each other. The polytheistic position is inconsistent with the assumptions normally made by scientists, namely, the assumption that there is ultimately only one power. There is no god of the sea who is different from the god of the high places.

6. Are there natural divisions between disciplines? For example, is the division between biology and the physical sciences artificial or natural? If attempts to unify an area of knowledge show that unification is possible without including observations in and laws

for another area, then it seems that the two areas *separately* point to the single, coherent power of God and that the areas are naturally distinct. Thus, working out the implications of the Unification Principle could demonstrate that which is ordinarily taken to be true, viz., that the various aspects of Creation are independent in that one aspect cannot be derived from another. Reductionism would be shown to be illegitimate. In fact, as such a program is carried out it would probably be demonstrated that "law" refers to one kind of concept in one area (e.g., equations or their equivalent in the physical aspect) but an entirely different kind of concept in another area.

It is thus suggested that aspects of Creation besides the physical are also unifiable and that there are as many unification strands leading back to the Hands of God as there are naturally different aspects. The sum of all that can be traced to those unification strands is thus created reality.

7. According to the Uncertainty Principle, an observer cannot simultaneously and accurately know both the position and the velocity of a particle. If the value of one of these two variables is known exactly, then nothing is known about the value of the other variable. Is it possible for one to know that a particle is at rest with respect to some frame of reference? Presumably, something would be known about its position; at least, the position of an at-rest particle would not be *completely* unknown. Its velocity (zero) would be known accurately. But the Uncertainty Principle says that one cannot know the velocity accurately if something is known about the position. Therefore, since we can know something about the position of an at-rest particle, we cannot observe a particle to be at rest.

For our purpose, we can consider that the physical aspect of creation consists of particles and radiation. Radiation is also not at rest. Therefore, "physical" always implies motion.

Since only finite velocities are possible, time elapses when there is motion. It follows that we can know nothing about the physical aspect of Creation which is not associated with time. Thus, it seems that with the creation of the physical that time was either created or was a necessary prerequisite. This conclusion has been arrived at by considering what we can observe. Our observations of the physical *need* time. It may not be provable, but it also seems that *the time about which we ordinarily speak needs the physical aspect of Creation*. Time is not a separate category.

Space as well as time is needed for motion. The argument concerning space is parallel to the one used for time. It seems that the concept of space is also meaningless if matter and radiation do not exist.

Thus, these three seem to be bound up together: the physical, time, and space. But notice how this "binding together" has come about. It is not merely that our minds observe the union "out there." The argument

hinges on *what we can know*. In the model of Creation that *we* construct, space, time, and the physical are united. In what *we* see there is coherence in what God created and upholds. But this emphasis on what God leads us to understand is precisely the emphasis given so far in our discussion of the Unification Principle. Man, created in the image of God, even though he is now sinful, is still able to see that there is unity in Creation as he realizes that his observations point to the coherent power of the Godhead.

Do time and space exist for man after he dies? We do not know. We do know that man is body-soul, and that "body" and "soul" are not separable while man lives, i.e., while his life is associated with the physical. When Christ comes again, there will be *bodily* resurrection. What seems possible, although this idea is speculative, is that time and space do not exist for man after he dies but before he is resurrected. Perhaps man is man only when he is a body-soul. On the other hand, certain scriptural statements may indicate that man exists as a soul after death but before resurrection; if so, the speculation is not correct.

8. The idea of unification can be distorted. As presented here, unification is possible just because God created. Some men have started out with the idea that God did not create. They hold to the idea of no beginning. There never was creation of life or of anything else; life evolved from non-living matter and there never was a discontinuity. Man's universal desire can be claimed by some to rest on the principle that God created, a true principle; but it is claimed by others that this universal desire rests on exactly the opposite principle, a principle that is not a true principle, but the statement of a lie.

9. Perhaps we can see that the Unification Principle aids us in achieving a Christian approach to physical science. Physical scientific activity can be made to be a Christian activity not just because of technological applications which can be made. Thus, it is not enough to say that there is something Christian about work in the physical sciences because it is the physical scientist who can teach the technologist how to avoid polluting the environment, or because it is the physical scientist who can discover principles which will enable the technologist to invent labor-saving devices. Physical scientific activity is Christian when the physical scientist knows that the physical aspect of Creation with which he works is a manifestation of the power of a creating and upholding God. Every physical observation and every physical law are to be seen in a creational, providential context.

**REFERENCE**

1T. S. Kuhn, *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago, 1962.



# The Trauma of the Infinite Universe



OWEN GINGERICH

Smithsonian Institution

Astrophysical Observatory  
Cambridge, MA 02138

A few years ago there was a world-wide round of celebrations for the 500th anniversary of Nicolaus Copernicus, and in a few years hence we will likewise commemorate the birth of Martin Luther. It would be hard to say which of these men most influenced the course of Western civilization. Did the Reformation or the Scientific Revolution have the more profound consequences?

Because man's religious and philosophical outlook is so sharply shaped by his view of his own place within the physical environment, I feel it is worthwhile to examine whether Copernicus' radical cosmology has had any real impact on our view of man himself. I am going to argue that the particular step of removing the earth from the center of the universe and flinging it into motion was not so important as a closely related concept that developed soon after, namely, the idea of the immensity of the universe itself.

Copernicus' book was carefully studied by the astronomers, particularly at the Lutheran universities, and Copernicus' name was known to the students in even comparatively elementary courses. To be sure, there was a certain amount of religious criticism of the new doctrine, and the topic of its "physical truth" was treated with kid gloves. But I feel that the religious resistance to the acceptance of heliocentrism has generally been overemphasized; I believe that the 16th-century astronomers honestly felt that it was a physical absurdity to hurl this lazy sluggish earth into motion.

In fact, one of the most interesting questions facing the historian of science is to understand just why Johannes Kepler and Galileo Galilei adopted the heliocentric viewpoint. But when they did, they aggressively pushed for its acceptance as a physical reality. It was then, and only then, that the Catholic Church reacted violently (and in retrospect ill-advisedly) in trying to suppress the new teaching. The scriptural report of Joshua commanding the sun, not the Earth, to stand still was a particularly crucial issue, and both Kepler and Galileo addressed themselves to it. Galileo remarked that the Scriptures tell how to go to Heaven, not how the heavens go. Kepler explained this more fully in his *Epitome of Copernican Astronomy*: "For

astronomy discloses the causes of natural phenomena and takes within its purview the investigation of optical illusions. Much loftier subjects are treated by Holy Writ, which employs popular speech in order to be understood."

Today the view presented by Galileo and Kepler is almost universally accepted. With this interpretation the Church has safely assimilated the Copernican Revolution. We could even argue, along with Kepler, that life on a moving platform gives us a broader vantage point from which to view the glories of God's heavens.

The real blow to man's ego was, I think, not being displaced from the center of the planetary system, but rather the subsequent reduction in size of the planetary system itself with respect to the starry universe. Copernicus himself placed all the stars at the same finite distance within a great shell. Only later in that century did the Englishman Thomas Digges produce a diagram showing the stars scattered out at various distances toward infinity. By the end of the following century the leading scientists recognized that the stars were in reality other suns at great distances.

## Immensity of the Universe

In our century we have become even more acutely aware of the immensity of the universe. First came Harlow Shapley's discovery that the sun is but a peripheral star in our great Milky Way spiral, a mediocre member in an assemblage of 200 billion stars. Soon thereafter astronomers recognized that our own Milky Way galaxy is only one of billions of galaxies, which we now know stretch out to distances exceeding 10 billion light-years. Surrounding many of these billion billion stars must be planets, and a sizable fraction must provide habitable environments.

For centuries man has speculated about life elsewhere, and with the increased understanding of molecular biology and chemical evolution, such speculations have reached a crescendo. Is man cosmically lonely in the vast reaches of space? Or is he surrounded by other civilizations, by incredibly higher intellects? Either prospect is intimidating. Man, when he considers

himself within the physical universe, is overwhelmed by his own finiteness—a fragile protoplasm on a small blue planet orbiting a second-rate star. That is the trauma of space, the shock wave inadvertently set in motion by Copernicus.

There are, nevertheless, some alternative views concerning the grandeur of the universe. Freeman Dyson, the philosopher-scientist at the Institute for Advanced Study has written “A naïve person looking at the cosmos has the impression that the whole thing is extravagantly, even irrelevantly, large.” He goes on to say that this extravagant size is our primary protection against a variety of catastrophes that would otherwise engulf the universe. Dyson continues, “It would not be surprising if it should turn out that the origin and destiny of the energy in the universe cannot be completely understood in isolation from the phenomenon of life and consciousness.”

### The Theology of Astrophysics

For many years astronomers have recognized that the universe is expanding and that the galaxies are rushing away from each other at enormous velocities. If the energy of the initial “big bang” had been less, the universe would long ago have reached its maximum size and would have collapsed—presumably long before the tedious force of evolution would have brought forth mankind. On the other hand, if the universe had blown up with more energy, according to the noted Dutch astronomer Jan Oort, its density would have dropped too rapidly for stars and galaxies to form. In this great sea of amorphous gas there would be no planets and presumably no us. This is, I submit, remarkably teleological; I call it the theology of astrophysics.

At the turn of the 19th century, the English natural theologian, William Paley, wrote in his *Evidences of the Existence and Attributes of Deity Collected from the Appearances of Nature*,

My opinion of astronomy has always been, that it is not the best medium through which to prove the agency of an intelligent Creator; but that, this being proved, it shows, beyond all other sciences, the magnificence of his operations. The mind which is once convinced, it raises to sublimer views of the Deity than any other subject affords; but it is not so well adapted, as some other subjects are, to the purpose of argument.

Paley continues,

After all the real subject of admiration is, that we understand so much of astronomy as we do. That an animal confined to the surface of one of the planets; bearing a less proportion to it than the smallest microscopic insect does to the plant it lives upon; that this little, busy, inquisitive creature, by the use of senses which were given to it for its domestic necessities, and by means of these senses should have been enabled to observe the whole system of worlds—all this is wonderful, whether we refer our admiration to the heavenly motions, or to the perspicacity with which they have been noticed by mankind.

I think we must agree with Paley how admirable it is that we can understand so much of the astronomical bodies, bodies so remote and so different from the objects immediately around us. And further, there is much going for Paley’s view that astronomy is not the

*What if the meaning of the universe is to bring forth life? Could we make the universe more economically, without so many stars and galaxies, so much vastness of space? . . . a purported extravagance in our universe is far from obvious.*

---

best medium for proving the agency of an intelligent creator. Nevertheless, if Paley were writing his book today, he would probably want to reconsider the efficacy of those evidences for the existence of Deity collected from the astronomical universe.

### Nuclear Structure of Beryllium

My second example concerns the nuclear structure of beryllium, carbon and oxygen. These nuclei can be thought of as combinations of two, three and four alpha particles respectively. Astronomers now believe that most all of the elements heavier than hydrogen and helium were synthesized in cataclysmic supernovae explosions much earlier in the history of the universe. In other words, you and I are made of recycled material—not just the dust of the earth, but the ashes of supernovae. Now it happens that Be<sup>8</sup> is not very stable, so that in the supernovae explosion, when two alpha particles collide, they do not stick together very well. However, there just happens to be a resonant state of carbon with almost exactly the same energy as a Be<sup>8</sup> plus an alpha particle, which means that although the Be<sup>8</sup> itself is not very stable, there is an easy route to form stable carbon by adding the alpha particle to the beryllium. Now it just happens that the opposite is true with respect to oxygen. When you add an alpha particle to the carbon, there is no resonance level in oxygen that will allow the alpha particle to stick easily and to convert the carbon to oxygen.

I shouldn’t really say, “there is no resonance level” because in fact there is—only it just happens to be one half percent too low for the nuclear reaction to take place. What if that resonance level were one half percent higher? Then virtually all carbon would have been converted to oxygen, and carbon would be too rare to permit the development of much organic chemistry. Similarly, if the Be<sup>8</sup> had been stable, the helium would have quickly burned to Be<sup>8</sup> and perhaps stopped there. Again, carbon would be too rare to permit the formation of any organic compounds. In other words, we wouldn’t be here! Sir Fred Hoyle, who originally noticed this, has admitted that nothing has shaken his atheism quite as much as this discovery.

### Essential Extravagance?

At a symposium we organized for the Copernican anniversary, the Princeton physicist and cosmologist John Wheeler addressed himself to the paradox of intelligent life on this small corner of such a vast universe. He asked, can science dare to ask the greatest question of all? What role does life and mind play in the structure of the universe? Zero? Or everything? Wheeler asked us to consider a flower—a tiny part of a giant plant—yet the entire purpose for the existence

of the plant. What if the meaning of the universe is to bring forth life? Could we make the universe more economically, without so many stars and galaxies, so much vastness of space? Instead of 100 billion galaxies, how about making just one? If we try, the total mass and energy of the universe would be so small that it would expand to a limit, stop, and collapse in just a year, scarcely time for any interesting history on

earth! From this point of view, Wheeler concludes, a purported extravagance in our universe is far from obvious.

In describing the nucleochemistry I used the expression "it just happens that . . ." four times. If indeed the meaning of the universe is life, I should perhaps have said, "miraculously. . . ."

---

## Creation: Pattern, God and Man



DANIEL A. TAPPEINER

Melodyland School of Theology

Anaheim, California 92806

*"By the word of the Lord the heavens were made, and all their host by the breath of his mouth." Ps. 33:6*

*"For from him and through him and to him are all things, to him be glory for ever. Amen." Rom. 11:36*

### INTRODUCTION

The task of theology is "to think God's thoughts after Him." To do this requires humble submission to the leading of the Spirit of Truth and careful study of God's authoritative revelation in Holy Scripture. Without the Spirit the Word becomes mere words to us. Without the Word the Spirit becomes human fantasy and imagination. This combination of Word and Spirit, so necessary to the theological task is, as we shall see, no accident. It is based upon the fundamental biblical pattern in creation itself—the pattern of *Ruach-Dabar*, of *Pneuma-Logos*, of Spirit and Word.

There are many ways in which a theologian might look at creation. Typically there is an analytic approach in which logic, reasoning and implication are used. This is the method of the scientist and the scholastic theologian. There is, however, another method—that of poet and seer, mystic and dreamer. Here the first task is to "see", in an holistic way, in a state of passive perception, the reality to be described and discussed. It is an effort, in and through careful analysis of *Logos*—structure, however it may present itself, to penetrate to the reality symbolically represented to us in words and categories. It is usually the purpose of the poet and mystic to speak in ways which

will evoke an awareness of the "reality" itself. It is the purpose of scientists and theologians to construct an adequate representation of that reality in terms which can be weighed and tested in the community of committed, concerned and capable persons who occupy themselves with such matters.

Both approaches seem necessary. High vision and careful exposition are needed if the living word of God is to exercise its proper authority over our lives and thought. Prior to the writing of this paper there has been some attempt to "see" the majestic mystery of creation originally perceived by Scripture writers. The paper itself will reflect this by its method. Under three basic rubrics, "Creation and Pattern", "Creation and God", "Creation and Man", a series of propositions will be given which are crystallizations of perceptions of the reality of creation. The purpose is not to prove but to expound a vision of creation which, it is hoped, is both biblically adequate and theologically illuminating.

Before proceeding, the following definition of creation is provided as containing the basic elements which must be treated in a discussion of creation which is biblically, theologically and philosophically complete:

Creation is

—an act of God alone by which he  
 —of his own free will  
 —in a progressive sequence of actions  
 —formed all things, visible and invisible  
 —ex nihilo  
 —from the depths of his being as *pneuma*  
 —by the Word of God  
 —through the agency of the Spirit  
 —for the manifestation of his glory (*doxophany*),  
 —the benefit of man,  
 —and all very good.

## CREATION AND PATTERN

THESIS I. *The basic biblical pattern in creation is the majestic and mysterious co-ordination of Ruach and Dabar, Pneuma and Logos, Spirit and Word. In the biblical materials the emphasis falls on Dabar-Hochma, Logos-Sophia (Word and Wisdom) as providing order, coherence, structure and teleology in creation.*

Anyone acquainted with the biblical materials becomes aware that such a co-ordination of *Ruach* and *Dabar* exists. The opening chapter of Genesis clearly indicates this. Creation, which proceeds through a series of majestic and almighty "fiats" is preceded by a mysterious and deeply significant reference to the *Ruach-Elohim* which "broods" over the face of the unformed void. No exposition of this fact is given in the inspired record, but reference to the Spirit here must be taken into account. A two-fold significance suggests itself. First it points to the depths of God's own being as the source of his creative activity. The infinite inwardness of God as *ruach* is the source of this creative activity. Second, it points to the agency of the Spirit of God in the execution of the divine fiat. It is evident in Gen. 1.2 that *Ruach-Elohim* is clearly distinguishable from the fiat. It is also evident that the "uttering" of the fiat is not possible without *ruach* both as preceding and fulfilling the word "uttered". In this way a basic pattern of *ruach-dabar-ruach* emerges as the pattern of creative activity.

It is very clear however, that in the biblical materials prominence is given to *dabar*, rather than to *ruach*. Speaking theologically it is evident that emphasis is placed upon the eternal *Logos* as the agent of creation rather than on *Pneuma* as source or agency in creation. (John 1:1-3; Heb. 1:2,3; Col. 1:16,17, 1 Cor. 8:6). *Dabar* is the outward manifestation of the inwardness of God. It accurately portrays that inwardness and expresses in the categories of finite, created space-time, the order and coherence, structure and purposefulness of that inwardness. Dean Inge has expressed this point very perceptively in the following words: "the world is the poem of the Word to the glory of the Father: in it and by means of it, He displays in time all the riches which God has eternally put within him."<sup>1</sup>

THESIS II. *In the order Ruach-Dabar emphasis must be placed upon the mystery of creative activity as proceeding from the depths of God Who is not only the "thinking God" but is also the living God, the God Who, in personal self-determination, acts spontaneously for the fulfilment of personal purposes.*

Here it is necessary to see with the eye of the seer. Here it is necessary to join the unending chorus of worship and praise to God—"worthy art thou, our Lord and God, to receive glory and honor and power, for

*This combination of Word and Spirit, so necessary to the theological task, is based upon the fundamental biblical pattern in creation itself.*

thou didst create all things, and by thy will they existed and were created." (Rev. 4:11) Perhaps the deepest puzzlement of man as philosopher, is over the fact that *anything* is. That there should be anything is a great mystery—matched only by the greater mystery of the self-existent, personal reality of God. It is very necessary to recognize the utterly free and totally self-determined nature of God's creative activity. Creation, in relation to the divine freedom, as proceeding from God as *ruach*, means that it is an act of volition on the part of God, not a necessary (non-volitional) outworking of the divine essence independent of the divine *personae* of the Godhead. The aseity of God and the divine simplicity do not allow the separation of essence and existence in God. Creation is not simply the overflow of the infinite richness of the divine inwardness but is an absolutely unique, free and profound activity.

Yet it is an expression of this infinite richness. When, with seer's eye, we perceive this incredible richness in God as expressed in creation, we can but cry out with St. Paul, "O, the depth of the riches and wisdom and knowledge of God" (Rom. 11:33). A marvelous modern expression of this perception is found in C. S. Lewis' "The Great Dance" described so eloquently and skillfully in *Perelandra*.<sup>2</sup>

Never did He make two things the same; never did He utter one word twice. After earths, not better earths but beasts; after beasts, not better beasts but spirits. After falling, not a recovery but a new creation. Out of the new creation, not a third but the mode of change itself is changed for ever. Blessed be He!

THESIS III. *The fact that Ruach is part of the divine pattern of creation along with Dabar means that there is an inexhaustible richness and elusive mystery underlying Logos-structure which makes creation forever beyond the total ordering of man's finite application of Logos to the Logos-structure.*

This is simply a call to humility to the busy reasonings of man, a call which itself proceeds from a proper application of *Logos* to the *Logos*-structure. Pascal aptly and epigrammatically enunciated this insight in his famous words "the heart has its reasons which reason does not know."<sup>3</sup>

It is only in the deceitful grasp of "tinker toy reason", that man struts proudly about proclaiming a kind of omniscience and capability for his own ability to know. The deeper call of reason points beyond itself to a reality fully coherent yet ever beyond the limits of man's knowing.

Unfortunately such a midget attitude quite often prevails among us as Evangelicals who profess to be in true submission to the authority of the word and yet presume to confuse our own understanding with the word itself!

THESIS IV. *The fact that Ruach is part of the divine pattern of creation along with Dabar also means that*

*all genuine activity of divine Ruach fulfills Logos-structure, rather than destroys it.*

This is the other side of the previous thesis. Just as it is necessary to avoid the danger of squeezing the "juice" out of the inexhaustible richness and mystery of creation, so it is needful to avoid any separation of *Ruach* and *Dabar* which would destroy our capability for the recognition of reality as it is in itself. It is only demonic *ruach* which destroys *Logos*-structure. *Ruach* divorced from *Dabar* is at best man's subjective fantasy and at worst the delusion of demonic power. This means that though we recognize our limits and the depth of mystery and power implied in *Ruach*, yet we always assert a fundamental orderliness and coherence in created reality itself. There must be neither metaphysical nor epistemological dualism here.

All of this points to the necessity of keeping clearly and definitely before us the distinction of *Ruach* and *Dabar* and therefore the diversity of purpose between *ruach*-perception and *dabar*-perception<sup>4</sup>, as well as the indivisible coordination of the two elements in the basic pattern of creation which allows the fruitful interplay of *Ruach* and *Dabar* in man's own limited, yet correct, perception of created reality.<sup>5</sup>

THESIS V. *Man, who creates relatively, knows the experience of the emergence of powerful insights into the structure of created reality through the holistic mode of perception (Ruach-perception) which is associated with the depths of man's being (the unconscious dimension in psychology and "spirit" in religious experience). This experience of the dimension of depth, mystery, meaning and power, in short the experience of Ruach, provides a model for our understanding of the divine creative activity as it relates to the order of Ruach-Dabar in the pattern of creative activity.*

In this thesis the distinction, dialectic and unity of *Ruach* and *Dabar* in man's experience is used to shed some light on the basic pattern in creation. Man experiences a two-foldness in his perception and in his creative efforts in science and art. There is a dialectic which takes place between *Ruach*-perception and *Dabar*-perception. Man as *Imago Dei* seeks dominion over created reality in accord both with his nature and with the Divine mandate (Gen. 1:26,27). As he seeks, he uses *Dabar*-perception to classify, analyze, organize and manipulate creaturely reality. This is the raw material which must then be contemplated deeply and passively—with *Ruach*-perception. Then there emerges from the depths of man's being a new insight into the nature of created reality, insight which cannot be derived from the mode of *Dabar*-perception, but which must be subjected to that mode for clarification, testing, purifying, and conceptualizing. The history of art and science is replete with such dynamic and often dramatic interplay of *Ruach* and *Dabar* in man. It is the *Ruach* which provides the incredible richness, depth and perpetual value of creative art or science. But it is *Dabar* which supplies articulation and adequate expression for the insight of *Ruach*. *Ruach* insight without *Dabar* is only a fleeting thing unavailable to the whole family of man for its continued benefit. *Dabar* without *Ruach* is simply a lifeless game of empty symbols—much like the formalisms of symbolic logic. The distinction and unity of *Ruach* and *Dabar*

in man's experience is but a reflection of the pattern of Divine creation.

We must not suppose, however, that such a separation of *Ruach* and *Dabar* as we experience in our relative creation, is to be found in God. There is no unconscious in God! God is, as the older theologians were wont to say, *actus purrissimus*, "absolute actuality". As such there can be no distinction within the Godhead between God as *Ruach*, (personal, self-determined infinitely rich life) and God as *Dabar* (coherent, structured, ordered). The inner divine "activities" which are forever beyond our capacity to grasp as they are in themselves, are *opera essentialia et personalia* experienced and executed in the marvelous unity of God which is higher and more intensely one by virtue of the richness of oneness of essence and threeness of person.

THESIS VI. *The order Dabar-Ruach points to the fact that in the execution of creation Ruach is in the service of Dabar as agency to agent.*

We are now on more familiar territory. Most of the biblical evidence emphasizes the role of *Dabar* in the creation, with *Ruach* perceived as the instrumentality of *Dabar*. In the Genesis account, which is so profoundly explicated in the Fourth Gospel in terms of *Logos*-Christology, it is God's activity as "speaking" which is the dramatic focus. The repetition of "God said—and there was" portrays a "majestic instancy" of divine purpose and power culminating in the creation of man and the Divine sabbath. B. B. Warfield expresses this significance of the order *Dabar-Ruach* with his usual insight when he comments on the role of the Spirit in Genesis 1 thus:<sup>6</sup>

To the voice of God in heaven saying, Let there be light! the energy of the Spirit of God brooding upon the face of the waters responded, and lo! there was light . . . God's thought and will and word take effect in the world, because God is not only over the world, thinking and willing and commanding, but also in the world as the principle of all activity, executing . . .

It is important to note here that in the order *Dabar-Ruach*, *Ruach* is conceived in terms of the dynamic power of God immanent, in terms of the *opera personalia* of the Holy Spirit, rather than as the depths of richness and mystery in divine freedom as it appears in the order *Ruach-Dabar*.

Creation is through *Dabar*, by *Ruach*. The classical passage on *Hochma* (Prov. 8), which has come to be identified with the person of Jesus Christ in Christological discussion, indicates the agency of *Hochma* in God's creative activity.<sup>7</sup>

The Fourth Gospel makes the identification between *Dabar-Logos* and Jesus Christ explicit. St. Paul and the writer to the Hebrews also make this quite clear. (I Cor. 8:6; Col. 1:16, 17; Heb. 1:2, 3).

The significance of this is that strong emphasis is placed on creation as a personal effect, coherent, ordered and knowable. This has profound implications for man as worshiper and scientist which will be touched upon more fully in another thesis. In this order of *Dabar-Ruach* the unity and fundamental harmony of *Dabar* and *Ruach* is highlighted. This provides a sense of boundary and norm for all authentic

insights into the created order of *Logos*-structure.

### CREATION AND GOD

Much has already been stated concerning the relation of creation and God in treating the basic biblical/theological speculative pattern of creation as *Ruach-Dabar-Ruach*. A few further points are important.

#### THESIS VII. *Creation is a personal activity of God.*

It has already been asserted that creation is personal rather than unconscious or necessary (coerced). This is evident by the meanings of the words *Ruach* and *Dabar* themselves: *Ruach*, as indicating self-conscious inwardness, and *Dabar* as indicating knowledge, purpose and order. Only that which is personal speaks. Creation is not the overflow of the divine richness in an unconscious or unintentional way. There can be no conflict in God between *opera essentialia* and *opera personalia*. All that God does is done according to his own self-determined essence and through the personal will of God.

At this point the Trinitarian formulae should be brought forth. Creation is always said (and this is agreeable to Scripture) to be *from* the Father, *through* the Son and *by* the Holy Spirit. Thus the theological axiom: *Opera ad extra sunt indivisa seu omnibus personis communia*.<sup>8</sup> Yet creation is specially the work of the Father as *fons Trinitatis* even as redemption is uniquely of the Son and sanctification is of the Holy Spirit. Yet nothing is done without the whole Godhead.

#### THESIS VIII. *Creation is a powerful activity of God.*

Two points of significance are noted here. First, creation was not deficiency motivated. Having declared creation as a personal and free activity of God it will not do to speak of it as an expression of God's need for a love-object. To put it thus would be to make creation an action of weakness rather than of power. The inner Trinitarian relations within the Godhead preclude such a dependent view of God in creation. God is eternal *agape* as Father, Son and Holy Spirit. The eternal moving of self-giving love is found above all in the self-communication of the Father to the Son and the relation of the eternal Son to the Father by the Holy Spirit.

The second point concerns the absolute independence of God in relation to any antecedent reality outside or independent of God who alone is self-existent. Here the expression *creatio ex nihilo* must be used. Negatively this means a denial of emanation theories (Gnostic or pantheistic) or dualistic theories as in the Greek doctrine of primordial *hulē* which conditioned the divine execution of perfection in the creative activity of God. Positively it expresses the absolute independence of God in relation to the created order and the absolute dependence of creation upon the will of God. The phrase does not mean that no cause is posited for creation or that "nothing" is the material out of which all else was made. Rather, it asserts the almightiness of God's power and that the setting of the divine will in *Logos*-structure was in no way antecedently conditioned by anything external to God Himself.<sup>9</sup> This fact has very great significance practically to man as religious and scientific. A point which will be taken up later.

### Creation

"In the beginning", long before all worlds  
Or flaming stars or whirling galaxies,  
Before that first "big bang", if such it was,  
Or earlier contraction; back and back  
Beyond all time or co-related space  
And all that is and all that ever was  
And all that yet will be; Source of the whole,  
"In the beginning was the Word" of God.

*The Word of God; Reason, Design and Form,  
Intelligence, Whose workshop spans the stars  
Expressed within the Cosmos and alike  
In what seems chaos; He Who works as much  
In randomness as order, Who to make  
Man in His image scorns not to create  
By patient evolution on a scale  
Of craft divine which dwarfs a million years.*

Who is this God, that bows Himself to see  
The puny wonders of this little speck  
Of cosmic dust that we have named our Earth,  
The toy volcanoes and the restless sea  
That splashes from His bucket like a drop  
And still a captive to the circling Moon  
Flows and recedes, purging polluted shores  
Or sending tidal torrents up the Severn?

Who is this God, that circles either pole  
With fluorescent light—an arctic dawn,  
Whose rain makes little sparks and tiny cracks  
That we call thunder storms, this God Whose plan  
So shapes the atoms that they must combine  
To give dust life and then to feed that dust  
With inorganic substance to create  
By DNA a pattern like its own?

Who is this God and can this God be known  
Within the confines of a human skull,  
A litre and a half of mortal brain  
Whose interlinking neurones must depend  
On chemistry and physics in the end  
For all that Man can know or comprehend?  
Can Man know God eternally enthroned  
Throughout all space and in the great beyond?

The mystery of being, still unsolved  
By all our science and philosophy,  
Fills me with breathless wonder, and the God  
From Whom it all continually proceeds  
Calls forth my worship and shall worship have.  
But love in incarnation draws my soul  
To humble adoration of a Babe;  
"In this was manifest the love of God".

*Still Jesus comes to those who seek for God  
And still He answers as He did of old,  
"I've been with you so long, how can you say  
'I don't know God, oh show me God today'?"  
When you've met Me you've seen the eternal God  
Met Him as Father too, as He Who cares  
And loves and longs for men as I myself.  
I am the Christian message. God has come."*

ROBERT L. F. BOYD, C.B.E., F.I.E.E., F.R.S.

*Reprinted from Faith and Thought, publication of the  
Victoria Institute of Philosophical Society of Great Britain,  
Vol. 102, 182 (1975).*

#### THESIS IX. *Creation is a purposeful activity of God.*

Teleology is implied in the previous theses. Creation as personal activity and as executed through almighty fiat *ex nihilo* clearly point to a purpose in creation. Scripture in many places indicates not only that cre-

ation is purposeful but also what the purpose is.<sup>10</sup> That purpose is clearly the revelation of the glory of God—doxophany. There are, of course, many less ultimate purposes which might be noted from Scripture but doxophany sums up the final purpose of God in creation. It is only as we come to understand the doctrine of creation in terms of the fundamental biblical framework of eschatology that the meaning of creation attains its widest scope and richest significance. The “final cause” of anything is the ultimate category of interpretation, the point of reference for all else. Doxophany, the full manifestation of divine glory is the final cause for the unfolding drama of creation, salvation history and consummation. St. Paul’s doxological outburst in Rom. 11:36 puts this point in short form: “For from him and through him and to him are all things. To him be glory forever. Amen.” The song of the twenty-four elders worshiping before God’s throne expresses it eloquently: “Worthy art thou, our Lord and God, to receive glory and honor, and power, for thou didst create all things, and by thy will they existed and were created.” (Rev. 4:11). The final vision of the New Jerusalem presents it this way: “the city has no need of sun or moon to shine upon it, for the glory of God is its light and the lamp is the Lamb.” (Rev. 21:23)

All of this is in fulfilment of the ancient promises of God “all the earth shall be filled with the glory of the Lord” (Nu. 14:21), or more fully “the earth will be filled with the knowledge of the glory of the Lord as the waters cover the sea” (Hab. 2:14. See also Isa. 11:9). Isaiah, the prophet of glory, speaks of the final purpose of God’s gracious redeeming activity in these words “that he might be glorified” (Isa. 61:3; 60:19).

### CREATION AND MAN

The significance of the doctrine of creation to man can hardly be overstated. In particular it strikes fundamental chords in man as scientist and man as worshiper.

**THESIS X.** *The fact of divine creation implies that the created order bears the marks of divine character (Logos-structure) and is therefore knowable to man (Imago Dei); and forms an adequate ontological basis for genuine but conditioned knowledge both of created reality and of the transcendent reality of God who, in Himself, is incomprehensible to man.*

This is the epistemological significance of the doctrine of creation. A kind of “critical realism” follows from the fact of creation, which establishes the reality of the created order in relation to God, the ultimate Reality. This is philosophical realism. As an “artifact” of God, creation is in the pattern of *Dabar-Ruach* and thus has a structure independent of man’s consciousness. Order is not imposed upon sense data (as the positivists would have it) but is rather to be discerned by man the observer. Man as *Imago Dei* participates in *Logos-structure* as personal, knowing substance and therefore is equipped to discuss, according to the limits of his finite structure, the corresponding *Logos-structure* in created reality. In this way skepticism is avoided in view of the ontological basis for genuine knowledge, and healthy humility is inculcated in view

of the distinction between subject and object and the clear recognition of the dependence of perception upon the created categories of *Logos-structure* in man as *Imago Dei*.

**THESIS XI.** *Logos-structure in created reality is the foundation for man’s mandate to have dominion over the earth (Gen. 1:26, 27) and for the scientific and technological activity of man (even as fallen) in fulfilling that mandate.*

The fact of creation provides the basis not only for the possibility of scientific activity but also the *Magna Charta* for men’s duty and right to scientific activity, especially in view of man as *Imago Dei*. Man has the capacity, and is in relation to God as vicegerent on earth, to exercise *Dabar*-perception with its attendant technological results. Religious man must not limit the natural quest for scientific understanding of, and thus dominion over, creation. Religious authority must not be applied to man’s scientific activity in a way which will stop it from fulfilling its proper method and function. Man, however, is fallen and therefore does require, as scientist, light from divine revelation to protect him from misuse of his God-like ability for such dominion. The “Book of Creation” must be linked to the “Book of Special Revelation” in a fundamental complementary harmony.

**THESIS XII.** *The biblical view of creation, belonging as it does to the sphere of the transcendent and revelation, logically supercedes the legitimate sphere of scientific methodology which can never penetrate the mystery of the origin of the causal sequences which constitute the subject matter of its investigations and theorizing. All statements about first or final causes cease to be scientific thereby and are immediately in the realm of metaphysics and philosophical presupposition.*

Theology was once recognized as the “Queen of the Sciences”. Some of us still recognize it to be so. It is necessary to keep before us the limits and nature of the diverse methodologies of science and theology. The proper sphere of theology encompasses all of reality and therefore all science is to be regarded as a “subset” of theology. This does not mean, however, that theology dictates method and result to science. It simply means that science, in its proper form, is not large enough to interpret the ultimate meaning of its results. This task requires that the scientific endeavor be implicated in a larger, non-scientific (philosophical), pattern.

It is necessary to recognize that scientific description and analysis is within the system of the causal nexus itself and therefore by its very nature cannot speak directly to the meaning of creation or to its metaphysical nature. Any attempt to do so by a scientist immediately removes him from his role as scientist into the role of philosopher—at which exchange the scientist loses the positive results of science as uniquely his own and joins in the competitive task of interpreting science in a larger framework along with all other philosophers and theologians.

On the other hand, the scientist, as scientist, must not be censured for his inability to discern the ultimate causality of God in the causal nexus! There is quite properly a hiddenness of God in relation to

creaturely causality. God is not simply another cause in the chain of natural causes, but, as the doctrine of creation *ex nihilo* implies, is a "cause" of a wholly transcendent order. Therefore it is not obvious that God created the universe unless the observer steps back from the limited perspective offered by scientific methodology to the larger perspectives of philosophy and theology. This is further complicated by man's fallenness so that there are inner spiritual and moral conditions upon the interpreter of creation before he can, with the Psalmist, affirm "The heavens are telling the glory of God and the firmament proclaims his handiwork." (Ps. 19:1).

THESIS XIII. *The mystery of creation, as proceeding from the depths of God as Ruach, is in the transcendence of God as not part of the created order; therefore his activity in creation is forever beyond man and can be spoken about only in metaphor, myth and analogy.*

Here we touch upon an epistemological issue more general than the previous points concerned with scientific method. The issue now concerns human limitation to space-time categories in describing any perception of transcendent reality (the Kantian noumenal). *Ruach*-perception, which penetrates to the noumenal realm, is dependent upon *dabar*-expression in articulating its perceptions. At this point we agree with Bultmann and Tillich in noting the essentially symbolic or "mythical" nature of all description of transcendent, spiritual realities. This does not, however, imply that the Genesis revelation, for example, is simply a human description in space-time categories of transcendent realities. "Symbolic" and "historic" are not necessarily antithetical. The "facticity" of the Genesis narrative can (I think must) be maintained even though its symbolic quality can at the same time (I think must) be acknowledged.

It is correct, with theologians who discuss religious assertions from the point of view of linguistic analysis, to examine the nature, form and functions of religious and theological language and to point to the oddity (as Ian T. Ramsey does) of such language in relation to ordinary discourse. But it must also be recognized that all who have been committed to genuine biblical views, speak as "critical realists" when speaking religiously or theologically. No biblicist merely intends to speak of his own existential situation or his own values. There is always the intention to assert something which has objective significance, to describe "the way it really is" even if, in principle, such assertions are beyond the methods of science to verify or to falsify.

THESIS XIV. *The significance of creation to man as worshiper is that it establishes the total propriety of man's creaturely sense of absolute dependence upon God.*

The doctrine of creation *ex nihilo* clearly establishes the reality of our sense of absolute dependence upon God. As St. Paul put it in quoting the Greek poets "In Him we live and move and have our being" (Acts 17:28). It is certain that apart from God's continued willing of our existence we would fall instantly into "non-being". An awareness of this de-

*God is not simply another cause in the chain of natural causes, but, as the doctrine of creation ex nihilo implies, is a "cause" of a wholly transcendent order.*

pendence Schleiermacher correctly identified as the universal which is uniquely characteristic of man as creature and so as worshiper. To this general positive essence of religious experience the biblical record of salvation history adds the specific essence of all genuine Christian faith and experience which is an absolute dependence upon God as revealed in Jesus Christ—a dependence not simply of nature, of creaturehood, but of grace.

THESIS XV. *The final significance of creation to man as worshiper is that it provides the ultimate meaning to his existence as creature; to answer with doxology to the doxophany of God's self-revelation in creation.*

This is the other side of the fact that God is purposeful in creation. St. Paul gave us the maxim which sums it up: "So, whether you eat or drink, or whatever you do, do all to the glory of God" (I Cor. 10:31). The Westminster Shorter Catechism tells us that man's chief end is "to glorify God and to enjoy Him forever." The deepest heart cry of all creation and especially redeemed creation is *Soli Deo gloria!* To God alone be the glory! "Not unto us, O Lord, not unto us, but to thy name give glory!" (Ps. 115:1). The meaning of creaturehood for man is both doxophany and doxology. First doxophany as manifesting the infinite richness of the glory of the Godhead. Then doxology as calling forth the response of prostration and praise to God's glory revealed in creation and supremely in the person and work of Jesus Christ.

The eschaton most clearly points to this dual theme of doxophany and doxology. All of reality will be filled with the Spirit of glory. The end of all things is a Spirit-filled creation transposed from the present categories of history and space-time into a mode of existence flooded by the glory of God. (Hab. 2:14; Nu. 14:21). And the only proper response of man here and now as well as in the eschaton is the response of doxology—prostration before Him "who alone has immortality and dwells in unapproachable light" (I Tim. 6:16), praise, worship, adoration, a joyous acknowledgment of God as the source of all that is good and beautiful and true; as the ground for purpose and plan in life, as the good of all things. Stauffer so eloquently summarized this point in these glowing and insightful words;<sup>13</sup> "The antiphony of universal history leads into a symphonic doxology. At last God has attained the telos of his ways: the revelation of the *gloria Dei* achieves its end in the hallowing of his name."

Holy, holy, holy is the Lord of hosts; the whole earth is full of his glory. (Isa. 6:3). Who shall not fear and glorify thy name, O Lord, for thou alone art holy. (Rev. 15:4) Amen!

## REFERENCES

- 1W. R. Inge, "Christian Mysticism", in *Classics of Protestantism*, ed. by Vergilius Ferm, Philosophical Library, New York, 1959., p. 466. Given the meaning of the Greek word *poïema*, Dean Inge's use of the word poem is

especially apt. In the interests of greater precision from a Trinitarian point of view the last phrase might better be written "in it and by means of it, He displays all the riches which God the Father has eternally communicated to Him in the mysterious eternal generation of the son."

- <sup>2</sup>C. S. Lewis, *Perelandra*, The MacMillan Co., New York, 1972, p. 214. This exquisite expression of the mystic vision of the nature, meaning and movement of creation is worthy of careful study and exposition in its own right. It is theological poetry.
- <sup>3</sup>Blaise Pascal, *Pensees*, No. 277
- <sup>4</sup>"Ruach-perception" and "Dabar-perception" simply refer to the distinction of method and approach already referred to in the Introduction to this paper.
- <sup>5</sup>This is analogically related to the mystery of our Lord's person as expressed in Chalcedonian Christology "without confusion, without change, without division, without separation."
- <sup>6</sup>B. B. Warfield, "The Spirit of God in the Old Testament" in *Biblical and Theological Studies*, p. 134. It is important to note here that in the order *Dabar-Ruach*, *Ruach* is conceived in terms of the dynamic power of God immanent, in terms of the *opera personalia* of the Holy Spirit, rather than as the depths of richness and mystery in divine freedom as it appears in the order *Ruach-Dabar*.
- <sup>7</sup>It is curious that Irenaeus identifies *Hochma* in Proverbs 8 with the Holy Spirit rather than with Christ. "... the Son was always with the Father. And God tells us, through the mouth of Solomon, that wisdom, that is the Spirit, was with him before the whole creation (Prov. 3:19; 8:22ff)" *Ad Haer*, iv. xx. 3. quoted in *The Early Christian Fathers*, pp. 116, 117.
- <sup>8</sup>"All the works external (to God) are indivisible (among the three persons of the Godhead) because they are common to the three persons". See Heppie, p. 134.
- <sup>9</sup>Ian T. Ramsey has a very useful and illuminating discussion of the linguistic oddity and the real theological significance of this phrase in his excellent book, *Religious Language: An Empirical Placing of Theological Phrases*,

pp. 80-85. The biblical basis for such a phrase is found in the "fiats" of Gen. 1; in Ps. 33:9, "He spoke and it came to be; he commanded, and it stood forth"; and in Rom. 4:17 "God . . . who calls into existence the things that do not exist."

<sup>10</sup>Two classic works dealing with this matter of the final *telos* of creation are *Dissertation on the End for Which God Created the World* by Jonathan Edwards and B. F. Westcott's essay "The Gospel of Creation" in *The Epistles of St. John*, MacMillan and Co., London, 1886, pp. 285-330. Ethelbert Stauffer provides a stirring review of this theme in his *New Testament Theology*, chapter 19, "The Final Glory of God", though it is marred by an unbiblical conclusion of *apokatastasis*.

## BIBLIOGRAPHY

- Barbour, Ian G., *Issues in Science and Religion*, Prentice-Hall, Inc., Englewood Cliffs, 1966.
- Bavinck, Herman, *Our Reasonable Faith*, tr. by Henry Zylstra, Wm. B. Eerdmans Pub. Co., Grand Rapids, 1956.
- The Early Christian Fathers*, ed. & tr. by Henry Bettenson, Oxford Univ. Press, London, 1958.
- Edwards, Jonathan, *Works*, Robert Cartes and Brothers, New York, 1869, Vol. II.
- Heppie, Heinrich, *Reformed Dogmatics*, tr. G. T. Thompson, George Allen Unwin Ltd., London, 1950.
- Lewis, C. S. *Perelandra*, The Macmillan Co., New York, 1968.
- Ramsey, Ian T., *Religious Language: An Empirical Placing of Theological Phrases*, The MacMillan Co., New York, 1963.
- Schmid, Heinrich, *Doctrinal Theology of the Evangelical Lutheran Church*, trs. C. A. Hay and H. E. Jacobs, Augsburg Pub. House, Minneapolis, 1961.
- Science and Religion: New Perspectives on the Dialogue*, ed., Ian G. Barbour, Harper and Row Publishers, New York, 1968.
- Stauffer, Ethelbert, *New Testament Theology*, tr. by John Marsh, The Macmillan Co., New York, 1956.
- Warfield, B. D., *Biblical and Theological Studies*, The Presbyterian and Reformed Pub. Co., Phil., 1952.
- Westcott, B. F., *The Epistles of St. John*, MacMillan and Co., London, 1886.

# Origins and the Bible



JOEL BLOCK

Brien McMahon High School

Norwalk, Connecticut 06854

## THE CREATION OF THE SOLAR SYSTEM AND THE FORMATION OF EARTH

Any agreement on the origin and formation of the solar system between theology and science seems impossible. However, upon careful scrutiny, there are correlations that can be made. It is sometimes overlooked that the book of Genesis was presented to illiterate Israelites. Scientists hypothesize to a specialized, dedicated group of intelligent individuals. The background of each audience dictates different ap-

proaches to a common topic. For the purpose of this paper, the Old Testament is treated, not as a holy book, but a text utilized for the education of the people. The method of instruction can be considered similar to that used by the teachers of today—directing the presentation of facts at the student's academic level. In this context the biblical concept of solar system formation seems similar to that of modern science.

### Nebular Hypothesis

The most widely accepted scientific thoughts on

solar system origin are based upon a nebular hypothesis. Pierre Laplace (1749-1827) suggested that all universal matter was distributed through space in the form of a gaseous cloud. Concentrations formed and grew by gravitational attraction. If the cloud were rotating, contraction would produce an increased velocity and a disk-shaped form. Inevitably the rapid rotation would lead to instability and the release of gaseous rings to remove the unstable condition. However, further contraction would create other instabilities and the production of additional rings. Eventually the center of the cloud concentration would become hot enough to form the sun. The escaped ring would cool and coalesce forming protoplanets. However, contracting protoplanets would also produce instabilities resulting in the release of smaller rings eventually becoming their satellites. Although once widely accepted, Laplace's hypothesis proved mathematically unsound (Menzel, 1970).

### Tidal Hypothesis

Thomas Chamberlain (1843-1928) and Forest Moulton (1872-1952) of the University of Chicago proposed that huge tides of material were produced in the sun's outer rim by the close passage of another star. The gravitational forces of the intruder caused the sun to release a tremendous quantity of material to space. As the passing star disappeared, the escaped material encircled the sun, cooled, and congealed into lumps called planetessimals. Larger planetessimals swept up smaller ones and other debris eventually forming our planets.

A variation of this tidal hypothesis was suggested by Sir James Jeans and Sir Harold Jeffreys. The tidal effect of the passing star caused the sun to release a long filament which cooled and broke into protoplanet contractions (Menzel, 1970).

### Other Hypotheses

Fred Hoyle of Cambridge University postulated that the sun was once a double star. One of the pair became unstable, exploded, and headed into space leaving a trail of gas and dust. The planets were said to have developed from these remains (Menzel, 1970).

C. F. von Weizsäcker and G. P. Kuiper produced another nebular variation. Several condensations formed in the original cloud. The smaller concentrations gathered material as they orbited the forming sun. Some of the concentrations may even have been inside the sun's atmosphere. Solar wind and radiation pressure were to have driven material into space leaving the protoplanets behind (Menzel, 1970).

All of the above hypotheses are founded on a gaseous origin; they are modifications of a common theme.

### The Biblical Account

In the consideration of biblical creation, it is paramount that the reader concentrate on the following factors: (1) the nature of the audience, (2) the basic ideas, not the figurative presentation, and (3) the sequential order of creation. The six days of Biblical creation are found in the book of Genesis.

In simple terms, the first day's accomplishments (Gen. 1:1-5) include the creation of heaven, an unformed earth, and light in the midst of darkness.

*In this age of confrontation concerning the teaching of biblical creation in science classrooms, it seems ironic that the Bible and modern science agree on the sequence of cosmogony and the evolution of planet Earth.*

---

Elementary science students know that matter without form can exist in a gaseous state. The hypotheses discussed above agree that the solar system originally began as a gaseous cloud. They believe that the greatest concentration of material contracted to form the sun, and the planets, including earth, formed from the gases surrounding this center. It is also believed that the nebula was originally dark until the sun produced its own light.

The Bible concurs, stating that initially "the earth was unformed", that "darkness was upon the face of the deep", and then God said, "Let there be light".

In the second day of biblical creation (Gen. 1:6-8), the author (or authors) begins to expound upon a theory of planetary development. The ancients, including the Israelites, were geocentrically oriented; therefore, the prime concern is with the formation of earth. The Israelites are informed that the earth had cooled to a liquid state; however, there were two divided liquids. These former desert slaves were acquainted with several liquids: blood, oil, water, wine, and milk. Of the five, only water is not produced from a biological source. The water could have been one of the divided fluids of earth. Liquid rock, lava, which contains a great deal of water, had probably never been seen by the Israelite slaves. Therefore, by referring to the division of two waters, it is suggested that two different liquids composed earth: clouds above and liquid rock below (Block, 1976).

Many scientists believe that the earth may have passed from a gaseous to a molten or partially molten stage in the condensation of its material (Clark and Stern, 1968). This action was probably induced by the gravitational attraction of its material or the release of heat energy by the radioactive decay of its elements (Luce, 1955). Water vapor in addition to methane, ammonia, hydrogen, and carbon dioxide, escaped during the cooling process, forming earth's primal atmosphere and enshrouding the liquid earth with a thick cloud cover (Urey, 1972).

At the conclusion of the second day, a period of cooling is stated by denoting a liquid earth. The above scientific hypotheses supports this idea.

In verse nine further cooling is suggested by the presence of the first solid, land. Some scientists believe that the thick cloud cover surrounding earth kept the sun's light from penetrating to the liquid rock surface. Water falling from the cloud could have cooled the surface but would immediately steam back into the atmosphere. Eventually solid rock began to congeal when the surface temperature reached 1,000-2,000 degrees Fahrenheit (Luce, 1955). Many argue that the cooling earth became encrusted over its whole surface with a thin layer of light granitic material

forming land on top of heavier basaltic rock. Some say that the entire earth was basaltic with differentiation of material caused by the process of deformation (Kay, 1972). Be that as it may, laboratory experiments leave little doubt that granite, of which the continents are made, originally came from hot magmas (Tuttle, 1955).

Eventually the temperature of the surface fell below the boiling point of water. The great, all-encompassing cloud condensed and precipitated a deluge. Water began to accumulate. Cooling lava and volcanic emissions provided additional water to the low-lying areas, ultimately creating the oceans. Genesis states that the sea was "gathered together" and "the dry land became visible".

Twentieth century earth scientists, beginning with Alfred Wegener in 1912, agree with the claim that the sea, now called Panthalassa, was together. If the sea water was together, then the land must have been together. Overwhelming evidence has confirmed that a universal land mass, Pangaea, did exist (Dietz and Holden, 1972). Sections have since split and have drifted to their present location, probably by means of convection currents in the earth's mantle (Wilson, 1972). Today there is almost universal acceptance of the Theory of Continental Drift. Moses or the authors of Genesis may have been its first proponents.

The third day of creation, as well as the fifth and sixth days, are concerned with biological development and are the topic of the second part of this paper.

In the fourth day of Biblical creation (Gen. 1:14-19), a contradiction seems to appear between the Bible and science. The sun seems to have been created twice—on the first and fourth days. One school of scientific thought believes that a dense primitive atmosphere containing the volatile constituents of water and carbon dioxide surrounded the hot earth. As the cooling earth solidified, temperatures dropped sufficiently permitting the water to condense, precipitate, and collect in low-lying areas. The removal of water from the atmosphere would thin the cloud cover, ultimately permitting the light from the sun, moon, and stars to reach the surface of the land (Strahler, 1972). In other words, the sun was not created again but now could be seen from the surface of the earth. As is indicated, "God set them in the expansion of the heaven to give light upon the earth" (Block, 1976).

In this age of confrontation concerning the teaching of biblical creation in science classrooms, it seems ironic that the Bible and modern science agree on the sequence of cosmogony and the evolution of planet Earth. The difference in wording seems due to the nature of the audiences receiving the information. In addition, certain biblical statements, figuratively interpreted, seem to make the authors of Genesis pioneers in cosmogony, planetary development, and continental drift. It is my belief that the Bible and modern scientific hypotheses of creation are, in fact, alike, but expressed in different terms.

## THE DEVELOPMENT OF LIFE

### Plant Life

Biological creation begins during the third day and

continues on days five and six (Gen. 1:11-13). The Bible implies that the first living organisms on earth were plants. Many scientists say that the early atmosphere of earth, unlike today, probably consisted of methane, ammonia, carbon dioxide, hydrogen, and water vapor (Urey, 1972). Atmospheric oxygen increased as solar radiation dissociated water into hydrogen and oxygen. Most of the hydrogen, the lightest element, escaped from earth's gravitational pull. Carbon combining with oxygen as carbon dioxide, made plant life possible. The photosynthetic process released additional oxygen until there was an abundance of free atmospheric oxygen required for animal development (McAlester, 1968).

It is also known that plants occupy the first trophic level in the food chain and are the source of energy transferred to all other organisms (Odum, 1968). Since plants are responsible for food and oxygen, scientists and the Bible agree that plants preceded animal life on earth.

The most ancient organic life forms discovered to date are fossils of microscopic bacteria and blue-green algae found in Precambrian rock in South Africa: the Fig Tree Series and the underlying Onverwacht Series. Spheroidal forms exist in both series while the former also includes rod-shaped, bacterium-like bodies. The Fig Tree structure has been proven organic and is presently the oldest known remains of life on earth, 3100 mya (Dunbar and Waage, 1969).

The first land plants were seedless, pencil-like, organisms called Psilopsids which lacked both roots and leaves. Photosynthesis was accomplished in the stem. Horizontal portions of the stem covered the ground functioning as roots. These oldest known vascular fossil plants were found in the upper Silurian deposits in England. Other seedless plants including Lycopsids (club-mosses), Sphenopsida (horsetails), and Pteropsida (ferns) appear during the Devonian producing small herbs, and eventually, seedless trees. These trees contributed to the coal forests of the late Carboniferous (McAlester, 1968). By late Carboniferous and Permian time, seedless trees were giving way to gymnosperms, seed bearing flora, which could reproduce without external moisture. Cycads (Palm-like), ginkgoes (with a fan-shaped leaf), and conifers first appear in the Carboniferous, and developed into great forests during Triassic and Jurassic periods.

The more highly developed Angiosperms (flowering plants) first appear in the lower Cretaceous. They rapidly become the dominant plants and remain so to this day. Their evolutionary success is probably based upon its fruit-enclosed seeds and seed dispersal mechanisms (McAlester, 1968).

It is interesting to note the sequence of biblical floral creation: grass, herbs bearing seed, and fruit trees. The Old Testament could have indicated that plants evolve from small or simple organisms to more complex structures (Block, 1976).

It is scientifically known that different kinds of life succeeded one another—that life is continually evolving. The "fittest" individuals pass their desirable traits on to the next generation. Over many generations, selective reproduction by the most successful individuals would lead to adaptive changes in species

and, ultimately, to new species (McAlester, 1968). Organisms do become more complex by developing adaptations to meet environmental changes.

The Biblical "grass" could have represented small low-lying plants to the Israelites. Seed bearing herbs could be a reference to gymnosperm herbs. The final plants and highest level of development mentioned on the third day of creation are fruit trees which do represent the more highly advanced angiosperms. It is "coincidental" that Biblical creation seems to parallel principles of basic evolutionary thought (Block, 1976).

### Fish and Birds (Gen. 1:20-23)

In the Ediacara Hills of South Australia, M. F. Glaessner of the University of Adelaide in 1947 found fossils of what was to be the oldest known living animal life. In a late Precambrian to lower Cambrian formation, impressions attributed to jellyfish, segmented worms, and sea pens were discovered, as well as several other impressions that resemble no known organisms (Dunbar and Waage, 1969).

The oldest and most primitive fish were the agnaths, jawless fish, found during the Ordovician. Some were suspension-feeders straining plankton from the surface, while others moved along the bottom taking in the organic-rich sediments. Lampreys and hagfishes, which attach to and suck blood from other vertebrates, are today's jawless descendants of the agnath. By Devonian time, "great sea monsters" had developed as exemplified by the Dinichthys, a jawed, carnivorous fish of the Class Placodermi. These fish grew to a length of thirty feet with a mouth several feet wide. Late Devonian brought their decline as sharks and bony fish became dominant (McAlester, 1968).

The ability to fly is an adaptation of great advantage. It permits an animal to escape from danger easily and establish a wider range in which to search for food. The first flying animals were insects. The fossilized wing of a dragon fly-like species was found in rocks of Carboniferous age. This insect had a three-foot wingspan making it the largest insect known. Flying reptiles, Pterosaurs, existed during the Jurassic and Cretaceous periods. Skin was attached to one long finger on each side which functioned as a wing. The wing span of some Pterosaurs measured more than twenty-five feet, making them the largest animal to fly. Their fossil remains were last found in Upper Cretaceous rock (McAlester, 1968).

Once again, the "coincidence" of biblical creation follows the evolutionary pattern of development from the simple or small to the more complex creatures. Is the Bible preaching evolution?

### Creation of Man (Gen. 1:24-31)

Scientists believe that man has "dominion" over the earth because of superior intellect; therefore, the evolutionary trend should parallel cerebral development. The Bible seems to deviate from evolution since cattle are more advanced than "creeping things". I believe that this deviation may not have been by accident, but for the understanding of the Israelites. Cattle use little intelligence because their basic needs, food and protection, are provided by man. "Creeping things" generally have less cerebral growth; however, they are faced with "decisions" concerning food and

*It is my belief that the Bible can be used as a scientific reference and that the biblical and scientific hypotheses of biological development are alike, but expressed in different terms.*

predators. To the ancients, this could have denoted an act of "thinking". The creation of "beasts" bring to mind larger and more cunning carnivorous animals capable of higher intelligence. Lastly, man, possessing the power of reason, is the top of the intellectual ladder. The Bible figuratively seems to indicate domination on land by intellectual as opposed to physical evolution (Block, 1976).

The Bible and modern scientists seem to have the same hypothesis on the development of living organisms. The difference in wording could be due to the nature of the audiences receiving the information. It is my belief that the Bible can be used as a scientific reference and that the biblical and scientific hypotheses of biological development are alike, but expressed in different terms.

### REFERENCES

- Abell, George. 1966. *Exploration of the Universe*. Holt, Rinehart and Winston. New York. pp. 516-536, 577-590.
- Ballard, Sir Edward. 1972. "The Origin of Oceans". *Continents Adrift*. Scientific American, Incorporated. New York. pp. 88-97.
- Block, Joel 1976. "The Bible and Science on Creation," *Journal of Geological Education*, Vol. 24, No. 2, pp. 58-60.
- Clark, Thomas and Colin W. Stearn. 1968. *Geological Evolution of North America*. The Ronald Press Company. New York. pp. 74-81, 508.
- Dietz, Robert S. and John C. Holden. 1972. "The Breakup of Pangaea". *Continents Adrift*. Scientific American, Incorporated. New York. pp. 102-113.
- Dunbar, Carl O. and Karl M. Waage. 1969. *Historical Geology*. John Wiley and Sons, Incorporated. New York. pp. 159-167.
- Hurley, Patrick M. 1972. "The Confirmation of Continental Drift". *Continents Adrift*. Scientific American, Incorporated. New York. pp. 57-67.
- Kay, Marshall. 1972. "The Origin of Continents". *Continents Adrift*. Scientific American, Incorporated. New York. pp. 16-20.
- Leeser, Isaac. *The Pentateuch*. Hebrew Publishing Company. New York. pp. 1-3.
- Luce, Henry, Ed. 1955. *The World We Live In*. Time Incorporated. New York, pp. 4-13.
- Matthews, Samuel W. 1973. "The Changing Earth". *National Geographic Magazine*. Vol. CXLIII. pp. 1-37.
- McAlester, A. Lee. 1968. *The History of Life*. Prentice-Hall, Incorporated. Englewood Cliffs, New Jersey. pp. 4-144.
- Menzel, Donald H. 1970. *Astronomy*. Random House. New York. pp. 218-226, 260-273.
- Odum, Eugene P. 1968. *Fundamentals Of Ecology*. W. B. Saunders Company. Philadelphia. pp. 46-47.
- Sarna, Nahum M. 1972. *Understanding Genesis*. Schocken Books. New York. pp. 1-36.
- Strahler, Arthur N. 1972. *Planet Earth: Its Physical Systems Through Geologic Time*. Harper and Row Publishers. New York. p. 283.
- Tuttle, O. Frank. 1955. "The Origin of Granite". *Scientific American*. W. H. Freeman and Company. San Francisco. pp. 3-6.
- Urey, Harold C. 1972. "The Origin of the Earth". *Continents Adrift*. Scientific American, Incorporated. New York. pp. 4-9.
- Weaver, Kenneth F. 1974. "The Incredible Universe". *National Geographic Magazine*. Vol. CXLV. pp. 589-625.
- Wilson, J. Tuzo. 1972. "Continental Drift". *Continents Adrift*. Scientific American, Incorporated. New York. pp. 41-55.

# Creation and/or Evolution



DAVID L. WILLIS

Department of General Science

Oregon State University  
Corvallis, Oregon 97331

The two terms in my title are regarded by many people as violently antithetical. It is my purpose to demonstrate that such is not necessarily the case. I shall attempt to show that the Biblical record of creation allows more evolutionary change than many so-called "Creationists" admit. Conversely, the scientific evidence for a totally evolutionary scheme of life is not nearly so conclusive and overwhelming as so-called "Evolutionists" often state.

## Four Assumptions

Let me state the assumptions upon which I propose to build my arguments. The first assumption is that the Old and New Testaments constitute a trustworthy and accurate record of God's relation to man and the natural world. This record is divinely inspired (in the orthodox sense of the term), yet it bears the distinctive imprint of its various human writers and the sources from which they drew their information.

Secondly, the creation account in chapters 1 and 2 of Genesis, while pre-scientific and non-analytical in character, is nevertheless an accurate general description of the origin and subsequent early development of the natural world. It may not be merely written off as unrelated to the scientific evidence. However, the abbreviated and summary nature of the account and its strongly anthropocentric viewpoint should caution us against attempting any detailed correlation with the geological record.

Thirdly, the application of man's God-given capacities for logical and systematic investigation of the natural world—scientific study—is a valid enterprise. It is valid precisely because the results of creation appear to be a basically rational and comprehensible universe. However, it should be noted that the scientific study of non-repeatable occurrences of the distant past involves a very large margin of uncertainty compared to the investigation of contemporary events. Although science deals with natural rather than supernatural processes, it is not thereby intrinsically biased toward atheism.

Lastly, since we regard the Biblical record to be an accurate sourcebook and the application of the scien-

tific method to the natural world a valid approach, there can exist no ultimate conflict in our interpretation of the two. Given our assumptions, apparent discrepancies *must* be the result of incomplete evidence or faulty interpretation of one or both sources. A major goal of the Christian scientist is to formulate and/or identify positions which satisfactorily harmonize the scientific evidence with the Scriptures, without doing violence to either.

## Genesis Record of Origins

With these assumptions clarified, let us next consider the Genesis record of origins. This portion of the Bible is familiar, perhaps too familiar. With such passages, there is always the danger of reading into the text meaning that is not there. (For example, how many of you conceive of Adam as any other than a red-blooded, all-American boy? We don't get this racial bias from the text, but from our own mental interpolation.) A hyper-literal interpretation of Genesis accompanied by a wholesale reading into the text of inferred or supposed concepts characterizes much of the current Creationist movement. Christian scientists must come to grips with this approach.

The self-styled "Creationists" make much of a "literal" interpretation of chapters 1 and 2 of Genesis. Explicit in their view is a series of recent creative acts that produced a world and its array of living forms much like those of today. Creative acts are usually defined as instantaneous and involving neither natural processes nor use of pre-existing materials. Greater or lesser emphasis may be placed on a universal cataclysmic deluge which accounted for fossils and other such troublesome artifacts. This literalistic interpretation is commonly promulgated as "The Christian View of Creation." With this approach to creation in mind, let us examine the pertinent Biblical terms and their apparent meanings.

## Translation of Key Words

Attention immediately centers on the Hebrew word *bara*, commonly translated "create." This word or its derivatives occur only seven times in the Genesis rec-

ord of origins (1:1, 21, 27 [three times]; 2:3, 4) and about forty times elsewhere in the Old Testament. God is always the subject of the verb and it normally refers to some unique formative action. The product may be concrete ("man"—Gen. 1:26) or abstract ("a clean heart"—Psalm 51:10). Beyond this point one cannot realistically drive the meaning of the term. It is important to recognize here that the Old Testament is the only extant Hebrew literature of its era. Thus, for such infrequently used words the opportunity to cross-check their range of meanings with the context of other literary types is absent. The point is that we do not have a precise definition of *bara* from the Bible, itself.

Does *bara* uniformly refer to an instantaneous creation without process or use of pre-existing material? Let us examine the instances where it is used. In Genesis 1:1 ("In the beginning God created the heaven and the earth."), the traditional meaning very well may apply. Unless one assumes that matter is eternal, this verse apparently records the origin of matter *de novo* and its assembly into the astronomical bodies. However, the verse is a brief, but majestic statement of results, not necessarily ruling out process.

The next occurrence is in Genesis 1:21 ("And God created great whales, and every living creature that moveth . . ."). The context here does not define the nature of the creative act. From verse 20, one might infer that some natural process was involved.

Any argument for a restricted meaning of *bara* is badly shaken by the context of the remaining usages in Genesis. In verse 27, the verb is repeated three times in connection with the origin of the first humans. However, the previous verse states, "And God said, Let us *make* man in our image. . . ." The word "make" here is the Hebrew *asah*. It is the common term for "make" or "do" and is used hundreds of times in the Old Testament with a wide range of meanings. The subject of this verb is variously man, God, animals, etc. It commonly involves natural processes and use of materials. Furthermore, in Genesis 2:3, 4, the words *bara* and *asah* are used interchangeably in immediate and parallel context. In view of the very general meaning of *asah*, it would strain the clear statements in these passages to attempt to assign a special and restrictive meaning to *bara*.

If creation is to be understood as an event without process or use of pre-existing material, one is confronted with the description of Adam's origin in Genesis 2:7. Here the pre-existing material ("dust") and at least some process ("breathed into his nostrils") are clearly stated for even a literalist to see. The word here translated "formed" is also significant. It is the Hebrew *yatsar*, whose root meaning is to mold or form. It is commonly used of human or divine activity in the Old Testament and relates to a variety of manufacturing activities, among them pottery making. Whether in this context God was making the original human crackpot, I'll leave to your decision!

In summary, one cannot derive from the context in Genesis 1 and 2 the restricted meaning of "create" that the creationists desire. The special term *bara* is used interchangeably with common words for acts of purely human production. In fact, in Isaiah 43:7 all three of the above words are used in a perfectly

*The biblical record of creation does not rule out the divine employment of natural processes in either origins or subsequent development. The record simply states that behind all matter and life stands God, the Creator.*

---

parallel series to describe God's relation to the Jews! We must avoid insisting on a special definition for the word "create" which goes beyond the more general use in the Bible, itself.

### Must Creation Be Instantaneous?

The emphasis on creation being instantaneous, or at least without use of long time periods is another problem. This emphasis often is tied to an interesting theological attitude. I sadly remember a debate with a well-known conservative Old Testament scholar several years ago on these matters. He fervently insisted that a series of instantaneous creative acts over a literal period of six days was a key Christian belief related to the omnipotence of God. I can't forget the look on his face when I mischievously reduced his argument to absurdity. My observations went something like this, "If God's omnipotence is revealed by a six-day creation, then wouldn't He be more omnipotent (sic) if He accomplished it in only one day? He would be still more omnipotent if it took place in only one hour, etc., etc." In dealing with such matters we must always remember that it is not a question of what God *can* do, but what He *did* do.

The Genesis record of origins does not contain a clear statement of its purpose. We would probably agree that this purpose is religious, not scientific. However, it is not thereby scientifically in error. The common denominator of religions of the ancient world was the identification of deity(ies) with natural features or manmade images—idolatry. The repeated religious failure of the Jews was to lapse into the idolatrous customs of neighboring cultures. The Jewish prophets regularly pointed out that the God who "created heaven and earth" cannot be appropriately represented by an image or a natural feature of the creation. In other words, a clear view of the creator-role of God is antithetical to idolatry.

In our time old-fashioned idolatry is somewhat out of style. Instead of an overeagerness to see God in every tree or stone, our age would largely reason Him out of business. Here, again, the emphasis on the Creator-God is pertinent. Atheistic humanism that sees man as "the measure of all things" may be opposed by the clear statement, "In the beginning God created . . ." It would be tragic if the definition of creation were made so restrictive as to be wholly incompatible with the record of science. This would allow our contemporaries to avoid the philosophical impact of God the creator because of our scientific obscurantism.

The biblical record of creation does not rule out the divine employment of natural processes in either origins or subsequent development. The length of time involved is not an essential factor. The record simply states that behind all matter and life stands

God, the Creator. The details of origin (creation) and subsequent change (evolution) are in the realm of science, not theology. Any attempt to read all of the scientific evidence through the narrow slit of a particular restrictive "creationist" interpretation is both unfortunate and untenable.

### Dogma of Evolution

Just as some "creationists" promulgate a narrowly literalistic interpretation of Genesis, so many contemporary scientists proclaim the dogma of evolution. Before evaluating this matter, let us carefully define the term. Evolution basically means "change." As used by biologists, it refers to changes in populations of living organisms by natural processes over a span of time. There are really two levels of usage for this term, although the important distinctions between them are often blurred in common practice. *Limited evolution* (microevolution) involves the formation of new species or varieties by natural selection operating on the genetic pool of a population over a limited period of time.

By contrast, *general evolution* envisions an extension of such limited changes to account for the origin of all living and extinct species of organisms from a single source over the span of geological time. It is this broad generalization about the presumed interrelationship of all living things that is usually intended by the unmodified word "evolution." In addition, *chemical evolution* is a term frequently used today. It refers to assumed pre-biotic changes on the primeval earth which gave rise to the first organism(s) by purely natural means.

Judging from the outcries by leading biological and scientific societies and leaders regarding textbook controversies, general evolution is yet a strongly-held contemporary dogma, if not a sacred cow. Introductory biology textbooks commonly treat the theory as proven beyond all shadow of doubt. Statements such as, "the vast majority of scientists accept evolution," suggest that scientific truth is determined by the ballot box. From my own experience in 21 years of teaching, few students (or faculty for that matter) are aware that a significant minority viewpoint exists. I mean from a scientific, not a religious basis. Let us consider some of these criticisms of the general evolutionary theory.

### Criticisms of General Evolution

Several contemporary biologists have attempted to make the point that most of the evidence presented for general evolution, in fact, substantiates only limited evolution. General evolutionary theory is primarily a grand extrapolation of this evidence. Limited evolution is rather clearly demonstrable, whereas general evolution should be regarded much more hesitantly at present.

In the preface to his book *Implications of Evolution*, G. S. Kerkut, a leading invertebrate zoologist at the University of Southampton, England, succinctly summarizes the situation,

May I here humbly state as part of my biological *credo* that I believe that the theory of Evolution as presented by orthodox evolutionists is in many ways a satisfying explanation of some of the evidence. At the same time I

think that the attempt to explain all living forms in terms of an evolution *from a unique source*, though a brave and valid attempt, is one that is premature and not satisfactorily supported by present-day evidence. It may in fact be shown ultimately to be the correct explanation, but the supporting evidence remains to be discovered. We can, if we like, believe that such an evolutionary system has taken place, but I for one do not think that "it has been proven beyond all reasonable doubt." In the pages of the book that follow I shall present evidence for the point of view that there are many discrete groups of animals and that we do not know how they have evolved nor how they are interrelated. It is possible that they might have evolved quite independently from discrete and separate sources. (pp. vii-viii).

Dr. John T. Bonner of Princeton University, in his review of Kerkut's book in the *American Scientist*, responded with deep feeling to Kerkut's approach,

This is a book with a disturbing message; it points to some unseemly cracks in the foundations. One is disturbed because what is said gives us the uneasy feeling that we knew it for a long time deep down but were never willing to admit this even to ourselves. It is another one of those cold and uncompromising situations where the naked truth and human nature travel in different directions. (p. 240).

A quite different criticism of aspects of general evolution has been raised by several mathematicians in recent years. The thrust of their criticism was that computerized mathematical models of evolutionary phenomena did not fit the evolutionary time scale. There simply hasn't been enough time to account for all the presumed evolutionary changes based on a mechanism of natural selection of mutant characteristics. Moreover, they objected to the concept that blind selection (chance) could result in cumulative improvements in populations. No mathematical models could encompass such a situation. In other words, the proposed means are inadequate to account for the presumed results of general evolution.

A formal symposium featuring a frank confrontation between some of these mathematicians (led by Dr. Murray Eden of M.I.T.) and well known evolutionary theorists was held in 1966. The proceedings of this symposium were published under the revealing title of *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution*. The verbatim transcript of the discussions following each position paper revealed just how closed was the circle of evidence considered by some evolutionary thinkers.

Loren Eiseley, giving the introductory address at the symposium identified the problem,

. . . we should give serious thought to the question of whether we have reached a certain point of hesitation in our seemingly clear explanation of the way evolution comes about. Have we really answered all the questions; . . .? . . . In connection with some of these obscure problems of related mutations, or variations that have to be related almost from the beginning in order to be effective, he [Darwin] was not as confident in some of his expressions as the neo-Darwinists. . . . The point, it seems to me, . . . lies . . . over in another domain of the organismic approach, the problem of whether there are some aspects of life, and of chemistry under the control of life, which are not yet totally accountable for with the means at our command. (pp. 3-4).

Here, he is clearly addressing the almost cocky attitude of some molecular biologists today who insist that life

is *only* an extension of chemistry and physics. Eiseley gently suggests that such a conclusion may be a trifle premature in light of many unexplained phenomena of life.

The fossil record is appealed to as conclusive evidence that general evolution has occurred according to the classic pattern. It is not always made clear that while fossil remains are "facts," the interpretation of their interrelationships in time and space is often tenuous. Frequently, lines of descent for a series of fossil "species" (such as the horse) are based on fossils found at random in widely remote regions of the earth. To justify such questionable interpretations, appeal is made to hypothetical dispersion routes, corridors and filters. Elaborate biogeographical schemes have been propounded of which P. J. Darlington's *Zoogeography: The Geographical Distribution of Animals* is a classic. All such schemes envision an essentially stable system of continents which changed in only minor geographic details.

The revolutionary development of the geophysical theory of plate tectonics during the past decade has now established that the continents indeed have moved extensively and continue to do so. The older idea of continental drift is again in vogue, but now with a reasonable scientific mechanism. Evolutionary schemes based on former biogeographical concepts are now hopelessly obsolete. Hypotheses about the adaptive radiation of various plant and animal groups, relict populations, etc., are now undergoing wholesale revision. A recent volume in this area, *Evolution, Mammals, and Southern Continents*, is one of the first books on historical biogeography to appear since continental movement became a fact. Anyone familiar with the former schemes is shocked to discover just how many settled issues have suffered major surgery or been abandoned. Clearly, it is premature to be dogmatic about the implications of at least the terrestrial fossil record at this point in history.

### Philosophical Inadequacies of Darwinian Theory

Too frequently, scientific considerations of evolution deal exclusively with the hard data and their interpretation. Such is the framework of scientific training. Philosophers of science, however, view the subject with a much broader perspective. It is from this angle that some of the most serious objections to Darwinian evolution come. Many names are associated with this attack, but Dr. Marjorie Grene, of the University of California at Davis, is the most readable from my perspective. In her book *The Knower and the Known* in a masterful chapter entitled "The Faith of Darwinism" she charts the philosophical inadequacies of Darwinian theory. I would recommend her writings to anyone seriously interested in this subject. A few quotations may whet your appetite.

Relative to the oft-cited case of industrial melanism and English peppered moths, she states:

Here, say the neo-Darwinians, is natural selection, that is, evolution, actually going on. But to this we may answer: selection, yes; the colour of moths or snails or mice is clearly controlled by visibility to predators; but 'evolution'? Do these observations explain how in the first place there came to be any moths or snails or mice at all? By what right are we to extrapolate the pattern by which colour or other such superficial char-

*As a biologist and a Christian committed to the Scriptures as God's revelation, I believe that the concepts of creation and evolutionary change, properly understood, are compatible.*

---

acters are governed to the origin of species, let alone of orders, classes, phyla of living organisms? But, say the neo-Darwinians again, natural selection is the only mechanism we observe in present-day nature. But again, if this were so, we should still have no right to say that the only mechanism we see at work now is the only one that has been at work in all the long past of the living world. Nor, for that matter, is it the only 'mechanism'. (pp. 193-194).

Her most telling criticisms deal with the inadequacy of natural selection to really "explain" the facts of life:

It is precisely the insistence on the equation of life with adaptation that defines the limits of Darwinism, and it is doubt of the all-inclusiveness of adaptation as a concept definitive of life that motivates the most effective objections to the Darwinian synthesis. . . . One may indeed ask whether all adaptations have arisen by Darwinian-Mendelian means; but one may also ask, as some eminent biologists do, whether evolution, on a large as well as a small scale, is essentially a matter of adaptation at all. . . . There are, indeed, all the minute specialized divergences like those of the Galapagos finches which so fascinated Darwin; it is their story that is told in the *Origin* and elaborated by the selectionists today. But these are dead ends, last minutiae of development; it is not from them that the great massive novelties of evolution could have sprung. For this, such dissenters feel, is the major evolutionary theme: great new inventions, new ideas of living, which arise with startling suddenness, proliferate in a variety of directions, yet persist with fundamental constancy—as in Darwinian terms they would have no reason in the world to do. Neither the origin and persistence of great new modes of life—photosynthesis, breathing, thinking—nor all the intricate and co-ordinated changes needed to support them, are explained or even made conceivable on the Darwinian view. (pp. 196-197).

Perhaps the most revealing evaluation of evolutionary theory she gives is from the philosophical standpoint.

Yet, if all this is so, why is the neo-Darwinian theory so confidently affirmed? Because neo-Darwinism is not only a scientific theory, and a comprehensive, seemingly self-confirming theory, but a theory deeply embedded in a metaphysical faith: in the faith that science can and must explain all the phenomena of nature in terms of one hypothesis, and that an hypothesis of maximum simplicity, of maximum impersonality and objectivity. Relatively speaking, neo-Darwinism is logically simple: there are just two things happening, chance variations and the elimination of the worst ones among them; and both these happenings are just plain facts, things that *do* or *don't* happen, *yes* or *no*. Nature is like a vast computing machine set up in binary digits; no mystery there. And—what man has not yet achieved—the machine is self-programmed: it began by chance, it continues automatically, its master plan itself creeping up on itself, so to speak, by means of its own automatism. Again, no mystery there; man seems at home in a simply rational world. (pp. 199-200).

### Summary

In summary, the actual Biblical statements about creation are not as definitive nor as restrictive as to

process and time as many creationists demand. Taken at face value, the Genesis account seems to describe the divine origin of a variety of distinctive forms of life. These forms subsequently produced descendants by purely natural processes. The general theory of evolution postulates an ultimate relatedness of all living forms because of a common ancestry and origin. Natural selection operating on random mutations in populations is proposed as the effective method to produce the present diversity of life. However, both the ultimate biological relatedness of all forms and the effectiveness of the proposed mechanism are seriously being questioned today. Kerkut, in the closing paragraph of his book summarizes the current situation.

There is a theory which states that many living animals can be observed over the course of time to undergo changes so that new species are formed. This can be called the "Special Theory of Evolution" and can be demonstrated in certain cases by experiments. On the other hand there is the theory that all the living forms in the world have arisen from a single source which itself came from an inorganic form. This theory can be called the "General Theory of Evolution" and the evidence that supports it is not sufficiently strong to allow us to consider it as anything more than a working hypothesis. It is not clear whether the changes that bring about speciation are of the same nature as those that brought about the development of new phyla. The answer will be found by future experimental work and not by dogmatic assertions that the General Theory of Evolution must be correct because there is nothing else that will satisfactorily take its place. (p. 157).

Several hypotheses which would harmonize the biblical statements with the current scientific evidence exist. One is particularly attractive to me. It proposes that the major forms of life were indeed brought into existence by some unique and non-repeatable mechanism (creation?). Thereafter, natural selection or other natural factors led to diversification within broad limits. Determination of the range of these limits is a subject for scientific investigation and, thus, must remain an open question for the present. This approach actually fits the general data of paleontology as well as the general theory of evolution does. In addition, it serves to explain the evident absence of transitional forms between major groups of organisms and the lack of evidence for phyletic evolutionary origins.

Most importantly, such an approach allows for new scientific data to be accommodated without the necessity of a major revision of one's theoretical foundations. This latter point is crucial, as witness the exhaustive efforts of certain "creationists" to discredit any and every type of evidence for a great age of the earth. They are forced into such desperate actions because the concept of a recent earth is a key plank in their philosophical platform. To borrow the language of the "uptight" generation, our broad hypotheses should "hang loose," avoiding rigidly fixed positions which, like the Maginot Line of the 1940's, may be outflanked by a novel offensive.

As a biologist and a Christian committed to the Scriptures as God's revelation, I believe that the concepts of creation and evolutionary change, properly understood, are compatible. One need not sacrifice the accuracy of the Genesis account or the validity of the scientific record in any shotgun marriage. Thus, the divine origin of the forms of life by methods at present unresolved is not in opposition to present scientific evidence. Nor, on the other hand, is the occurrence of extensive evolutionary change over great periods of time irreconcilable with the Biblical record. The "golden mean" of truth in this area will be found neither with the hyperliteralism of some creationists nor with the narrow dogmatism of the more numerous neo-Darwinians.

## REFERENCES

- <sup>1</sup>Kerkut, G.A. (1960) *Implications of Evolution*. New York, Pergamon Press. 174 p.
- <sup>2</sup>Bonner, John Tyler. (1961) Perspectives. *American Scientist* 49:240-244. June.
- <sup>3</sup>Moorhead, Paul S., and Martin M. Kaplan (eds.). (1967) *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution*. A Symposium held at The Wistar Institute of Anatomy and Biology, April 25-26, 1966. Philadelphia, Wistar Institute Press. 140 p. (The Wistar Institute Symposium Monograph No. 5).
- <sup>4</sup>Darlington, P. J., Jr. (1957) *Zoogeography: the Geographical Distribution of Animals*. New York, Wiley.
- <sup>5</sup>Keast, Allen, Frank C. Erk, and Bentley Glass (eds.). (1972) *Evolution, Mammals, and Southern Continents*. Albany, S.U.N.Y. Press. 544 p. (Reviewed by David S. Woodruff in *Science* 180:603-605, May 11, 1973).
- <sup>6</sup>Greene, Marjorie. (1966) *The Knower and the Known*. London, Faber and Faber. 283 p.

### **Evangelical Philosophical Society**

We are happy to announce to you the formation of the Evangelical Philosophical Society in Philadelphia, December 28, 1976. Twenty original members elected the following officers:

*President:* Norman L. Geisler, Deerfield, Ill.

*Vice-President:* Gordon Lewis, Denver, Col.

*Secretary-Treasurer:* Jay Grimstead, Los Altos, Ca.

The purpose of the Society is to "encourage and advance scholarly production in any of the areas of Philosophy of Religion, Philosophical Theology, Apologetics, Ethics, and other related areas."

The Society has adopted for itself the same very simple and broad statement of Faith as the Evangelical Theological Society: "The Bible alone and the Bible in its entirety is the Word of God written, and therefore inerrant in the autographs." We have chosen to meet at the same time as the ETS for mutual dialogue and enrichment. The next annual meeting will be December 26-28, 1977 in San Francisco. Dr. Gordon Lewis, Conservative Baptist Seminary, Denver, Colorado, is the program chairman. Anyone desiring to read a paper should send an abstract to him by September, 1977.

Membership in the Evangelical Philosophical Society (EPS) is open to teachers and other professional people involved in the above stated areas and who have at last an accredited Masters in one of the areas or the equivalent in scholarly production. Associate and Student membership are open to those not meeting the above qualifications. Some of our hopes include a scholarly journal, monographs and books and an employment clearing house for teachers.

*Those desiring membership may write for an application form to: Jay Grimstead, 2011 Fallen Leaf Lane, Los Altos, Ca. 94022.*

# Evolution: A Personal Dilemma



D. GARETH JONES

Department of Anatomy and Human Biology

University of Western Australia  
Nedlands, W.A. 6009  
Australia

Remarkably little appears to have taken place over the past 10 years or so in Christian thinking on evolution. The same camps are still there, their front lines looking remarkably like those of a decade ago. Much the same propaganda is put out by the respective combatants, and the lines of battle look as solid and stagnant as they have done in recent memory.

Whether or not we appreciate the battlefield allusion, we cannot easily deny the underlying reality of warfare. It can be argued of course that, while evangelicals do disagree over the mechanisms and scope of evolution, they are basically agreed over the reality and omnipotence of the Creator-God and over the fundamental importance of creation as a major theological truth. This undoubtedly is the case, even if the statement as it stands is unduly simplistic. In spite of this however, the creation-evolution controversy remains a deep-rooted cause of division among evangelicals.

This article, as its title suggests, is a personal view of the debate. It is not intended to be an academic exposition either of biblical or scientific issues. It is simply an expression of the feelings of one person who, by virtue of his standing as a human biologist and Christian, finds himself constantly surrounded by evolutionary thinking and also more specifically by evolutionary humanistic thinking. For me therefore, the evolutionary debate cannot be shelved as of merely theoretical interest. Neither can I adopt an intellectual position which does not make sense for me as a human being. And neither can I content myself with a belief which is of little relevance in solving contemporary ethical and social issues.

The end result is that I find myself on the horns of a dilemma. I have no easy answers one way or the other. But I do not despair. Perhaps there are others in a similar position to myself, dissatisfied with the usual evangelical answers and looking for a new way out of the dilemma—whatever that might be.

## The Controversy

The majority opinion among some sectors of the evangelical community still seems to be that the choice between creation and evolution is an "either-or" one.

*Either creation or evolution.* Such an option precludes compromise of any kind. Indeed compromise is regarded in its perjorative sense, in that to compromise on this issue implies a denial of certain basic biblical truths.

One of the major reasons for this attitude, it seems to me, is that emotional and philosophical considerations have been allowed to hold sway at the expense of theological and scientific principles. On the one hand this means that for many scientists (generally those who are humanists anyway) the theory of evolution has been transformed into the dogma of evolutionism. This provides them with what to them is a satisfying philosophical and humanistic alternative to the doctrine of special creation. Evolutionism contains within itself the potential for explaining the whole of the cosmos in strictly natural terms, with the result that the need for a god or for any supernatural agency apparently disappears. There are many variations of evolutionism, some of which have religious ideas built into them. In its extreme form however, it is distinctly atheistic and, for many people, serves as a god-substitute. It is hardly surprising that evangelicals with a high view of Scripture vehemently oppose evolution in this guise. It is just as well to remember though that evolutionism is a philosophical extension (some would say travesty) of the more scientific evolutionary theories.

At the other extreme we meet those Christians for whom the literal interpretation of the early chapters of Genesis, in the context of a static world-view, almost completely rules out the possibility of change in living forms. Such a position cannot, by its very nature, be influenced by the findings of science and in particular of the so-called historical sciences such as geology and palaeontology. Consistency demands that these sciences be reinterpreted, with biblical data (generally the Noachic flood) and catastrophic concepts as the starting point, as opposed to contemporary scientific concepts with their dependence upon uniformitarianism and immense periods of time. Almost invariably, the advocates of this type of position are strongly anti-evolutionary, viewing it in essence as

specifically anti-Christian, with creationism the only valid Christian alternative to evolution. This position additionally leads to a Christian vs science stance, with science conveying overtones of atheism.

It is not my intention to argue the pros and cons of either extreme position here, except to remark that both are agreed on one point. Both view evolution as a philosophical system. To the one, it affirms the freedom of nature and autonomy of man; to the other, it is a denial of God as God. Unfortunately, advocates of both points are frequently guilty of failing to define the way in which they are using the term "evolution", with the result that no distinction is made between its scientific and philosophical connotations. To fail to distinguish between observation and hypothesis in scientific thinking, or between limited and broad generalizations in science is simply misleading, especially when the end result is presented as an incontrovertible law with universal applicability. On the other side, it is not unduly helpful to ignore the legitimate scientific aspects of evolution because these do not fit neatly into a particular interpretation of the early chapters of Genesis.

Many of the controversies within the creation-evolution realm result from ambiguities over the use of the term "evolution". System-building is a philosophical past-time, and philosophical thinking invariably predominates over scientific thinking when evolutionary issues are in the balance. Unfortunately, this is a general tendency applying to both humanists and Christians. The result, almost invariably, is confusion and much unnecessary controversy.

Probably all of us desire to see life in terms of some vast system, by which any and every aspect of life can be satisfactorily explained. There can be little doubt that an evolutionistic synthesis provides such a framework for many scientifically inclined humanists. The temptation for Christians is to build an alternative system based upon a relatively static view of creation. But is this what Christians should be doing? This, to me, is the crux of the creation-evolution controversy, and yet as far as I can see it is the one issue that is studiously avoided.

### Evolutionary Theory

In order to answer this question, we need to examine very briefly one or two aspects of evolutionary thinking. In its scientific usage, evolution embraces either the *special* theory of evolution or the *general* theory. Of these, the special theory refers to the relatively small changes that can be *observed* to occur in living species of animals and plants with the production of new species. The general theory, by contrast, asserts that all the living forms in the world today have arisen from a single source which itself was derived from a nonliving form. Simplistic as is this distinction, it draws our attention to two important points. The special theory is a strictly experimental discipline, with the result that its scope is limited and its generalizations few. The general theory however, is a far more speculative affair, making vast assumptions and suggesting far-reaching hypotheses. The one is science in its narrow, disciplined sense; the other is science in its broad, predictive sense. The one is capable of rigorous scientific testing; the other is not and never

will be.

The dividing line between the general theory of evolution and philosophical evolutionism is a fine one. Moreover it may on many occasions be difficult to determine, while on others it may be blatantly ignored. I want to suggest that the principal distinction between them lies in the reliance which is placed on the assumptions and speculations. In the scientific arena the speculations are regarded quite openly as speculations. They have a purpose in holding together a scientific idea long enough for it to be tested in some way. Subsequently they are discarded if found wanting, or modified and strengthened if proved useful. In the philosophical arena speculations are readily transformed into essential concepts. Their speculative nature is soon forgotten and they emerge as indispensable principles.

---

*The Christian is free to view the scientific validity and usefulness of evolutionary theories in an objective manner, and is therefore able to retain the distinction between the scientific and philosophical aspects of evolution.*

---

The reliance we place, therefore, upon the assumptions and speculations of the general theory of evolution depends on our philosophical presuppositions. For the humanist they are essential if he is to possess a coherent and unified picture of the world. Hence evolutionary theory undergoes a mutation to become evolutionism. However, a Christian with a biblically-orientated view of the world is free to accept or reject such assumptions. The Christian possesses a degree of freedom unknown to the humanist who, as we have seen, is driven by his philosophical premises towards an evolutionistic position. The Christian is free to take a far more objective view of the scientific evidence. This indeed is a precious liberty in such a difficult area, and it behooves him to value this freedom highly and to use it aright.

A Christian today is in a position where he can accept or reject the current assumptions underlying scientific theories of evolution. There is one proviso however, and this is that as long as he is thinking scientifically his sole criteria must be scientific ones. The possibility of rejection of evolutionary ideas is open to him, as it should be to all scientists. Nevertheless, in scientific terms, the rejection of one hypothesis follows from its inadequacy to account for available evidence and, in turn, leads to the emergence of a more satisfactory hypothesis. Both old and new hypotheses are subject to the same scientific principles of experimental testing. The controlling principle is the scientific evidence. From this it follows that evolutionary theories cannot be regarded as permanent or impregnable, that is, as long as they are viewed scientifically. Such a statement does not allow us to jump to the opposite conclusion either, that their demise is imminent. The Christian is free to view their scientific validity and usefulness in an objective man-

ner, and is therefore able to retain the distinction between the scientific and philosophical aspects of evolution. It can also be argued that, if these aspects of evolution are distinguished, the detailed mechanism of evolution will be of no concern to the Christian as a Christian.

### Alternatives to Evolutionary Theory

If these points are accepted, they will have a number of consequences for the Christian. As a start he will strive hard to view evolution in precise terms, so that he will see clearly where alternatives are required and the nature of such alternatives. For instance, in rejecting the anti-Christian stance of evolutionary humanists, he will be in a position to decide which emphases are of a religious nature and which are scientific in character.

The importance of this distinction cannot be over-emphasized, because while it is honouring to God to reject a false religious position it is far from honouring to Him to reject experimental findings in the name of Christ. Linked with this is the nature of the suggested alternatives to evolution. Simply because it is felt that evolutionism with its humanistic presuppositions must be replaced with a God-centered view of the created universe, it does not follow that evolutionary theory must be replaced with catastrophic creationism. The former is essentially a religious-philosophical issue; the latter should be a scientific one. In practice however, both are frequently treated as religious-philosophical issues, thereby confusing categories and blurring the true challenges to Christian thinking.

The confusion of categories which may arise can be illustrated by asking what are the biblical alternatives to evolution. In the eyes of the biblical writers this world is dominated by God, not by an evolutionary process nor by autonomous man nor by an emerging Christ-like consciousness. God created, God sustains and God directs. From this it follows that in the religious-philosophical sphere God is the Christian's alternative to evolution—the two are mutually exclusive. It behooves Christians therefore, to think far more constructively about the cosmic role of Christ in the universe—a realm traditionally left to liberal theologians.

---

*At the scientific level, I must call myself an evolutionist . . . at the religious-philosophical level I am more than happy to call myself a creationist.*

---

Far more controversial perhaps are the possibility and nature of alternatives to evolution at the mechanistic-scientific level. From what I have already said, Christians should not feel any need to find "Christian" alternatives, although as I have also said, Christians (and others) should not be complacent about the alleged adequacy of currently accepted evolutionary ideas.

I do not believe there are alternatives at the mechanistic level which are specifically Christian. This brings me back to the question I raised previously, and which I suggested then was the crux of the creation-evolution

controversy. Should Christians view as their chief task in this controversy the erection of systems of thought designed to combat evolutionary thinking at the level of mechanism? My view is that, in striving to provide such systems, they are misguided. I have a number of reasons for saying this. In the first place, whatever the biblical writers do or do not tell us about the mechanisms of creation, it is in the form of very general principles. Second, even if we today are able to discern the direction in which these principles are pointing, the task of applying them at a detailed level and in terms of current scientific concepts will involve an enormous amount of speculation. This in turn must inevitably be dependent upon a whole host of extra-biblical principles and data. Third, any system based upon general "biblical" principles, however valid it may be in theological terms, cannot by its very nature be experimental and hence cannot be scientific in this sense. This is because the principles, if they are truly biblical ones, are immutable. They are not dependent upon experimental evidence for their validity, and they are not subject to the testing-retesting, proof-disproof approach of scientific experimentation.

### A Personal Dilemma

If I reject the creationist systems put forward as alternatives to evolutionary systems, where do I stand? To answer this question I find it necessary to resort to the distinction I have already made between scientific and philosophical views of evolution. At the scientific level I must call myself an evolutionist, not because I particularly like this designation nor because I view evolutionary ideas as unchangeable. Rather, I can find no better explanation at present for the bulk of the available evidence on the development and relationships of living forms. At the religious-philosophical level I am more than happy to call myself a creationist, believing implicitly in the biblical data on the sovereign work of God in creation.

A number of objections will immediately be raised to this position. It can be argued that I am compartmentalizing my thinking, holding as I do two beliefs which some consider to be incompatible. To an extent of course I am compartmentalizing my thinking, but only because the nature of the issues is such that their integration into a single system of thought is not readily possible. This is one aspect of my personal dilemma. No one wants to live with tension, and yet tension may be inevitable in this area. No one wants to live with unresolved questions, and yet there may well be questions in this area incapable of resolution at present.

My position is an open ended one and hence unsatisfactory in the eyes of many. Note however, that its open endedness is essentially on the scientific issues where, in my opinion as a scientist, open endedness is mandatory. Even very general scientific principles are subject to revision and, occasionally, rejection. Whether or not this ever happens with evolution I am in no position to judge, but I must keep my options open particularly regarding some of its more detailed mechanisms. How open ended are creationist views? The biblical data are not open ended, biblical interpretation on Genesis 1-11 is somewhat more so, while creationist schemes are very much more so. Even on the religious side then, the matter is not as black and

white as some would have us believe. Nevertheless, open endedness is not always easy to accommodate in one's thinking, and it constitutes another segment of my personal dilemma.

It will be asserted by some that I am unfaithful to biblical revelation and that my view of the Scriptures is not as high as it should be. In other words, it may be argued that I am not thinking in a truly evangelical fashion. This I would resolutely deny. All I am saying is that the Bible does not speak in an experimental scientific manner. It cannot, because it is God's revelation to man and not man's attempt to unfathom the riches of God's world by a strict system of experimentation. Man needs both these, man uses both these, and God ordained that both should be exploited to the full. This principle is not abrogated in the creation-evolution area, simply because misunderstandings and genuine difficulties abound in it. This is a part of my personal dilemma too, because the body of Christ is being torn asunder by claims and counter-claims about fidelity to God's word.

Then there is a final twist to this controversy which puts my personal dilemma in a nutshell. As I look at man from the perspective of both a human biologist and a Christian, how do I see him? When confronted by the numerous problems facing man today, what principles do I resort to in an attempt to solve them? Do I find help in evolutionary concepts, or not? According to some evolutionary humanists, the principles uncovered in studying evolutionary trends should point the way forward for modern man.

It is at precisely this juncture that the limitations of evolutionary thinking become all too obvious. I (and many others) cannot find in man's evolutionary past the principles which will help unravel the complexities of the ethical decisions facing us today. In this regard evolution as a value generating system is bankrupt. We have to look elsewhere for help, and for the Christian of course this is to the Bible. In terms of what I have said previously, we should not

expect to obtain value judgments from evolution. And we do not when it is presented as a scientific theory. The only value judgments ever present in evolution are those injected into it from outside, and whenever that occurs we are dealing with some form of evolutionism.

If this is the case, evolutionary theory may have far less relevance for our understanding of man, even in a biological sense, than is generally supposed. We need to ask, for example, whether the evolutionary description of the human brain provides us with much meaningful information about the way in which human beings behave today. Is it, perhaps, more profitable to study the modern brain than the sequence of primate brains which may have preceded the modern one? I will not attempt to answer this question here, as it raises very many intriguing issues. It is, nonetheless, a question to be treated seriously.

Then again, there is the highly subjective issue of my reaction to the time-span of an evolutionary past. Without touching on the validity or otherwise of these time-scales, the meaningfulness of them for life now is debatable. To me, they are no more than of abstract academic interest; they have nothing of the impact of the dynamic of biblical history. Perhaps there is no reason why they should. Nevertheless, their remoteness perplexes me, and I am left wondering about their meaning.

It should be obvious by now that, while I have no ready solutions to the creation-evolution controversy, I am more at home with creation. This is part and parcel of my world-view. Unfortunately it is not part and parcel of the scientific heritage to which I also belong, and I cannot dismiss this heritage and remain true to myself or to that view of God's world which it gives me. I feel something of a stranger in two quite different worlds, two worlds of which I—as one of God's creatures—am very much a part. It is this sense of alienation which is at the heart of my personal dilemma.

---

## A Biochemical View of Life



JERRY D. ALBERT

Mercy Hospital Medical Research Facility

San Diego, CA 92103

### BIOCHEMICAL EVIDENCE OF EVOLUTION

#### Unity and Continuity in the Molecular Logic of Living Matter

A biochemist attempts to understand the origin, development, and functions of biological life by study-

ing the nature and functions of the molecules found in living matter (biomolecules), the physical and chemical principles governing the behavior of inanimate matter, and axioms in the molecular logic of the living state. These latter axioms are a unique set of ground rules that govern the nature, functions, and interactions of the biomolecules and endow them with

the capacity for self-organization, self-regulation, and self-replication.

Very simple, low molecular weight precursors obtained from the environment (carbon dioxide, water, nitrogen) are converted via sequences of metabolic intermediates of increasing molecular size into the biomolecules (amino acids, nucleotides, sugars, glycerol and fatty acids). "The sizes, shapes, and surface characteristics of these biomolecules are exceedingly important in the specificity of their biological interactions and also in their role as building blocks in the structural elements of cells."<sup>1</sup> The biomolecules are ordered into a hierarchy of increasing complexity. These building blocks of the same type are linked together to each other covalently to form the macromolecules of the cell: proteins, nucleic acids, polysaccharides, and lipids, respectively. The cell macromolecules are non-covalently associated into supra-molecular assemblies, and these, in turn, into cell organelles (mitochondria, chloroplasts, Golgi complexes, etc.), the structural components of living cells. Unity is expressed in the general cellular (organelles, nucleus, membranes, ribosomes) and chemical (proteins, nucleic acids, lipids, carbohydrates, coenzymes, minerals, oxygen, water) composition of all life. The major types of macromolecules have identical functions in all species of cells and are distributed in about the same proportions in all cells.

Recent studies of the chemical composition of the simplest cells suggest that the first cells to have arisen on earth may have been built from only 25-30 different biomolecules. "It appears likely that these primordial biomolecules were particularly suited to be the components of living matter, not only because of their intrinsic structures and properties, but also because feasible chemical pathways existed for their enzymatic interconversion" through consecutive reactions having common intermediates.<sup>1</sup> These primordial biomolecules may be regarded as the ancestors of all other biomolecules. New biomolecules of greater complexity and variety evolved as living organisms evolved into more highly differentiated and complex forms. Nearly all of the 150 different biologically occurring amino acids are derived from the 20 common amino acid building blocks of proteins. The dozens of different nucleotides known are all descendants of the five major nitrogenous bases found in nucleic acids. "Over 70 simple sugars derive from glucose, and from these a large variety of polysaccharides are formed in different organisms. There are many different fatty acids, which are all descended from palmitic acid."<sup>1</sup> Recent research on the biogenesis of many of the extremely complex and specialized biomolecules (pigments, waxes, essential oils, alkaloids, antibiotics) "shows that they can be classed into a few different types, all of which are ultimately derived from the primordial biomolecules or their breakdown products."<sup>1</sup>

All living things synthesize, utilize, and store the same high energy compound, adenosine triphosphate (ATP), to drive biochemical reactions required for synthesis (repair, growth, and development or reproduction), motion (muscle contraction), and active transport of substances across membranes into cells. In general, all life shares common metabolic pathways, common enzyme and coenzyme catalysts for biochemical reactions, common nucleic acid replicating mech-

*Twenty amino acids and eight mononucleotides are identical in all species and each serves multi-functions. This underlying simplicity in molecular organization of cells implies common ancestry of life.*

---

anisms for storage and transmission of information and hereditary characteristics, common protein synthesizing mechanisms leading to species-specific phenotypic characteristics, common mechanisms for regulation of synthesis. Complex organisms share internal communication routes via hormones; compatible use of the same hormones is made by different, though related species. All animals with nerve transmission utilize acetylcholine and cholinesterases. Strong evolutionary relationships exist between the blood group proteins of humans and other primates.

All life depends on photosynthesis, directly or indirectly capturing energy from the sun via complex biochemical reactions leading to carbohydrates. Life depends on oxidative phosphorylation, another series of biochemical reactions, for building new life and providing energy for life's processes. A biochemist sees an interrelatedness and interdependence in all life. Although living forms have obvious morphological or phenotypic differences, molecular similarities abound at the subcellular level. Small chemical changes in proteins make radical changes in biological adaptation possible. The similarities in structures of homologous macromolecules having the same functions in widely divergent species is a unifying feature of life.

Since the proteins of all living forms today possess amino acids having one of two possible asymmetric configurations, the derivation of all organisms from one cell or a closely related population of cells is suggested. Biological stereospecificity is also possessed by polynucleotides. Continuity is implied in the development of all life from simple origins to complex structures. In reproduction and differentiation or development to maturity all multicellular organisms originate from single, simpler cells.

Evolutionary aspects are linked to the origin or biosynthesis of natural products, e.g., alkaloids in early evolutionary pathways (polyacetates derived from relatively simple enzymic pathways) are simpler in chemical structures than alkaloids produced from later evolutionary pathways (shikimate in complex enzymic pathways). Continuity of life is also implied in the underlying principle of molecular economy. Twenty amino acids and eight mononucleotides are identical in all species and each serves multi-functions. These facts suggest selection during the course of chemical evolution for the capacity to serve several functions. This underlying simplicity in molecular organization of cells implies common ancestry of life.

*"A living cell is a self-assembling, self-adjusting, self-perpetuating, isothermal open system consisting of many consecutive, linked organic reactions promoted by organic catalysts produced by the cell operating on the principle of maximum economy of parts and processes."<sup>1</sup>*

## Energy Transformations in Living Cells and Self-Regulation of Cell Reactions

"The living cell is an isothermal chemical engine," containing catalysts (enzymes) capable of greatly enhancing the rates of specific chemical reactions. The high degree of specificity of enzymes results from operation of the *principle of structural complementarity*. The active site of an enzyme fits its substrate with a near-perfect complementarity. Enzyme-catalyzed reactions are linked into many different sequences of consecutive reactions having common intermediates. The formation or breakdown of ATP, the major carrier of chemical energy in the cells of all living species, is the connecting link between the two large networks of enzyme-catalyzed reactions—metabolism and biosynthesis. "These consecutively linked networks of enzyme-catalyzed reactions are essentially identical in all living species."<sup>1</sup>

"The linking of enzyme-catalyzed reactions into sequences of consecutive reactions makes possible the orderly channelling of the thousands of chemical reactions taking place in cells (simultaneously from simple precursors), so that all the specific biomolecules required in cell structure and function are produced in appropriate amounts and rates (very rapidly) to maintain the normal steady state," characteristic of the living, functioning cell. "*The rate of a specific reaction of one portion of the complex network of enzymatic reactions in the cell can be controlled or modulated by the rates of reactions in another part of the network.*" Certain enzymes, "particularly those at the beginning of reaction sequences or at branch points, function as regulatory enzymes; they are inhibited by the end product of that reaction sequence. Living cells possess the power to regulate the synthesis of their own catalysts. They can turn off the synthesis of the enzymes required to make a given product from its precursors whenever that product is available, ready-made, from the environment. Such self-regulating and self-adjusting properties are fundamental in the maintenance of the steady state of the living cell and are essential to its energy-transforming efficiency."<sup>1</sup>

"*Living organisms create and maintain their essential orderliness at the expense of the environment, which they cause to become more disordered and random.* The cell is a nonequilibrium open system (steady state), a machine for extracting free energy from the environment, which it causes to increase in entropy. Another reflection of the principle of maximum economy is that living cells are highly efficient in handling energy and matter."<sup>1</sup>

## Self-Replication and Adaptation of Living Organisms

The genetic information is compressed into the nucleus of cells, in the nucleotide sequence of a very small amount of deoxyribonucleic acid (DNA). "The one-dimensional information of DNA is translated into the three-dimensional information inherent in the macromolecular and supramolecular components of living organisms by translation of DNA structure into protein structure."<sup>1</sup> The common genetic code (trinucleotide=amino acid) for all life puts the mechanism for evolution on a chemical basis. The events that take place in DNA molecules to give rise to molecular evo-

lution are of three general types: (1) duplication of DNA double strands, as gene duplication followed by a functional differentiation, via mechanisms of crossing-over or recombination; (2) shortening or deletions of portions of DNA strands; (3) point mutations or replacements of one base pair in DNA.<sup>2</sup> DNA changes are then translated into changed proteins by means of the common messenger-ribonucleic acid, ribosomal-ribonucleic acid, amino acid-transfer-ribonucleic acid mechanisms. These changed proteins, especially if they are enzymes, are often capable of changing some properties of the cell and lead to phenotypic changes in the organism.<sup>3</sup> "It now appears certain that, even in the intact cell, the DNA molecule may break frequently. Usually it is quickly repaired, but such errors or mutations are not always deleterious and may possess advantages in enabling organisms to better adapt to their environment."<sup>1</sup>

Adaptation of living organisms to their changing environment enables conditions inside the cells to alter in response to the external pressures. Adaptation is a result of biomacromolecules changing to enable organisms to survive in a changed environment. Although these molecular events may be statistically random the net result is not, since the environmental pressure is the final determinant in the expression of new or changed DNA (genes) as evolutionary changes. Perpetuation or disappearance of the phenotypic consequences of these DNA changes is decided by classical natural selection.<sup>2</sup> The remainder of the evolutionary process is concerned with various complexities arising from morphological, ecological, and other results of translation of the molecular changes among populations of organisms.

## Biological Fitness of Organic Compounds

"Carbon, hydrogen, and nitrogen are far more abundant in living matter than in the earth's crust. We may therefore presume that compounds of these elements possess unique molecular fitness for the processes that collectively constitute the living state."<sup>1</sup> The four most abundant elements making up about 99% of the mass of most living cells (carbon, hydrogen, nitrogen, oxygen) readily form covalent bonds by electron-pair sharing, readily react with each other to fill their outer electron shells, and are the lightest elements capable of forming covalent bonds. "Since the strength of a covalent bond is inversely related to the atomic weights of the bonded atoms, it appears that living organisms have selected those elements capable of forming the strongest (and most stable) covalent bonds."<sup>1</sup> Carbon is unique as an element, because no other chemical element can form stable molecules of such widely different sizes and shapes, nor with such a variety of functional groups with oxygen, nitrogen, and sulfur. "We may therefore conclude that organic carbon compounds must be especially well suited for the purposes of living organisms, since they were selected despite the relative sparseness of carbon in the earth's crust and despite the fact that energy must be expended to reduce organic carbon."<sup>1</sup>

"Current evidence supports the concept that the biomolecules we know today were selected from a much larger number of available compounds because of their special fitness, which gave cells containing them superior survival value." "Since several hundred

organic compounds have been isolated during experiments on the abiotic origin of organic molecules" . . . and only some 25 or 30 "different compounds may have been required to form the first cells, it appears very likely that a process of selection took place." "Presumably the biomolecules are the simplest, most versatile, and most fit molecules for their multiple functions in cells."<sup>1</sup>

## PREBIOTIC SYNTHESIS OF BIOMOLECULES AND CELL STRUCTURES

### Chemical Origin of Biomolecules

"Recent research suggests that early in the history of the earth, conditions favored the existence of many different organic compounds in relatively high concentration in the surface waters of the ocean and that the first living cells arose in this warm soup of organic compounds."<sup>1</sup> Hypotheses stimulated experiments on the prebiotic origin of biomolecules, and experimental demonstrations have verified these hypotheses. Much progress has been made in the brief 20-year period of this young science.

Most of the chemical reactions from which life is thought to have begun could not have taken place in the present oxidizing atmosphere. The biological systems that emerged both contributed to and adapted to the oxidation of the atmosphere. "That the gaseous components (methane, carbon dioxide, carbon monoxide, hydrogen, nitrogen, ammonia) thought to be present in the primitive atmosphere can be precursors of organic compounds is now well supported by laboratory studies."<sup>1</sup> Plausible prebiotic conditions have yielded several hundred different organic compounds, including representatives of all the important types of biomolecules (all the common amino acids present in proteins, the five nitrogenous bases of nucleic acids, and many biologically occurring organic acids and sugars). "In view of these results, it now appears quite plausible that these may have included many or all of the basic building-block molecules we recognize in living cells today."<sup>1</sup> Most of them originated in the primitive atmosphere and oceans as the energy of sunlight, heat of volcanic action, and lightning acted on the chemicals of the reducing atmosphere.

A principle of organization of prebiotic, as well as living, systems: *Flow of energy through a system of coupled chemical reactions leads to a greater degree of organization of the system.* A more highly organized system can utilize further radiation energy more efficiently by breaking up the energy into manageable "packets."

Mechanisms for protecting biomolecules, macromolecules, and prebiotic and primitive living systems from radiation destruction have been hypothesized and can be readily visualized. Thirty feet of water absorbs all solar ultraviolet radiation. This means that thirty feet of water can protect prebiotic biomolecules from destruction by ultraviolet radiation. After formation by radiation in the atmosphere or surface waters enough prebiotic biomolecules can be carried by convection currents to safety below this 30-foot depth where survivors could concentrate. Primitive life forms, too, could have survived under 30 feet of water until

*The scientific theories of evolution are not inconsistent with the biblical doctrine of creation, because they are on different levels and have different purposes.*

the ozone layer formed to shield the earth from high intensity radiation.

Closer to the water's surface local environments where preservation of prebiotic systems is favorable are provided by rocks, watery caves, and other geologic structures which shield out the solar radiation. After formation by radiation, tides and currents can carry the biomolecules to these shielded "islands" of safety which abound on the shorelines of bodies of water.

### Macromolecular Prebiotic Synthesis

The connection or polymerization of these biomolecules into the macromolecules of life requires higher concentrations which could easily have been achieved through evaporation or partial freezing. The linkage of primordial building-block molecules can take place by condensing reactions driven by anhydrous conditions or by the chemical condensing agents formed prebiotically. Even though polypeptide and polynucleotide chains could well have been formed prebiotically, specific sequences of monomers in such chains must be recorded and replicated during the molecular evolution. Polymerization to nucleic acids is hypothesized in one scheme to begin with adsorption of nucleotides onto mineral crystals and then bonding together, with condensing agents, while held together as neighbors. Recording of the nucleotide sequence, and likewise the amino acid sequence, resides in the base-pairing principle inherent in the DNA double helix. There is specificity in the complexing of certain nucleic acid bases with others and with certain amino acids. Experiments have shown that polynucleotides serve as templates for nonenzymatic synthesis of complementary polynucleotides under prebiotic conditions with water-soluble condensing agents.

Orgel's "natural selection with function" is the critical stage (the transition from chemical to biological systems) of interaction of proteins and nucleic acids with one another and with their environment, forming larger systems of molecules, the precursors of the first cells. The central problem is to show how proteins and nucleic acids first began to work together, for neither could sustain a living system by itself. The nucleic acids can replicate, but they would not have been effective in acting on the environment; the proteins can act on the environment but could not replicate in individual units accurately. In living systems the two work together: the nucleic acids code for the production of proteins, and proteins act or feed on the environment and to assist in the replication of more nucleic acids.

### Nucleic Acid Hypothesis

In order to explain "how complex energy conversion mechanisms and genetic systems arose in the absence

of such systems, when there is a general natural tendency to go from order to disorder,"<sup>4</sup> a plausible hypothesis has been needed. The most plausible is the nucleic acid hypothesis of Crick and Orgel, which postulates that a nucleic acid molecule possesses the potential capacity to "live" by virtue of its ability to code for proteins, to undergo self-replication and mutation. Supporting thought and evidence include: (1) The molecular structure and self-replicability of viruses, which contain nucleic acids carrying their genetic information since these nucleic acids alone are infective. The range of size and complexity of viruses up to very small infectious bacteria (parasitic procaryotes) indicate a vague difference between the largest viruses and the smallest bacteria. (2) The role of non-informational RNA in protein synthesis. (3) The wide range of biological functions of nucleotides in cells document the striking versatility of nucleotides. Monomeric units of DNA and of the three major types of RNA, energy carriers, hydrogen or electron carriers, sugar carriers, lipid component carriers, and methionine carriers are roles of nucleotides as functional elements in all aspects of metabolism and energy transfer, as well as in the genetic apparatus. "These metabolic and structural relationships suggest very strongly that much of the important metabolic and genetic machinery of the cell could have evolved or developed from nucleotides."<sup>1</sup>

"In simulated primitive earth experiments it has been found that polynucleotides can act as complementary templates in the absence of enzymes, through base pairing." The most primitive nucleic acids could have replicated themselves in the absence of enzymes, by the action of abiotically formed condensing agents." Similarly, the most primitive form of the present-day ATP-system for energy transfer could have functioned without enzymes . . . possibly through the action of primitive mineral or organic catalysts."<sup>1</sup>

Crick and Orgel have suggested that the real answers to the origin of life may lie in the origin of ribosomes, of transfer RNA, and of the genetic code. Non-informational nucleic acids, transfer RNA and ribosomal RNA, do not serve template function, but both are involved in translating the DNA genetic code into the synthesis of proteins. These two forms of RNA are suggested to be the vital parts of a primordial system which learned how to make true informational proteins, not merely random polymers of amino acids. The primitive forms of transfer and ribosomal RNA may have performed one of the important functions of an enzyme, namely, the provision of specific binding sites to position the loosely bound amino acid substrates in such a way as to allow them to interact in the presence of a nonenzymatic condensing agent. In developing the first template for specifying the sequence of t-RNA's and thus of the amino acids they carry, perhaps one of the many different prebiotically formed polyribonucleotides in the primeval broth coded for the sequence of some polypeptide that endowed the ribosomal apparatus with enhanced stability or activity, which became the precursor of present-day ribosomal proteins. "Perhaps others coded for the synthesis of a polypeptide that stabilized and provided a sheath for the first messenger RNA, and thus became the forerunner of a viral coat protein." "Later the primitive ribosomes may have learned to

synthesize an enzyme."<sup>1</sup>

In support of this idea, the direct precursors of the 2'-deoxyribonucleotide building blocks of DNA are the corresponding ribonucleotides. "Ultimately, the most compelling and probably over-riding features of the nucleic acid hypothesis, whatever its details, is that nucleic acids do have the capacity to serve as templates in the absence of enzymes or proteins, in such a way that a complementary nucleic acid can be formed by an abiotic catalyst or condensing agent. Moreover, through the tendency of nucleic acids to undergo mutation, the capacity of a nucleic acid-based life to undergo refined and subtle evolutionary modulations becomes greatly enhanced."<sup>1</sup>

### Origin of Enzymes and Cell Structures

"In the evolution of enzymes from simple precursors, it seems highly probable that catalytic capacity appeared first and that substrate specificity followed as a later evolutionary development." Cell "boundaries or membranes may be formed by coacervation of a polymer solution or by formation of lipid bilayers."<sup>1</sup> Such boundaries lend protection to biomacromolecules from environmental destruction. Self-forming, cell-like structures have been observed in the forms of coacervate droplets and microspheres of proteinoids. "Once a template system, a set of catalysts, and a surrounding membrane evolved, in whatever sequence, the process of cellular evolution becomes much easier to comprehend."<sup>1</sup>

"Living organisms may be the inevitable outcome of the evolution of self-organizing systems of organic molecules." "The laws of chemistry and physics we know today do not forbid the process of self-organization; they simply provide no explanation for it." These hypotheses "may well be experimentally approachable, since with the advantage of modern knowledge of the properties of organic molecules and of biochemistry, molecular science may be able to accelerate greatly the chemical processes leading to, or involved in, the tendency of organic molecules to undergo self-organization." "Life may therefore arise under any physical conditions in which organic compounds may undergo the full range of their potential evolution."<sup>1</sup>

### Related Evidence

The remaining physical evidence, in the form of astronomical, geological or paleontological (remains), is quite fragmentary, and clearly the experiment cannot be run again on its original scale. Chemicals thought to be key precursors in the prebiotic soup have been identified in outer space. Most of the common building-block biomolecules—amino acids, purines, pyrimidines, fatty acids—have been repeatedly found in ancient rocks and sediments, and in meteorites. The oldest known organic material dated by isotope methods to be 3.1 billion years is in the Fig Tree shale deposits in South Africa, which contain hydrocarbons, including isoprenoids, porphyrins, purines, pyrimidines, and cell-like structures, in addition to fossils of blue-green algae. These findings suggest that these biomolecules may be ubiquitous and perhaps even dominant products of energy-activated organic chemical evolution. All of these lend credence to this scientific theory of chemical prebiotic origins of life. There is a clear

parallel with the better-established theory of the evolution of organisms—a parallel first suggested by Darwin himself. The concern is with establishing plausibility, since the historical facts cannot be ascertained.

### A CHRISTIAN BIOCHEMIST LOOKS AT EVOLUTION AND CREATION

Concepts which have enabled me to reconcile the apparent conflict between evolution and creation include: distinguishing the category of worldview from that of scientific theory or mechanism, accepting the Biblical doctrine of creation as worldview and biological evolution as scientific theory, rejecting the mechanistic interpretation of special creationism and the philosophy of evolutionism, applying the doctrine of Providence and the principle of complementarity, adopting theistic evolution and a non-literal interpretation of Genesis, and affirming the Bible's own proclamation of its purposes and Jesus Christ alone as the foundation of my faith.

#### Worldviews and Scientific Mechanisms

The debate about creation and evolution is unfortunately involved in a confusion of categories: worldviews and scientific mechanisms.<sup>5</sup> Both creation and evolution have been described in terms of opposing ways of looking at the world, as well as opposing ways of explaining how living forms originated in the world. It is important that we appreciate the worldviews of Creation and Design as alternatives to Evolution (ism) and Chance, but we must also avoid the opposite extreme of insisting (1) that science somehow demands for us to accept only Evolution and Chance as worldviews and (2) that biblical Christian faith somehow demands for us to accept only fiat creation (spontaneous generation) and determinism, instead of evolutionary process and chance, as scientific mechanisms. One could (many do, including me) accept the creation worldview and evolutionary process as a scientific mechanism at the same time.

#### Creation as a Worldview

The Biblical doctrine of creation is the source of the creation worldview. Holy Scripture reveals to us that<sup>6</sup>:

(1) The God Who loves us is also the God Who created us and all things—which establishes the relationship between the God of our faith and the God of physical reality. Our Creator and Redeemer are One and the same God. (Jn. 1:1-3, I Cor. 8:6, Col. 1:16-17, Heb. 1:2, 11:3, Ps. 136:5-9, 146:5-6, Is. 40:28-31, 43:1-2,5-7, 44:24)

(2) We can trust in the reality of a physical and moral structure to the universe, which we can explore as scientists and experience as persons. God creates life with physical matter and through natural processes. (Gen. 1:12, 20, 24, 2:7, 9)

(3) The universe and everything in it depends moment-by-moment upon the sustaining power and activity of God. (Heb. 1:3, Ps. 95:4-5, 104:2-30, 147:8-9, Rev. 4:11, Job 34:14-15)

(4) God created the universe freely and separately, with a beginning and with a temporal existence which He alone gives it. (Gen. 1:1, Heb. 1:3, 11:3, Ps. 90:2-6)

*Theistic evolution is consistent with my science and my Christian faith, and I believe it is also consistent with the best exegesis of Genesis 1 and 2.*

(5) We are not the end-products of meaningless processes in an impersonal universe, but persons made in the image of a personal God. (Gen. 1:26-28, 5:1, Ps. 139:13, Is. 40:28-31, 43:1-2, 5-7, 44:24)

(6) Everything created is intrinsically good. (Gen. 1:10b, 12b, 18b, 21b, 25b, 31a, 1 Tim. 4:4a) Human corruption of the good creation (disobedience and rebellion against God, Gen. 3:22; inhumane treatment of our fellow human beings, Gen. 4:8; mismanagement and misuse of the earth, Gen. 3:17b-18a) is the manifestation of evil in the world.

Attempts to go beyond the basic theological principles or revealed truths of creation like those listed above are fraught with problems, dangers, and controversies. Such attempts include interpreting the details of Genesis narratives as historical events and explaining these details in scientific terms. These interpretations are unwarranted by exegesis of the text and are inconsistent with the purposes of God's revelation in Scripture, which are "to give us the wisdom that leads to salvation through faith in Christ Jesus, . . . for teaching the truth, rebuking error, correcting faults, giving instruction for right living, . . . so that we may be fully qualified and equipped to do every kind of good work." (TEV, 2 Tim. 3:15-17; see also Jn. 5:39, 20:31, Rom. 15:4)

#### "Special" Creation as Scientific Mechanism in Pre-Darwinian Biology

The biblical doctrine of creation is not the "special" creation described as the scientific mechanism or explanation of pre-Darwinian biology. Before the theory of evolution was accepted as the scientific explanation of how living organisms developed and changed over long periods of time, the explanation of special creation reigned in biology. Every species of life was considered to have been specially or individually created by an instantaneous process of spontaneous generation. This scientific view fitted in well with the literal interpretation of the Genesis accounts which described how (by "fiat" or God's spoken word) and when creation took place (about 6000 years ago and in the total time period of less than one ordinary week). Most Christians readily incorporated this science into their theology and selected that interpretation (literal) of Genesis which could best be reconciled with their current science. One of the few exceptions to this dangerous thinking among Bible scholars included Martin Luther, who wrote:

Until now there has not been anyone in the church who has explained everything in this chapter (Gen. 1) with adequate skill. The commentators, with their sundry, different, and countless questions, have so confused everything in this as to make it clear enough that God has reserved his exalted wisdom and correct understanding of this chapter for Himself alone, although He has left us with this general knowledge that the world had a beginning and that it was created by God out of nothing.

When science accepted Darwin's evidence for the theory of evolution, those who clung to special creationism for providing answers to the "how" and "when" of the origins of life found themselves out on the proverbial sawed-off limb. Their immediate reaction was one of defensive over-reaction, instead of re-evaluation of their literal interpretation. Instead of re-examining the Scriptures for God's message and re-discovering His purposes in creation, the relationships He established, and the basic meanings of those purposes and relationships, special creationists mistakenly considered evolution as scientific mechanism to be a threat to creation as worldview. They should have seen evolution as an alternative scientific mechanism to special creationism.

I believe the message of God in creation is still obscured today by fundamentalist Christians who insist upon their literal-historical interpretation of Genesis 1 and 2 as the only correct view of creation. This rigid attitude also raises a stumbling block for many people educated in the sciences who cannot accept the promotion of special creation as a necessary doctrine of Christian faith. Furthermore, the literalists have not solved a number of critical problems and inconsistencies in their interpretation.<sup>7</sup>

### The Scientific Theories of Evolution

As a biochemist committed to the scientific method and its application to understanding the nature and functions of life, I accept both the special and general theories of evolution as viable scientific explanations of how biological life originated and developed. Evolution may be defined as the description and explanation of how changes in living forms took place over long periods of time. Special evolution is the description and explanation of how changes within populations of closely related organisms took place. Every scientist worth his salt accepts the special theory of evolution, although a few, who are special creationists, refuse to call it "evolution." Their "progressive creation model" incorporates the same evidence and principles of biological change comprising special evolution. Although the evidence is incomplete, I accept general evolution, which links all forms of life to common ancestral origins and beyond to simple chemical compounds on the primitive earth, as a working hypothesis for correlating biological and biochemical data.

The scientific theories of evolution are not inconsistent with the biblical doctrine of creation, because they are on different levels and have different purposes. However, the general theory is contradictory to the special creation model which attempts to explain how and when life originated on the basis of the Genesis accounts. According to one of its proponents<sup>4</sup>, special creation is not even scientific theory, but I think it may be classified as pseudo- or pre-scientific speculation.

### Providence and Complementarity as Keys for Reconciling the Creation Worldview and Scientific Evolution

If the origin of life via general evolution is an inevitable result of the self-organizing, self-replicating nature of organic matter under favorable conditions,

then what does this mechanistic view mean to Christian faith in the Creator based on the biblical message of creation? It removes the unnecessary argument for the existence of God from the design evident in living creatures. How then can Christians reconcile their faith in a Creator with the scientific theories of origins?<sup>9</sup> The continual providence of God and the principle of complementarity in human knowledge are two keys which can help reconcile the creation worldview with scientific evolution<sup>8</sup>.

*The Doctrine of Providence:* "The universe exists moment-by moment only because of the creative and preserving power of God."<sup>8</sup> (Bube's Thesis I) Therefore, the organic matter created by God which has the inherent tendency to self-organize and self-replicate into living systems under favorable conditions does so only because of the creative activity of God. We need to affirm that God is actively involved in sustaining and holding together all things in the universe continually, thus giving existence to all things.

*The Principle of Complementarity:* "There are many levels at which a given situation can be described. An exhaustive description on one level does not preclude meaningful descriptions on other levels."<sup>8</sup> (Bube's Thesis II) For example, human nature can be described on physicochemical, biological, psychological, social, and theological or spiritual levels. The human being can be described as a complex organic machine, a highly developed animal, a social being, a creation of God and a spiritual being. A complete description of human nature on any one of these levels does not rule out or invalidate meaningful descriptions on other levels. To obtain a balanced view of human nature and as complete an understanding as possible it is necessary to accept descriptions on all levels as complementary (additive) to each other. We need to recognize that a given situation or phenomenon can have any number of valid descriptions on different levels which are not contradictory.

The principle of complementarity can be applied to creation and evolution by stating that an exhaustive description of the origin of life on the biochemical level does not rule out meaningful descriptions of origins on the theological or biblical level. I believe that God's revelations to us in His Word and through His world are complementary, not contradictory or mutually exclusive<sup>9</sup>. Any apparent conflict between interpretations of His Word in Holy Scriptures and of science may exist only because the interpretations are faulty or our science is incomplete, or both. I believe that creation is a theological explanation of why life originated and by Whom. I think that evolution is only a scientific explanation of how and when biological life originated and developed. Creation is concerned with purpose and relationship to the Creator; evolution is concerned with mechanisms. Creation and evolution encompass the same phenomena of origins, but are on two separate, completely different and independent levels of understanding, expression, and description. The scientific theories of evolution are not inconsistent with the Biblical doctrine of creation when the principle of complementarity is applied and the doctrine of Providence is accepted in all its ramifications.

### Theistic Evolution and a Non-Literal Interpretation of Genesis

Two more approaches which are helpful in reconciling the apparent conflict between creation and evolution take completely different approaches. Theistic evolution, based on the doctrine of Providence, attributes the evolutionary process to God's actions. As a Christian I believe that God in the beginning made matter and energy which did not exist before. As a Christian and a biochemist I believe God made simple living things from this matter and energy by natural processes in favorable environmental conditions and proceeded to develop more complex living things from the simple forms by the evolutionary process. From anthropoid stock God made human beings with the most highly developed nervous system, thinking powers, and ability to verbally communicate. Our conscious awareness of self, sensitivity to the needs of others, abilities to dominate our environment and to reflect, all given us by God, make us unique creatures on this planet at least. We were created for unique communion with God, to serve Him as His managers of the earth, and to give Him the glory.

I believe God has been at work in the process of evolution as His mechanism of creating life. I withhold value judgments on such a process, which some may view as full of wasted time and energy and of cruel manipulation and experimentation in the "false starts" or "dead ends" (extinctions), because I cannot view history from the perspective of God or know what is in His plan for the universe. All I can hope to know on this level is what His purpose is for me in Jesus Christ.

Theistic evolution is consistent with my science and my Christian faith, and I believe it is also consistent with the best exegesis (biblical scholarship on the text) of Genesis 1 and 2. The theory of evolution from primitive forms is not necessarily opposed to our faith in the nearness of God. One who believes that God has used the process of evolution to bring the world as we know it into existence may just as easily picture God working in him and for him as one who believes that God created everything instantaneously about 6000 years ago. The methods which God uses to make our world what it is today are not as important to our Christian faith as we sometimes make them or as some would have us believe.

A non-literal interpretation of Genesis 1-2 attempts to clarify and emphasize God's message to us in creation. God's involvement in creation and the message of His Word are more clearly understood when the terminology and setting of the creation story are seen as the framework of an ancient worldview<sup>9, 10</sup>. Creation can be viewed as a kind of parable, rich in meaning and purposeful relationships for each person in his life now, instead of an historical account or a dogmatic propositional statement to be believed with intellectual assent and defended with emotional fervor. This is not meant to deny *that* creation has happened and is continuing to take place under God's Providence. But by moving away from a literal interpretation of the creation stories and by emphasizing God's message of creation's meaning and purpose we can gain insights to enrich our Christian lives and relationships. For example, the original sin of rejecting God can then

become more personal, and we can realize greater impetus to accept God's substitute for the "old Adam" within us with the "new Man" (Jesus Christ).

While this approach emphasizes that Genesis 1-2 affirms the relation between God and His world as "symbolic expressions of religious truths which are on a totally different level from evolutionary history," it declares that biblical creation is not concerned with describing historical events.<sup>11</sup> "The doctrine of creation is not fundamentally a hypothesis about origins, but an affirmation of our dependence on God (Who is sovereign, transcendent, freely acting, and purposeful), and of the essential goodness, orderliness, and meaningfulness of the world."<sup>12</sup>

Furthermore, God the Creator is not resting; He is continually creating (Ps. 104:14-30, 139:13, 147:8-18). All life is continually evolving, changing. New stars, comets, and other features of the universe are forming. Nothing in the universe remains stable. But while God continues to create, His love to us remains constant.

### Empty Philosophy of Evolutionism

The scientific theories of evolution are not a threat to my Christian faith, since no scientific theory has anything to say about meaning, purpose, personal relationships, beauty, love, feeling, goodness, evil, and other human emotions and values. However, the philosophy of atheistic evolutionism is contrary to Christian faith, because it progressively exalts man, denies the reality of moral guilt, and interprets the life of Jesus as nothing more than a good example<sup>6</sup>. Christians who are scientists have the task of declaring that an attitude or philosophy based solely on science is empty, meaningless, and a misuse of science. No matter what some non-Christians and some well-meaning Christians say, atheistic evolutionism has no foundation in science and should be exposed as an improper extrapolation of biological evolution into a general principle of human living. It is vitally important to clearly make this distinction between a neutral scientific theory of origins and a philosophical view of life without God which has no support in science.

### The Foundation of My Christian Faith

In his letter to the Romans (8:39) Paul writes that "nothing in all creation will ever be able to separate us from the love of God which is ours through Jesus Christ our Lord." (TEV) My Christian faith is built upon that redeeming, forgiving love of God in Jesus, Who died under the inhumanity and injustice of all humans for all time, but Who also arose from the dead to show God's victory over human death and evil, so that I, and all others who believe in these actions of God for us, may have life more abundantly now and live with our Creator in a personal relationship forever. "For God has already placed Jesus Christ as the one and only foundation, and no other foundation can be laid." (1 Cor. 3:11) This God Who gives meaning to my life has unconditioned power over all creation, so that my trust in Him gives me confidence in the fulfillment of His promises.

### SUMMARY

Evidence for unity and continuity in a biochemical view of life is seen in a universal biochemistry, a

molecular economy of common biomolecules (certain organic carbon compounds), each having multi-functions and linked into a few types of macromolecules, each with common functions in all cells. Development of all life from simple to complex structures implies common ancestry. Biomolecules appear to possess biological fitness and to be ubiquitous wherever conditions for organic chemical evolution have been favorable. They have been identified as energy-activated products of primitive atmospheric constituents under plausible, prebiotic conditions in the laboratory and have been polymerized to macromolecules by condensing agents or anhydrous conditions. Life is nucleic acid-based; a common genetic code provides a chemical mechanism for evolution: molecular adaptation (DNA changes leading to protein changes) in response to a changing environment, and chemical changes in DNA can account for mutations, recombinations, deletions and other molecular evolutionary mechanisms. The base-pairing principle inherent in polynucleotides can direct the synthesis of complementary polynucleotides in the absence of enzymes. Non-informational polynucleotides involved in translating the DNA genetic code into protein synthesis may be the key to understanding how life began in the absence of life.

Life may be the inevitable result of self-organizing systems of organic molecules taking place over many millions of years under favorable environmental conditions. Evolution (as a scientific theory, establishing a model of mechanisms relating all life to common origins) and Biblical creation (as theological explanation of Who created and for what purpose, establishing

relationships for all life to the Creator) are on different levels of understanding, and are therefore, not contradictory, but complementary.

Christians who are scientists should declare that a philosophy based on science (e.g., atheistic evolutionism) is meaningless and a misuse of science. Meaningful life is based on a personal relationship with Jesus Christ, through acceptance of His redeeming, forgiving love.

#### REFERENCES

- 1A. L. Lehninger, *Biochemistry: The Molecular Basis of Cell Structure and Function*, Worth Publishers, Inc., New York (1970) pp. 3-29, 36, 751-791.
- 2G. Ness, *The Molecules of Life*, World University Library, McGraw-Hill Book Co., New York (1970) p. 126.
- 3T. M. Jukes, *Molecules and Evolution*, Columbia University Press, New York (1966)
- 4D. T. Gish, "Creation, Evolution, and Public Education," (copies available from the author at the Institute for Creation Research, El Cajon, CA 92020).
- 5R. H. Bube, "Creation and Evolution in Science Education," *Journal ASA* 25, 70-71 (1973).
- 6R. H. Bube, "We Believe in Creation," *Journal ASA* 23, 121-122 (1971).
- 7M. A. Jeeves, *The Scientific Enterprise & Christian Faith*, Inter-Varsity Press, Downers Grove, IL (1971) pp. 106-107.
- 8R. H. Bube, *The Human Quest*, Word Books, Inc. Waco, TX (1971) pp. 26-35.
- 9A. Van der Ziel, *Genesis and Scientific Inquiry*. T. S. Denison & Co., Inc., Minneapolis, MN (1965).
- 10W. A. Schmeling, *Creation Versus Evolution? Not Really!* Clayton Publishing House, St. Louis, MO. (1976).
- 11I. G. Barbour, *Issues in Science and Religion*, Harper & Row, New York (1971).
- 12L. Gilkey, *Maker of Heaven and Earth; The Christian Doctrine of Creation in the Light of Modern Knowledge*, Doubleday & Co., Inc., Garden City, New York (1959).

By a Molecular Biologist

## A Critical Evaluation of Evolution



PATTLE P. T. PUN

Department of Biology

Wheaton College  
Wheaton, Illinois 60187

### How Much Emphasis Should One Put on Scientific Data?

Ever since the publication of the "Origin of Species" by Charles Darwin in 1859, a storm of controversy has been raging among theologians and scientists. Some proponents of Darwin's theory have elevated it to such an extent that they have established a new paradigm with which human experience is to be re-interpreted. Others have identified the theory of evolution as the work of the devil without any scientific merit and

have committed themselves to fight against the theory as if it is to fight against the devil himself. Richard Bube summarized the controversy in this way: "If the evolutionists usually puts too much emphasis on these (empirical) data, the antievolutionists usually puts too little".<sup>1</sup> The question remains: How much emphasis should one put on the scientific data related to the theory of evolution? This paper attempts to analyze these data, delineate the strengths and weaknesses of the theory of evolution and to present a possible

Christian interpretation to aid in resolving some of the controversy.

### Criteria for Evaluating the Theory of Evolution.

If the theory of evolution is to be established as a close approximation of reality, it is fair that it should be evaluated epistemologically. While there is a wealth of epistemological theories explaining the nature of truth, the following two criteria similar to those enunciated by Arthur Holmes<sup>2</sup> seem to be very useful in approaching this problem.

*Empirical adequacy:* The concept under question should be amenable to empirical verification.

*Rational coherency:* The concept under question should be consistent with other concepts which were arrived at rationally.

We shall attempt to analyze the theory of evolution accordingly.

### Evaluation of the Theory of Evolution.

*The antiquity of evolutionary thought and Darwin's contribution.*

The Darwinian theory of evolutionary change and struggle for existence can be traced all the way back to the Greek philosopher Heraclitus (540-475 B.C.) who is noted for his concept of a continual, universal process of flux, having two sides, generation and decay. He also postulated that individual things endeavor to maintain themselves in permanence against the universal process of destruction and renovation. The immediate precursors of Charles Darwin include George de Buffon (1707-1788 A.D.) who believed in a change in form from one animal type to another. Erasmus Darwin (1731-1802 A.D.), the grandfather of Charles Darwin, first alluded to the term "evolution" to designate the process which involved "the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions and associations and thus possessing the faculty of continuing to improve by its own inherent activity and of delivering these improvements by generation down to its posterity world without end".<sup>3</sup> Darwin's contemporaries, Chevalier de Lamarck (1744-1829 A.D.), E. Geoffrey Saint-Hilaire (1772-1844 A.D.), Herbert Spencer (1820-1903 A.D.), among others, all contributed in one way or the other some form of the theory of evolution. But it was not until 1858 that Charles Darwin (1809-1882 A.D.) and Alfred R. Wallace (1823-1913 A.D.) successfully attracted the attention of the scientific community by presenting their theory to the Linnaean Society. Upon the publication of *The Origin of Species* in 1859, the public was first exposed to Darwin's idea of evolution. Darwin's success in getting across his idea to the scientific community hinges on his conception of "Natural Selection", the survival of the fittest, which provided a mechanism to account for the process of evolution. It is appropriate at this time, then, to examine the evidence which Darwin used in formulating his theory.

*Evidence Darwin used.*

1. Empirical evidence: data collected by observation and experience.

*The abiogenesis of a cell with its highest level of complexity as a self-reproducing unit is extremely improbable.*

- (a) Domestication of plants and animals.

Ever since the dawn of civilization man has been exploiting wild animals and plants by cultivation and domestication. Cultivated plants or domesticated animals have a greater degree of diversity than their counterparts in nature. They have varied due to artificial selection of particular traits and according to the conditions under which they have been raised. Darwin concluded that there are two factors controlling the variations of animals and plants under domestication: namely, the nature of the organism and the nature of the conditions,<sup>4</sup> which are presumably analogous to the situation in nature.

- (b) Variation of organisms in nature.

In 1831, Darwin sailed as a naturalist on the H.M.S. Beagle from England to South America as part of a survey of continental coastlines. He visited the various isolated oceanic islands off the coast of Ecuador. On several of the Galapagos Islands Darwin found several species and varieties of finches which had beaks with various sizes and shapes. They were presumably the descendants of a species of finch in the mainland, which was 600 miles away. Darwin suggested that all these varieties of birds were descended from an ancestral species introduced to the island. After the offspring of this ancestral species had become too numerous they outstripped the food supply. By a process of natural selection, the variant individuals with better equipped beaks were able to survive in distinct parts of the island according to the variable type of food available. Over the course of time different variant forms would occupy distinct niches in the environment.<sup>7</sup>

2. Circumstantial evidence: evidence which is proposed as factual based on reasonable inferences from other accepted facts (e.g.,—empirical facts).

- (a) Paleontological collections.

There are 4 main geological periods of earth history classified according to their relative antiquity, namely, Proterozoic (Pre-Cambrian), Paleozoic, Mesozoic and Cenozoic in chronological order with the Proterozoic era dated by several methods back to more than 3.6 billion years ago. There were fossils of single-celled bacteria and algae found in the Pre-cambrian period. However, multicellular forms of life were scarcely represented in the fossil record until the Cambrian period, the oldest of the Paleozoic era. Throughout the remaining geological strata, there was a noted absence of intermediate varieties between major groups of fossilized organisms in any given formation.<sup>5</sup> Recent paleontological collections represent more varieties but whether they have bridged the gaps between major groups of organisms is disputable.<sup>8</sup> One of the often cited "transitional" fossils unearthed having the characteristics of both birds and reptiles was *Archaeopteryx*, which in addition to the bird-like features of wings and feathers also has reptile-like

characteristics, namely, claw-like appendages on the edges of the wings, the possession of teeth, and vertebrae extending out along the tail. However, its advanced features of the bird and primitive features of the reptile led some to conclude that *Archaeopteryx* was a true bird which can be partly represented by modern day species of birds found in Africa and South America.<sup>9</sup> All in all, the interpretation of paleontological record is disputable and it can at most be used as circumstantial evidence for Darwin's theory.

(b) Comparative structures and functions.

The similarities in morphology, structures and functions among living organisms prompted Darwin to postulate that these similarities were evidence of descent from a common ancestor. Recent evidences in physiology, biochemical metabolism, genetics and molecular biology also indicate that there are great similarities among living organisms. However, these evidences do not support the theory of evolution exclusively. A theory of common design by a Designer is equally supported by these evidences. Darwin regarded some structures found in man and in higher forms of life as the remains of organs which were once required by their ancestral forms but which are no longer essential to the organism.<sup>6</sup> However, this concept has been questioned in light of recent findings. For example, the appendix in mammals which was thought to be rudimentary has been found to be rich in lymphoid tissue,<sup>14</sup> and is responsible for the replenishment of part of the immune system after irradiation.<sup>15</sup>

*Mechanisms of evolutionary change.*

In order for an organism to survive under natural selection it has to adapt to the new set of conditions, and also pass on its capacity to survive to its offspring. In Darwin's time, little was publicly known about the science of genetics although Mendel's original work was published in 1865. Lamarck had postulated in genetics that organisms adapt to their environment by acquiring certain new characteristics which are in turn passed on to their offspring. After the dawn of the science of genetics at the turn of this century, a theory originally proposed by Gregor Mendel (1822-1884) and elaborated by Hugo de Vries (1848-1935) stated that intrinsic genetic characteristics diversified by the process of mutation and recombination. These changes gave rise to the source of varieties. Later on, the ideas of Mendel and de Vries were coupled with the concept of Natural Selection and additional components of evolutionary theory to become the dominant view of the Neo-Darwinian version of evolution with the Lamarckian view largely repudiated.

*Status of the modern theory of evolution: Neo-Darwinism.*

1. Definition of a species.

In order to examine the modern development of Darwinism, it is paramount to establish a working definition of the term "species" upon which much of the theory of evolution is based.

The first systematic attempt to classify living organisms was made by John Ray (1628-1705) and Carolus Linnaeus (1707-1778). Linnaeus adopted the principles of Ray using as criteria the morphological con-

formity and the potentiality of forming a fertile progeny to categorize the members of the smallest unit of taxonomy as species. Linnaeus adhered to the concept of "fixity of species" which denotes that there existed at that time just as many species as God created in the beginning. His ideas were later challenged by Buffon and Lamarck who set the stage for Darwin's *The Origin of Species*. Today, although the taxonomic system of Linnaeus is still being used as the basis for designation of organisms, his classification scheme has been repeatedly revised. The generally accepted definition of a contemporary "species" today is a group of related individuals that are actually or potentially capable of interbreeding or a group of organisms constituting a single gene pool.

2. Micro- versus macro- evolution.

The theory of evolution in its present form can be divided into two parts, namely, microevolution (the special theory of evolution) and macroevolution (the general theory of evolution or the synthetic theory of evolution).<sup>10</sup> In microevolution new varieties of a species developed from the source of diversification through mutation (sudden change in the DNA molecule) and genetic recombination (random assortment of chromosomes as well as crossing over of the chromosomes) by the process of natural selection. In macroevolution, the theory of microevolution is extrapolated from inorganic molecules to man to include the chance development of higher forms of life from lower forms of life, lower forms of life from unicellular organisms, and the cell from inorganic molecules by the process of natural selection.<sup>16</sup> Neo-Darwinism holds the view that the accumulation of point-mutations selected for by natural selection will not only lead to the development of new varieties, but new species in the higher categories.<sup>10</sup> In other words, the General Theory is an extensive extrapolation of the Special Theory.

3. The evolving concept of "Natural Selection".

After the triumphant Centennial Celebration of Darwinism in 1959, a quiet philosophical debate was going on in the 1960's regarding the logical coherency of Darwin's concept of "Natural Selection". The arguments focused on the circular reasoning of Darwin's premise of "The Survival of the Fittest". Darwin did not provide any objective criteria to identify the fittest other than looking at the survivors.<sup>23</sup> The Nobel laureate, geneticist T. H. Morgan first pointed out this discrepancy and evolutionists have come to realize the tautological nature of Darwin's theory of natural selection. However, this recognition did not greatly bother them for they had already redefined natural selection to mean differential reproduction, a concept which was quite foreign to Darwin.

*Strengths and weaknesses of Neo-Darwinism.*

1. Strengths: Microevolution.

(a) Empirical adequacy.

The mechanism for the Special Theory of evolution can be documented empirically. Mutants can easily be isolated from a culture of bacteria by using a selective growth medium.<sup>11</sup> The actual continuous process of microevolution has also been observed using an apparatus called a chemostat which provides the growing bacterial culture with a steady supply of nutrients and constantly washes away ex-

cessive growth and metabolic by-products to maintain a well-balanced density. Spontaneous mutants (mutants generated spontaneously in the absence of external mutagens) which grow faster under the conditions prevailing in the chemostat overtake the parent bacterial culture entirely in just a few generations.<sup>12</sup>

Domestication of animals and plants has continually been practiced since Darwin's time and the varieties of cultivated plants and animals have been exploited for human use. Varieties of a species (sometimes called races or subspecies) can also be observed in different natural environments. In the case of industrial melanism, different colored varieties of peppered moths were selected for in the industrial area of Manchester, England, according to their capacity to adapt to the color of their natural habitat. The bark of the tree trunk was darkened by air pollution from the industries, and the darker varieties thus escape their predators.<sup>25</sup> Both of these incidences are examples of microevolution.

(b) Rational coherency.

It seems logical to interpret the many subspecies or sibling species of a given species of organism as descendents from a given prototype by the process of microevolution. The many sibling or sub-species of the fruit fly *Drosophila* may well have evolved from the same ancestral species of fruit fly by microevolution and geographic and ecological isolation. The criteria for differentiating species (sibling or sub) from varieties in this case may be subtle. If two members of *Drosophila* will not produce fertile offspring with each other, they will normally be classified as two separate species. However the factors involved in reproductive isolating barriers have to be considered. These are post mating barriers (mechanisms that prevent gene exchange only after mating has occurred) and premating barriers (seasonal, habitat isolation, behavioral differences, among others, which prevent the mating of two individuals).<sup>13</sup> Varieties developed from the same species may be grouped into sibling or subspecies if they are prevented from producing fertile offspring by the above mentioned conditions.

2. Weaknesses: macroevolution or the synthetic theory of evolution. Despite the systematic unity of the synthetic theory of evolution in its comprehensive scope, there are serious weaknesses inherent in this theory.

(a) Empirical inadequacy.

(i) The demise of the theory of spontaneous generation.

The theory of spontaneous generation which states that life arose continually from the non-living was very popular in the medieval and enlightenment periods because of its apparent consistency with one's sense experience: worms arise from mud, maggots from decaying meat, mice from refuse of various kind. The establishment of this theory was paramount to the synthetic theory of evolution to explain the evolutionary development of life from the non-living. However, through a series of ingenious experiments performed by Francesco Redi, Lazzaro Spallanzani and finally Louis Pasteur in the 19th Century, it was shown that life arises always from pre-existing life.<sup>17</sup> Evolutionists who want to reject the

*The Naturalistic extrapolation of the theory of evolution into various areas of human experience has led to frustration, confusion and despair.*

notion of a single primary act of creation are left with no choice. They have to approach the origin of life again through a hypothesis of spontaneous generation by assuming that organisms may have arisen spontaneously under different conditions in some former period, granted that they do so no longer.<sup>18</sup> Empirical documentation of this hypothesis using experimentation under the present condition would be quite difficult.<sup>21</sup>

(ii) The difficulties involved in accounting for the abiogenesis of the first cell.

In the search for the origin of life, some progress has been made in the synthesis of amino acids,<sup>19</sup> nucleic acid constituents,<sup>20</sup> protenoid microspheres and coacervate droplets<sup>16</sup> under simulated primordial conditions. However, there still remain many difficult problems to be resolved. First of all, polymerization of chemical monomers under simulated primordial conditions contains no more than "information" input defined by physical and chemical parameters. It does not start new life processes as self reproducing systems. It is analogous to the self assembling process of a computer which operates only insofar as the informational input dictates. Secondly, it will be difficult to account for the switch to internal control which is a characteristic of the cell when the polymerization process of chemical monomers triggered by external forces finally brings about a truly self reproducing system. Thirdly, the probability of achieving complexity from simple starting materials will be decreased drastically (geometrically) as the systems become more and more complex. This will lead to the conclusion that the abiogenesis of a cell with its highest level of complexity as a self-reproducing unit is extremely improbable.<sup>21</sup>

(iii) Evolution above the species level is poorly documented empirically.

Evolution above the species level has to rest quite heavily on the concept of speciation (the formation of new species). Although rational explanation can be formulated to account for the diversification of species by microevolution in nature, it is yet to be observed in a controlled laboratory setting that speciation occurs readily. One of the rare cases of speciation observed empirically was the speciation in wheat in which the hybridization of two strains of wheat produces a fertile offspring strain which is incapable of interbreeding with its parent strain.<sup>50</sup> However, the mechanism in which this process of speciation occurs, namely, polyploidy, is commonly observed only in plants and cannot be used to account for the overall mechanism of macroevolution in all living organisms. The chemostat experiment mentioned earlier can allow the observation of numerous generations of bacterial evolution in a relatively short period of time. However, only varieties within a species but not new species have been detected.<sup>12</sup> Empirical documentation of evolution above

the species level is not yet forthcoming. It can be argued that since macroevolution happened over a long period of time, it cannot be observed empirically in one's lifetime. Nonetheless, the theory of macroevolution would be without a firm empirical foundation if it were divorced from the empirical documentation of the theory of microevolution. It will be seen in the following section that the mechanism operative in microevolution is insufficient to account for macroevolution.

- (iv) The inconsistency of molecular biological data with other data supporting macroevolution.

The advent of molecular biology in the last two decades has made biology a more exact science. With the elucidation of the structure of a gene (DNA) and the correlation of biological activities with physical and chemical processes, a quantitative examination of different living organisms is made possible by comparing their genetic constitutions. Through the technologies of protein sequencing and nucleic acid hybridization, it is possible to calculate the genetic distance between different species of organisms by comparing their degree of protein sequence similarities and DNA homologies. Recently, a surprising observation concerning genetic relatedness of man and chimpanzee has been made.<sup>22</sup> After comparing the sequences of more than 40 proteins from chimpanzee and man and their DNA homologies by hybridization, it was concluded that the genetic distances among species from different genera are considerably larger than the human-chimpanzee genetic distance. In other words, the anatomically and behaviorally distinct species of human and chimpanzee are found, according to these data, to be more closely related genetically to each other than are several sibling species or congeneric species of frog, fruit fly or mouse. These findings are inconsistent with the general scheme of macroevolution which predicts that human and chimpanzee after their evolutionary divergence should differ genetically to a greater extent than what was inferred from the protein and nucleic acid evidence.

- (b) Rational incoherency.

- (i) "Chance" has been used as the teleological explanation of evolution.

It had been criticized in Darwin's day that in order to deny purposes in nature, Darwinism substituted "chance and accidents" to account for the necessity for evolution while maintaining that the evolutionary process is not teleological.<sup>24</sup> Evolutionists, while stressing the material and efficient causes of evolution, have yet to come up with a valid counter-argument to explain why chance alone can be in such marvelous harmony to produce the orderly array in the biosphere instead of causing disruption of the whole structure, since both of these phenomena would be called for in equal probability, a condition implicit in the use of the term "chance".

- (ii) The insufficiency of the concept of "Natural Selection" to account for macroevolution.

Evolution above the species level has not been satisfactorily accounted for by the mechanism of "Natural Selection". To quote from a leading contemporary evolutionist, Dr. Jay M. Savage, "The

essential features of microevolution and speciation are now fairly well understood by biologists but the complex processes leading to the grander scale remain an area inviting investigation".<sup>25</sup> Various concepts have been postulated to try to account for the mechanisms of macroevolution.

- (1) The "Systemic mutation" concept.

The late Richard B. Goldschmidt, geneticist at the University of California, has expressed frustration in trying to account for the macroevolutionary development of many structures in higher organisms on the bases of the mechanisms of microevolution alone. He challenged his fellow evolutionists to work out a step-by-step evolution scheme for 18 structures in higher organisms, among them hair in mammals and feathers in birds. His challenge was unanswered. Therefore, he postulated a novel concept of "Systemic Mutation" which involves changes of intrachromosomal pattern.<sup>26, 27</sup> This view was not popular because the concept of "Systemic Mutation" did not find any support in an experimental model. However, the insufficiency of "Natural Selection" as it works in microevolution to account for macroevolution was first brought into attention.

- (2) The "Neutral Mutation" concept.

Upon the advent of the molecular biological methodologies to compare the genetic relatedness of different species it was apparent that there were great variabilities in primary structure (amino acid sequence) of homologous proteins from various sources.<sup>28</sup> Interpretation of the molecular biological evidence and organismal evidence seemed to lead to the conclusion that the two levels of evolution are to a large extent independent of each other.<sup>22</sup> Based on these observations, the concept of "Neutral Mutation" was postulated. It denotes that certain genetic changes are neither beneficial nor detrimental to the organism and that "Natural Selection" can do nothing to stop these "neutral mutations" which spread at a constant rate.<sup>28, 29</sup> This concept demands additional factors to explain macroevolution besides natural selection.

- (3) The "Species Selection" concept.

In reaction to the arguments of the opponents of macroevolution, modern evolutionists tried to reiterate their convictions that the process of natural selection is responsible for both microevolution and macroevolution. However, a recent article examined the fossil record and came up with a novel concept of "Species Selection".<sup>30</sup> It was concluded in this article that natural selection while operating very nicely in microevolution, fails to account for the major features of evolution and that species selection which operates on variation provided by the largely random process of speciation favors species that speciate at high rates or survive for long periods and therefore tend to leave many daughter species.<sup>30</sup>

All in all, while the idea of Darwin's evolution is still venerated as the most comprehensive theory in Biology, the concept of Natural Selection, by which the theory was first established on scientific ground, is being gradually abandoned as the only mechanism which can account for the features of macroevolution.

**Extrapolation of the Theory of Evolution by Naturalism**

Naturalism is a philosophy maintaining the propositions that matter exists eternally and is the only reality, that the cosmos exists as a uniformity of cause and effect in a closed system, that man is only a complex machine, that death is extinction of personality and individuality, that history is a linear stream of events linked by cause and effect but without an over arching purpose, and that man is the central reference point of ethical views. It was first formulated as a systematic school of thought in the eighteenth century and it came of age at Darwin's time.<sup>49</sup> Despite Darwin's upbringing in theistic thought, his later ideas were more or less influenced by naturalism.<sup>51</sup> Naturalism in turn extrapolates Darwin's theory of natural selection into various areas of human experience:

*The extrapolation of Darwinism into religion and theology.*

Upon the advent of Darwinism, religion has been treated by the naturalists as man's evolving concepts of a felt practical relationship with what is believed in as a supernatural being or beings, in the eternal quest for the meaning of life and death, starting from primitive tribal ritualism and animism and culminating in monotheism in Christianity.<sup>31</sup> The Bible is viewed as a product of man's progressive understanding of God, a viewpoint which contributed to the development of higher criticism and the repudiation of the verbal inspiration of the Bible.<sup>32</sup> Prominent Catholic and Protestant theologians embraced evolution and espoused a modernistic social gospel.<sup>33, 34</sup> Christ was viewed as a great teacher providing an example for ethical living. The mission of the church was to alleviate human suffering in direct harmony with the inevitable progress fostered by evolution. Concern with the life to come was largely repudiated.

*Social Darwinism.*

Darwin's contemporary, Herbert Spencer, was the first person to link the idea of social evolution to Darwin's idea of organic evolution. The theory of survival of the fittest "became a vogue that swept Western thought in the late 19th century. It also became a convenient doctrine for justifying various economic and political theories".<sup>35</sup> Unscrupulous industrialists took advantage of Darwin's theory to condone their unethical practices. Some militarists justified their aggression by the principle of the survival of the fittest.<sup>36</sup> Communists based their thesis of class struggle in history partly on Darwin's natural selection.<sup>37</sup>

*The extrapolation of Darwinism into philosophy and education.*

Pragmatism, an evolutionistic philosophy developed in America, states that the mind is not separate from the total organism but a part of it and thus subject to development and change as the organism itself. It has "an emphasis on the evolution and changing character of reality, on the relevance of knowledge to practical situations, on the need of testing truth by its ability to 'work', and on the instrumental nature of ideas".<sup>38</sup> The influence of Darwinism and Pragmatism also extends to education to some degree in the nat-

*I accept the day-age interpretation of the Genesis account because it is exegetically defensible and it is proposed by numerous evangelical theologians. It also provides for the antiquity of the earth.*

---

uralistic philosophy of progressivism and reconstructionism.<sup>39</sup>

*The extrapolation of Darwinism into psychology and history.*

Various influential psychologists like C. H. Judd, G. S. Hall, J. Dewey and S. Freud,<sup>40</sup> all held to the evolutionary interpretation of man's origin and developed their psychological theories accordingly. The behavioristic approach to psychology was one of the outcomes of the Darwinist influence. The naturalistic extrapolation of Darwinian evolution has also given birth to an optimistic view of the meaning of history. This particular philosophy of history resulted in the adoption of the ideology that progress is inevitable even though individuals or pressure groups may follow their own selfish purposes for the realization of special privileges.<sup>41</sup>

The Naturalistic extrapolation of the theory of evolution into various areas of human experience has led to frustration, confusion and despair. Man is awakening to the necessity of the re-evaluation of his own nature in a more holistic context.

**Attempts to Integrate Christian Faith and The Biological Theory of Evolution**

As a Christian who is a molecular biologist, I accept the validity of God's general revelation through nature which is the realm of scientific investigation, as well as God's special revelation through the Bible which is the realm of theological interpretation. Both of these avenues of God's revelation should lead us into a consistent although incomplete understanding of the creation and the Creator. The scientific enterprise, despite its theory-laden nature, has the methodological element which enables man to perceive God's general revelation regardless of the scientists' presuppositions. The apparent conflicts which have arisen between science and the Bible can be attributed either to the misinterpretation of scientific data or the Bible. After enumerating the strengths and weaknesses of the biological theory of evolution and its naturalistic extrapolation into other facets of human experience, it is appropriate to evaluate the theory of the evolution in light of the biblical record of creation. While there are numerous views represented among evangelicals on this issue I shall delineate a position according to my present understanding of the biological sciences and of the Bible. I am leaving open the option that God may change my view in the future by giving me more insight into the Scripture as well as by the advancement of biological science and other areas of learning where evolutionary naturalism has been influential.

*Interpretation of Genesis.*

I believe in the Scriptures of the Old and the New

Testaments as verbally inspired by God and inerrant in the original writing. In order to actualize this conviction, it behooves me to interpret the Bible contextually, historically and literarily. Because of my insufficient preparation in theology, I have to rely heavily on other theologians' painstaking studies in the book of Genesis. The most important question to be asked on the interpretation of Genesis 1 and 2 is whether it is (1) an allegorical account to convey a meaning metaphorically implied but not expressly stated, (2) a descriptive quasi-scientific history or (3) a literary account of history in some non-descriptive genre. The difficulty is to treat what was intended to be allegory as allegory and what was intended to be history as history. I reject the allegorical interpretation of Genesis because it is not exegetically sound<sup>43</sup> and also because this position places a tremendous pressure on the interpretation of the historicity of the Fall and the trustworthiness of Christ when He quoted from the Genesis account of man (Mark 10:6). In addition, this position has yielded an unnecessary compromise to the atheistic evolutionist who maintains that man is a product of chance only. I also reject as unlikely the naive literal interpretation of the creation day as a 24 hour solar day, because it is not necessarily called for in the text. This position also overlooks the current scientific concept of the antiquity of the earth which was arrived at by six independent dating methods.<sup>42</sup> I accept the day-age interpretation of the Genesis account because it is exegetically defensible and it is proposed by numerous evangelical theologians.<sup>43, 44, 45</sup> It also provides room for the antiquity of the earth.

*Synthesis*

1. God created the prototypes of each "kind" of organism in six geological eras and they diversified by the process of microevolution to generate the various species or sub-species observed today. The Genesis record of "kind" did not specify its exact biological boundaries and so we should be cautious in suggesting what these might have been. It is thus reasonable to interpret that the "kind" may mean the original ancestral form of a certain group of organisms, e.g., the fruit fly *Drosophila*, which later on developed into the present day varieties. This view is shared by other biologists,<sup>46</sup> anthropologists,<sup>47</sup> and orthodox theologians.<sup>45-48</sup>

2. God created all living organisms with a similar blueprint. This will account for the similarities of the comparative structures and functions among organisms, and their similarities in physiology and biochemical metabolism.

3. Man is God's special creation in the sixth and final epoch of the creation account. He is not derived from pre-existing living forms. His uniqueness lies in his transcendence of nature despite his earthly origin through his spiritual capacity to relate to God and his fellow men as a free agent. The documentation of this view is beyond the scope of this paper.

## Conclusion

I have attempted to integrate the issue of evolution in Biology with Christian faith. Other areas which are to be integrated in my thinking are the relation of fact to theory, the difference between a religious

account and a scientific account of an incidence, the hermeneutic problems of Genesis, and man's transcendence and/or dependence concerning his biological makeup. These issues will be pondered and pursued throughout my academic and ministerial endeavors.

I thank Dr. Raymond Brand, Dr. Joseph Spradley and Dr. Arthur Holmes for critically reviewing this article.

## REFERENCES

- 1 Bube, R., *The Human Quest*, Word Books, p. 207, 1971.
- 2 Holmes, A., Professor of Philosophy, Wheaton College. Lecture given during the Integration of Faith and Learning seminar held at Wheaton College, July 12 to August 6, 1976.
- 3 Darwin, E., Vol. I. *Zoonamia*, Boston, Mass: Thomas & Andrews. Preface. 1803.
- 4 Darwin, C., *The Origin of Species*, The New American Library, p. 32, 1958.
- 5 *Ibid.* p. 298.
- 6 *Ibid.* p. 412, 418.
- 7 *Ibid.* p. 371; Darwin, C., *The Voyage of the Beagle*, New York: Dutton, 1957.
- 8 Moore, J. N. and Cuffey, R. J., *Journal ASA*, 24 No. 4 p. 160, 1972.
- 9 Gish, D. T., *Evolution, The Fossils Say No!* Creation-Life Publishers, p. 62, 1973.
- 10 Simpson, G. G., *The Major Features of Evolution*, Columbia Univ. Press. 1953.
- 11 Pun, P., C. D. Murray and N. Strauss., *J. Bacteriol.* 123, p. 346, 1975.
- 12 Novick, A. and L. Szilard, *Proc. Natl. Acad. Sc. Wash.* 36, p. 717, 1950.
- 13 Kirk, D., ed. *Biology Today*, CRM, Random House, 2nd ed. p. 708, 1975.
- 14 Archer, O. K., *Nature*. p. 338, Oct. 26, 1963.
- 15 Jaroslow, B. N., Immunologist, Argonne National Laboratory, Lecture given in an Immunology class, Spring, 1976.
- 16 Oparin, A. I., *Genesis and Evolutionary Development of Life*. Acad. Press. 1968.
- 17 Frobisher, M., R. D. Hinsdill, K. J. Crabtree and C. R. Goodheart, *Fundamentals of Microbiology*, 9th ed. W. B. Saunders Co. p. 21, 1974.
- 18 Wald, G. *Scientific American*. August, 1954.
- 19 Miller, S. L., *Science*. 117, p. 528, 1953.
- 20 Fox, S. W. ed., *The Origins of Prebiological Systems*, Acad. Press, p. 221, 1965.
- 21 *Ibid.* p. 39.
- 22 King, M. C., and A. C. Wilson, *Science*. Vol. 188, p. 107, 1975.
- 23 Bethell, T., *Harper's Magazine*, Feb. 1976.
- 24 Von Baer, K. E., *Augsburger Allgemeine Zeitung*, No. 130, p. 1986, 1873.
- 25 Savage, J. M., *Evolution*, 2nd ed., Holt, Rinehart and Winston, Inc. p. 118, p. 72, 1969.
- 26 Goldschmidt, R. B., *The Material Basis of Evolution*, Yale Univ. Press. 1940.
- 27 Goldschmidt, R. B., *American Scientist*. 40, p. 84, 1952.
- 28 King, J. L. and T. H. Juke, *Science*, p. 788, May 16, 1969.
- 29 Sparks, H., *Journal ASA*, 23, No. 4, p. 123, 1971.
- 30 Stanley, S. M., *Proc. Natl. Acad. Sc. USA*, 72, p. 646, 1975.
- 31 Lewis, J., *The Religions of the World Made Simple*, Doubleday & Co., Inc., 1958.
- 32 Elliott-Binns, L. E., *English Thoughts, 1860-1900. The Theological Aspect*, The Seabury Press. 1956.
- 33 DeChardin, T., *Christianity & Evolution*, Harper & Row, 1969.
- 34 Fosdick, H. E., *The Modern Use of the Bible*, The Macmillan Co. 1924.
- 35 Wallbank, T. W. and A. M. Taylor, *Civilization Past and Present*, 4th ed. Scott, Foresman and Co. Vol. 2, p. 361, 1961.
- 36 Mussolini, *The Encyclopedia Britannica*, 16:27. 1957.
- 37 Zirkle, C., *Evolution, Marxian Biology, and the Social Scene*, Univ. of Penn. Press, p. 85, 1959.
- 38 Bixler, J. S., "Pragmatism" *An Encyclopedia of Religion*, The Philosophical Library, p. 601, 1945.
- 39 Meyer, A. E., *The Development of Education in the 20th Century*, Prentice-Hall, Inc. 1940.
- 40 Roback, A. A., *History of American Psychology*, Library Pub. 1952.
- 41 Thomas, H., *The Living World of Philosophy*, The Blackiston Co. 1946.

- <sup>42</sup>*Science*, Jan. 30, 1970. Wonderly, D., *Journal ASA*, p. 145, Dec. 1975.
- <sup>43</sup>Young, E. J. *Studies in Genesis One*, Presbyterian and Reformed Pub. Co. 1964.
- <sup>44</sup>Buswell, J. O. II, "Length of Creative Days" in *Chronology*, Davis Bible Dictionary, 1935.
- <sup>45</sup>Ramm, B., *The Christian View of Science and Scripture*, Wm. B. Eerdmans Pub. Co. p. 145, 1954. Ramm also mentions several other theologians who hold the same view.
- <sup>46</sup>Mixter, R. L., *Creation and Evolution*, 2nd ed., Amer. Sc. Affil.

- Monograph, 1967.
- <sup>47</sup>Buswell, J. O. III in *Evolution and Christian Thought Today*, R. L. Mixter, ed. W. B. Eerdmans Pub. Co. 1959.
- <sup>48</sup>Hamilton, F. G., *The Basis of Evolutionary Faith*, James Clarke & Co. p. 150, 1931.
- <sup>49</sup>Sire, J., *The Universe Next Door*, Inter-Varsity Press, p. 61, 1976.
- <sup>50</sup>Grant, V., *Plant Speciation*, Columbia Univ. Press. 1971.
- <sup>51</sup>Greene, J. C., *Darwin and the Modern World View*, Louisiana State Univ. Press. 1961.

## The Theory of Social Evolution and the Concept of Entropy



LOREN W. DOW

Department of Sociology

Emory and Henry College  
Emory, Virginia 24327

### The Concept of Automatic Social Progress

Herbert Spencer, in his book *Progress Its Law and Cause*, formulated the classic statement of the Organicist-Functionalist idea of progress. He saw man as living in a triumphantly-evolving universe of which one intricately-coordinated part was the social world. It would, he thought, be folly to intervene in the operation of that world's characteristic processes because it was from them that the good society would emerge. Professing himself to be an agnostic, Spencer nevertheless proceeded to enunciate a worldview based on a naive faith in cosmic progress.<sup>1</sup> In his grand scheme, devoid as it was of any clear epistemological rationale, there was a continuous cosmic movement from homogeneity toward heterogeneity, from incoherence toward coherence, and from upheaval and violence toward peace and tranquility. In the picture of the world which he projected there was no place for sin or for a fallen condition on the part of man. That which was ethically good was at all times that which was pleasant and biologically functional.

Writing in the generation which followed the trauma of the French Revolution, Spencer sought to reassure his contemporaries with a vision of *social* progress which saw it as one aspect of a *cosmic sequence* that was triumphantly underway.

The basic picture of the social world which Spencer projected has become largely normative for contemporary Functionalist sociology—a closed system programmed for perfection and leaving no room and no need for the supernatural. The result is a deterministic *Weltanschauung* which dogmatically refuses to recognize any historic role for human decisions based on ethical choices, or for charismatic leadership, or for revelation.

The willingness of contemporary Functionalists (protagonists of the general Spencerian tradition, who clearly constitute the majority school of current American sociological thought) to dispense with all non-deterministic concepts can be readily documented. *The Instructor's Guide To Society Today* is a group product, published by CRM Books, and representing a Berkeley-based but widely-accepted approach to the teaching of sociology in American colleges.<sup>2</sup> In the foreword to this *Guide* the authors state: "Determinism is another fundamental way of thinking that must be taught. Like all Americans, students tend to believe in individual free will." The *Guide* goes on to deprecate at some length the view that adherence to Nazism, contentment with poverty, and utilization of educational opportunity are all based on individual choice. It continues: "People are not easily weaned from this approach because it is instilled in them by the culture" (and because it is) "frightening to the ego to see oneself a creature of forces beyond one's own control," and concludes "The study of sociology is itself an antidote to this kind of thinking."

It is beyond the scope of this paper to delineate the ways in which this deterministic approach which is widely characteristic of present-day sociology teaching, and which is dogmatically assumed to represent the *only* way in which the subject can be taught, exerts its impact on the minds of students. That might well be a subject of another paper which could deal with such related topics as the determinism of Marxist "scientificism," the invalidity of Gouldner's "coming crisis" between Marxism and Functionalism, and the spread of those dogmatically materialistic conceptions of human society which are engendered by each of these.

The intent of the present paper is rather to raise certain questions concerning the naturalistic outlook which is endemic to the above-described approach to sociological knowledge and to the teaching of sociology, and to suggest an alternative means of interpreting man's social experience.

Can the corpus of presently-available sociological knowledge be so arranged that it will "make sense" of the historical facts and statistical data which form its "working capital"? Is it realistic, in the light of known human motivations and proclivities, to assume that when and if man discovers what is good, he will do what is good? Are there areas in our social and historical knowledge, like the "black holes" of astronomy where the use of rational criteria to implement the search for understanding must be held in abeyance because material that is being discovered fails to fit into the framework of our previous moral, social, or historical categories? Does the secular historian face an array of materials for which his conceptual tools do not suffice? Is there a need for a new concept to designate those areas which continue to exhibit ambiguities which lie outside the research skills of the social scientists as such?

### The Concept of Entropy in The Physical Sciences

The concept of entropy is commonly used in the physical sciences in connection with the Second Law of Thermodynamics. Physicists seek to make it intelligible to the layman by equating it with the word "disorder." The usual statement of the Law is that "the amount of disorder in the universe always increases or remains unchanged for any process."<sup>3</sup> To state this in another way we might say that the amount of *order* is *not* increasing. The universe is either remaining static, a view that contradicts observation, or it is running down. It is obvious that this is in contradiction to the Spencerian game-plan—the inexorable evolutionary process described above.

### Entropy in the New Testament

Both the word *entropē* itself and its verbal form *entrepo* appear with a pattern of consistent usage in several significant passages in the New Testament. The verbal form literally means to "turn inward," that is, as applied to the motives or the course of action of a human being to "turn him back upon himself" to "stop him short" or "in his tracks." When it appears in the form of a noun it is therefore preferable to translate it as "humiliation," the experience of being "humbled," or "nonplussed." These terms seem to make it somewhat more intelligible than the Authorized Version's use of "shame."

We have two New Testament instances of the use of the word as a noun. When Paul was calling to account the members of the church at Corinth over the practice of going to law against their fellow-Christians,<sup>4</sup> he said (*pros*: 'with reference to') your entropy." What he was seeking to convey was that their church, which had been confidently evolving within the context of its optimistic plans and prideful human programs, was suddenly finding itself "set back," "regressing," "turning in upon itself," "in a state of disorder."

Once more within the same epistle we find the

apostle employing the word in its nominative form. Wishing to call attention to the fact that the corrupt ways of the Corinthian congregation were turning good associations into bad, he said, "I speak to you concerning your entropy."<sup>5</sup> Again, the gist of what he intends to say is that they have programmed the affairs of their congregation, but that events have not worked out as they had planned.

---

*Is it realistic, in the light of known human motivations and proclivities, to assume that when and if man discovers what is good, he will do what is good?*

---

The verbal form *entrepo* is also used in directly relevant ways in several New Testament passages: In the parable of the "Wicked Husbandmen"<sup>6</sup> Jesus tells of a group of sharecroppers or land tenants who had killed, one after another, their landlord's agents who had been sent to collect an assessed share of the crops. At last, after several such incidents, the landlord decided to take more decisive action—he would send his own son to *entrapein* them, literally to overawe them, throw them into confusion, and overwhelm any lingering protests or objections to the collection of the rent. The essential point is that Jesus pictured God as "entropizing" i.e., overwhelming or throwing into confusion those who had become inured to an accepting attitude toward what they had come to regard as a safely-programmed and predictable pattern of events.

In the parable of the corrupt judge and the persistent widow,<sup>7</sup> the authorized Version tells us that the judge "feared not" God neither "regarded" man. It is noteworthy that both the verbs used in this passage (*phobeo*: "fear") and (*entrepo*: "turn inward") appear in this passage as participles. We might therefore translate the verse as saying that the judge had gone through life neither fearing God nor being overawed, nonplussed, or thrown into confusion by any human person.

There are several other New Testament passages in which the verbal form *entrepo* is used, and each of them is susceptible to a similar interpretation. For example Paul tells the Corinthians that he is not writing to "put them down" or "throw them into confusion" but that, considering them "beloved sons" he needs to "warn" them.<sup>8</sup> Again he tells the congregation of the Thessalonian church that, if there is anyone in their church who fails to obey the behests of this epistle, they are to shun this person so that he may be "put down," "set back," "thrown into confusion."<sup>9</sup>

In one of the pastoral epistles, where the author is exhorting young men to be sober-minded, grave, sincere, uncorruptible, and to show themselves as patterns of good works, he tells them that, above all, they should use sound speech, so that those who oppose them may be . . . and then uses a passive form of *entrepo* which should be translated "thrown into confusion."<sup>10</sup>

In the Epistle to the Hebrews we have the one remaining New Testament passage in which the word is used. In this instance the syntax is somewhat more

complicated, but the essential meaning is that just as our fathers in the flesh have corrected us, and "set us back" or "stopped us" in our wilful childish acts, so the chastening which comes from God will "yield the peaceable fruit of righteousness."<sup>11</sup>

### The Utility of the Entropy Concept for the Social Scientist

The contribution which the entropy concept can make to the study of man's social life will be found in its utility for designating those situations wherein church programs, governmental schemes, and other social rubrics are thrown into a state of unforeseen confusion which does not fit, or actually contradicts, the models. Blueprints for group, community, or societal action perennially fail to take into account the fragmentary nature of human schemes and constructs. Hence God sometimes finds it necessary to "confound" the languages of Babel-builders, and to show them that their simplistic programs are inadequate.<sup>12</sup> Statistically-minded social scientists convince themselves that the facts which they have gathered encompass final truth, but the Entropic Power which evaluates all human programs understands that, as with King David, when the "numbering" of the people assumes its intensive form, it becomes "mobilization," regimentation, and the destruction of human lives. Perennially, kings and rulers "take delight" in these things, but those who are charged with the implementation of their programs cringe when they see the direction that things are taking.<sup>13</sup>

The author of this ancient Hebrew narrative was more than an "objective writer of history." He was a man of prophetic insight who clearly saw that "numbering" could be a step on the road to mobilization, and that the process thus initiated could bring an enormously increased degree of royal control—could, in a sense result in the "building of another Babel"; and that this would be in violation of God's will for His peoples' lives.

---

*A realistic writing of history would necessarily include some happenings, some atypical events, some non-sequential processes for which a new concept appears to be indicated: the concept of "social entropy."*

---

In the late Twentieth Century, with its mega-states and super-programs, this biblical insight can be extremely relevant. The rise and fall of human cultures can be studied as mere exercise-material in historiography, or it can be interpreted in terms of Sorokin's "ideational-idealistic-sensate continuum," or of Spengler's "cultural life span" concept, or of Toynbee's classification of human civilizations into the "abortives, the arrested, and the still-alives." In any event the study of sociology, and ultimately the teaching of the subject, must address itself, sooner or later, to "grand-theory" considerations that can be seen only in "macro"

dimensions. Sociology's current concern with the statistical study of interpersonal relationships and other "micro" matters is to some degree a form of escapism occasioned by the conviction that the projection of grand theory is elusive and somewhat futile. Current functionalist sociology is largely unwilling to eschew a value-free orientation and to embark on projects that contemplate even a tentative commitment to the interpretation of broader historical patterns. However, contemporary man is not satisfied to live exclusively in the micro dimension. He hungers quite as much as did his ancestors for some broader rubric by which to discover whether there is any master plan for the meaningful interpretation of his interpersonal, group, and emerging historical experience.

I wish to suggest that historical facts constitute the valid and essential subject-matter of sociological inquiry, and that, while large areas of history can be validly understood in Spencerian terms, automatic evolutionism with its faith in functional autonomy and its naturalistic closed system leaves much that is still to be explained.

It is possible to describe the historic process in these terms only by selecting one's facts, and leaving out those which fail to substantiate a preconceived historical model. The Moslem enshrouded in a microcosm of Islamic lore can become convinced that his own civilization is the epitome of historic perfection. Those who are members of the Sun King's court circle can find reasons for thinking that the *ancien regime* is perfect, final, and complete. Loyal Nazis are sure that their *Reich* will last for a thousand years. Indoctrinated Marxists are sure that "scientific Socialism" will prove to be the ultimate answer to man's problems. So men build their Babels, and construct ambitious blueprints, but just as scholars in the physical sciences have to say, "This is the best we can do at present with the data at hand but there still remains an area of *entropy* which our present knowledge cannot explain," so those studying historical materials—whose subject matter is human lives—must say that here too there are areas that fail to correspond to man's Utopian plans or to substantiate his historic models. Thus a realistic writing of history would necessarily include some happenings, some atypical events, some non-sequential processes for which a new concept appears to be indicated. To fulfill this need the writer is proposing the concept of "social entropy."

This is not to suggest that we should construct a Christian apologetic based on reserving, with the continuing advance of scientific knowledge, successively smaller areas which are not yet explainable and calling them God. It is rather to propose as a valid hypothesis for understanding the nuances of history the concept that the areas which need to be reserved or withheld from normative historiographic study and labeled with the word "entropy" are *kairos* times—times of crisis and decision when forces are at work which cannot be understood by normative methods. The writer is therefore seeking to open rather than to close a door to new truth when he suggests that some of the not-yet-fully-understood factors at work in such times can best be explained in terms of divine or of supernatural activity within a world that is *more* than merely "natural," and a society that is *more* than solely "human."



personality of the man and the originality of his work.

Pascal was an artist in terms of his persuasive power in writing. He based his art of persuasion upon his careful study of man. He made his debut as a master writer in the (anonymous) publication of his *Provincial Letters*. Hazelton sees these letters as crucial in his life at that time but also profoundly affecting his later writing:

At all events, the 'Provinciales' succeeded in making an artist out of a scientist, thus adding a further dimension to Pascal's astounding genius; and they not only prepared the way, but actually prefigured his achievements in the *Pensees* (p. 157).

When I picked up this book, I had an earlier casual acquaintance with Pascal. I knew of the wager argument, his disagreement with Descartes and his famous "reasons of the heart". This book gave me a much more well-rounded introduction to Pascal. I feel like I want to learn more about him and read his *Provincial Letters*.

The book has a selected bibliography and index. It is a relatively small book but expensive. I still think it's well worth the money if you are interested in Pascal. I trust you will enjoy the book as much as I did.

*Reviewed by Maynard C. Nieboer, Campus Minister (InterVarsity Christian Fellowship), Arizona State University, Tempe, Arizona*

**ETHICS FOR ENVIRONMENT: THREE RELIGIOUS STRATEGIES**, edited by Dave Steffenson, Robert S. Cook, and Walter J. Herrscher: Green Bay, Wisconsin; U.W.G.B. Ecumenical Center, 1973, 132 pp., \$2.00.

This paperbound booklet contains the transcript of a conference on ethics and environment which met June 11-13, 1973, at the University of Wisconsin-Green Bay. The conference was the last in a series of three national meetings which were organized under the initiative of the Faith-Man-Nature Group, a coalition of theologians, philosophers, environmentalists, and other interested persons from academic circles and the religious community. Their aim was to respond to a challenge in an essay by historian Lynn H. White, Jr.: "More science and technology are not going to get us out of the present ecologic crisis until we find a new religion or rethink our old one." The contents include four addresses, the review of a case history, reports of task forces, and a panel discussion.

One unidentified participant in the panel discussion recalled that St. Bernard of Clairvaux (1091-1153) would not look at Lake Lucerne whenever he walked nearby. Its beauty turned his thoughts away from the glory of God. Older evangelicals within my memory used to resemble St. Bernard in having no place in their preaching and theology for anything but the plan of salvation. It is to the glory of God that younger thinkers among us now acknowledge that there is a place in God's plan and room in his love for all things great and small and for all of creation. Others, however, have been more prompt to notice and respond to the environmental problems which have come to a boil in our lifetimes. In the process, some have managed to impute to Christianity a large measure of the direct

ethical responsibility for wholesale industrial pollution and misuse of the earth's resources. They would, therefore, have us abandon Christianity in general and Protestantism in particular, and give us a new religion with ethical values that would enable us to live in harmony with the world of nature.

Rajagopal Ryali discussed the ecological perspectives revealed within Hinduism, and J. W. E. Newberry reviewed the insights within the beliefs of North American Indians. Oriental and native American religions have both attracted attention as alternative sources of ethics for the environment. Ryali, however, begins by reminding his listeners and readers of an earlier admonition that "it is difficult to claim that religion X has given a body of material relevant to ecological problems or that religion Y, by its very nature, offers a more helpful ecological perspective than religion X." That is at least a more honest *a priori* assumption than some taken by certain of our fellow-Christians. And just as Hindus can be sensible, so does their religion have sensitivities that we can esteem. Likewise, legends from cultures as diverse as those of the Eskimo and the Kalahari Bushmen embody depths of wisdom which are by no means restricted to environmental matters.

H. Paul Santmire does not deprecate any of these beliefs. In his article, the longest and most substantial contribution in this book, Santmire helps us to place them all in a theological perspective. The religions of men are ultimately cosmocentric, anthropocentric, or theocentric in their theology, and each approach has different ecological implications. Protestantism, as influenced by the scientific awakening and the Industrial Revolution, has become man-centered and subordinates the world of creation to man's interests, according to Santmire's thesis. Ecological bankruptcy and abuse resulted. The religions of the Orient and the American Indians tend toward a cosmocentric view of man and the universe. They hold no high regard for "what is man that thou are mindful of him?" A cosmocentric theology may have environmental integrity, but it has

**Books Received and Available for Review**

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

- Durka G. and J. Smith, *Emerging Issues in Religious Education*, Paulist Press, 1976.
- Francis, J. and P. Abrecht, *Facing Up to Nuclear Power: Risks and Potentialities*, Westminster, 1976.
- Hall, B. P., *The Development of Consciousness: A Confluent Theory of Values*, Paulist Press, 1976.
- Heinze, T. F., *Creation vs. Evolution Handbook*, second edition, Baker Books, 1976.
- Hennessy, T. C., *Values and Moral Development*, Paulist Press, 1976.
- Jeeves, M. A., *Psychology and Christianity: The View Both Ways*, InterVarsity Press, 1976.
- Scanzoni, L. and J., *Men, Women, and Change: A Sociology of Marriage and Family*, McGraw-Hill, 1976.
- Shannon, T. A., *Bioethics*, Paulist Press, 1976.
- Smith, M. A., *The Church Under Siege (Constantine to Charlemagne)*, InterVarsity Press, 1976.
- Trobisch, W. and I., *My Beautiful Feeling: Correspondence with Ilona*, InterVarsity Press, 1976.
- Wakatama, P., *Independence for the Third World Church: An African's Perspective on Missionary Work*, InterVarsity Press, 1976.

no place for divine justice and mercy or for social justice. It takes a theocentric theology to conceive a relationship of balance between mankind and the world of nature. Santmire shows that the theological framework of the Protestant reformers was theocentric and Scriptural. Within the framework of their tradition, Santmire outlines a threefold relationship of man to nature: as overlord, as creative steward, and as wondering onlooker. The winsome insights within other traditions and cultures can enable us to regain our forgotten role as wondering onlookers and so amend our record in the first two roles. Otherwise, interest in ecological concepts from non-Christian sources is likely to be no more than an escapist fad without practical value in dealing with our problems.

Santmire's historical analysis of the anthropocentric condition in Protestantism today leads me to a personal conclusion. Environmentally bankrupt theology is spiritually bankrupt theology. Both are the results of an accommodation to progress in scientific knowledge which discounts the value of Scripture. Evangelicals who retain a high view of Scripture and who preach a living faith are the ones best qualified to develop seminal contributions to a working environmental ethic. Just as they have not purged their hymnals of references to the blood of Jesus, neither have evangelicals disavowed hymns such as "This is my Father's world" or "For the beauty of the earth." Evangelicals have inherited the vision. Let us encourage them not to leave the realization of it to "ecofreaks".

*Ethics for Environment* falls short of the promise in its title, but it does contain seed which you should not ignore if it is in your heart to make the wasteland blossom and rejoice.

*Reviewed by Richard S. Barnett, Staff Geologist, Continental Oil Company, Lafayette, Louisiana 70501.*

**PROVIDENCE LOST: A CRITIQUE OF DARWINISM**, by Richard Spilsbury, London, Oxford University Press, 1974, 129 pp. \$11.25.

In writing this book Richard Spilsbury, a philosopher, has rendered a real and valuable service to everyone who wants to understand more clearly what is wrong with Neo-Darwinian evolution. This book is not a defense of creation, which is not mentioned. It is rather a demonstration of the value of the philosophy of science, and as such, is a valuable aid to anyone who wishes to understand the relationship of the Bible and science.

In the preface, the author states that his explicit aim in writing the book is "to explore some limitations in our scientific thinking about man, with special emphasis on the Neo-Darwinian concept of human evolution." He begins his pursuit of this aim with a chapter on the attempt of evolutionists to account for the beginning of man by means of chance. In the seven chapters following, the author examines aspects of human existence for which it is impossible to account by evolution by chance: Language, fine arts, consciousness, pain, love, values, consciousness of the inevitability of death. The final chapter discusses the

way in which Scientism replaces God with DNA or chance.

Spilsbury is a philosopher in the classic meaning of the term, meaning that he deals with ultimate questions. He demonstrates the inability of the naturalistic world-view to account for the facts. On page 19, he points out that, "The basic objection to Neo-Darwinism is not that it is speculative, but that it confers miraculous powers on inappropriate agents. In essence, it is an attempt to supernaturalize nature, to endow unthinking processes with more-than-human powers—including the power of creating thinkers." In elaborating this, the author strongly criticizes the claims of Jacques Monod that chance is sufficient to account for evolution. He shows that neither chance nor any form of selection can account for the origination of new capabilities, even if they could possibly account for their perpetuation. With deadly logic he shows that all non-purpose theories are totally inadequate.

Technical terms are used sparingly, so the book should be valuable to those who do not have a rich background in philosophy. It should be required reading for every scientist who is tempted by Scientism, or who wishes to help others who are so tempted.

*Reviewed by Kenneth E. Jones, Professor of Theology, Gulf Coast Bible College, Houston, Texas.*

**This Publication  
is Available in  
MICROFORM**



FOR INFORMATION  
WRITE:

**University Microfilms International**

Dept. F.A.  
300 North Zeeb Road  
Ann Arbor, MI 48106  
U.S.A.

Dept. F.A.  
18 Bedford Row  
London, WC1R 4EJ  
England

Founded in 1941 out of a concern for the relationship between science and Christian faith, the **American Scientific Affiliation** is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. The *Journal ASA* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

Members of the **American Scientific Affiliation** endorse the following statement of faith: (1) *The Holy Scriptures are the inspired Word of God, the only unerring guide of faith and conduct.* (2) *Jesus Christ is the Son of God and through His Atonement is the one and only Mediator between God and man.* (3) *God is the Creator of the physical universe. Certain laws are discernible in the manner in which God upholds the universe. The scientific approach is capable of giving reliable information about the natural world.*

*Associate Membership* is open to anyone with an active interest in the purpose of the ASA. *Members* hold a degree from a university or college in one of the natural or social sciences, and are currently engaged in scientific work. *Fellows* have a doctoral degree in one of the natural or social sciences, are currently engaged in scientific work, and are elected by the membership. *Dues:* Associate \$13.00, Member \$18.00, and Fellow \$25.00 per year. A member in any of these three categories can take the *special student rate* of \$5.00 per year as long as he is a full time student.

**EXECUTIVE COUNCIL:**

JOHN W. HAAS, JR. (Chemistry), Gordon College, Wenham, Massachusetts 01984 *President*

DEWEY K. CARPENTER (Chemistry), Louisiana State University, Baton Rouge, Louisiana, *Vice President*

HOWARD H. CLAASSEN (Physics), Wheaton College, Wheaton, Illinois 60187, *Secretary-Treasurer*

JAMES O. BUSWELL, III (Anthropology), Wheaton College, Wheaton, Illinois 60187

A. KURT WEISS (Physiology) University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma 73190

**EXECUTIVE SECRETARY:**

WILLIAM D. SISTERTSON, Suite 450, 5 Douglas Ave., Elgin, Illinois 60120.

**EDITOR, AMERICAN SCIENTIFIC AFFILIATION NEWS:**

WALTER R. HEARN, 762 Arlington Ave., Berkeley, California 94707.

**PUBLICATIONS** include the *ASA News* (sent to all members four to six times each year); four symposia: *Modern Science and Christian Faith*, F. Alton Everest, Editor, Van Kampen, Wheaton, Illinois (1950) (out of print), *Evolution and Christian Thought Today*, Russell L. Mixer, Editor, Eerdmans, Grand Rapids, Michigan (1960), *Our Society in Turmoil*, G. Collins, Editor, Creation House, Carol Stream, Illinois (1970), and *People, Power and Protein, Journal ASA Supplement 1* (1976). Individual authors are also encouraged to publish independently.

**LOCAL SECTIONS** of the American Scientific Affiliation have been organized to hold meetings and provide an interchange of ideas at the regional level. Membership application forms, ASA publications and other information may be obtained by writing to: AMERICAN SCIENTIFIC AFFILIATION, Suite 450, 5 Douglas Ave., Elgin, Illinois 60120.

CENTRAL CALIFORNIA

CHICAGO

DELAWARE VALLEY

GULF-SOUTHWEST

INDIANA

NEW ENGLAND

NEW YORK CITY AREA

NORTH CENTRAL (Minnesota)

ONTARIO

OREGON

RESEARCH TRIANGLE (North Carolina)

SAN DIEGO

SAN FRANCISCO BAY

SOUTHERN CALIFORNIA

WASHINGTON-BALTIMORE

WESTERN MICHIGAN

WESTERN NEW YORK

**1977 ANNUAL ASA MEETING**

*The Annual Meeting of the ASA will be held at Nyack College in Nyack, N.Y. on the Hudson on August 12-15, 1977. Dr. Kenneth Pike will be the principal speaker; he will be applying his linguistic skills to areas of interest to scientists and Christians. For further information on this annual meeting, write Bill Sisterson at 5 Douglas Ave., Elgin, Illinois 60120.*

SECOND CLASS POSTAGE  
PAID AT BRAINERD, MINN. 56401

248-4  
DR DONALD W MUNRO  
DEPT. OF BIOLOGY  
HOUGHTON COLLEGE  
HOUGHTON NY

14744

<i>In The Beginning . . .</i>	49	Valerie L. Mossman
The Unity in Creation	52	Russell Maatman
The Trauma of the Infinite Universe	56	Owen Gingerich
Creation: Pattern, God and Man	58	Daniel A. Tappeiner
Origins and the Bible	64	Joel Block
Creation and/or Evolution	68	David L. Willis
Evolution: A Personal Dilemma	73	D. Gareth Jones
A Biochemical View of Life	76	Jerry D. Albert
A Critical Evaluation of Evolution	84	Pattle P. T. Pun
The Theory of Social Evolution and the Concept of Entropy	91	Loren W. Dow
BOOK REVIEWS		
<i>Blaise Pascal: The Genius of His Thought</i>	94	Roger Hazelton
<i>Ethics for Environment: Three Religious Strategies</i>	95	David Steffenson, Robert S. Cook, and Walter J. Herrscher
<i>Providence Lost: A Critique of Darwinism</i>	96	Richard Spilsbury
"Upholding the Universe by His Word of power."	Hebrews 1:3	

VOLUME 29 NUMBER 2

JUNE 1977

*Was Our Face Green!*

Readers of the *Journal ASA* who have it all together will have realized that the cover color of the March 1977 issue was not the *blue* color that it was supposed to be. For eight years past the *Journal* has been consistently color-coded: *blue* for March, *green* for June, *orange* for September, and *red* for December. This year, however, there are two green issues. Connoisseurs and collectors may want to hang on to this March 1977 issue—it may have special value because of this error and become known as "the green March issue."