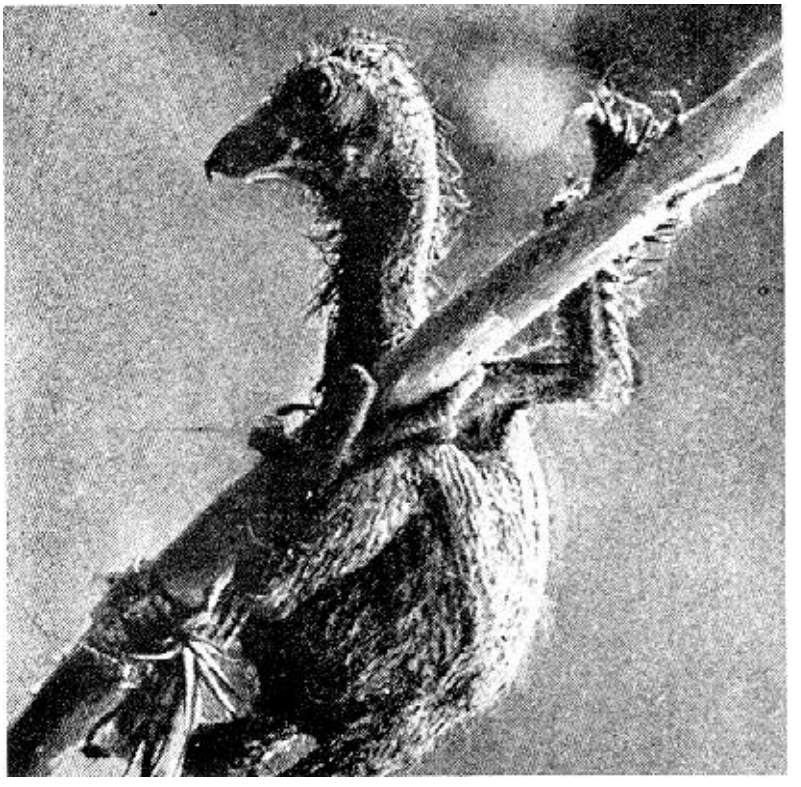
# CREATION RESEARCH SOCIETY QUARTERLY



**Haec credimus:**

**For in six days the Lord made heaven and earth, the sea, and all that in them is and rested on the seventh. — Exodus 20:11**

**VOLUME 11** **DECEMBER, 1974** **NUMBER 3**

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VOLUME 11 DECEMBER, 1974 NUMBER 3



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## COVER ILLUSTRATION

This illustration shows a young Hoatzin Bird clinging to a tree branch by means of claws on its wings. The presence of wing claws has been considered a mark of primitiveness. But certainly the "primitive" Hoatzin is very much alive today. For further discussion of this unusual bird, see the facing page. This picture is from *College Zoology* by Robert W. Hegner and Karl A. Stiles, Sixth Edition, published in 1951 by the Macmillan Publishing Company, New York, and is used here by permission of the publishers.

## CREATION RESEARCH SOCIETY

**History** The Creation Research Society was first organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creationism, with a current membership of about 500 voting members (with graduate degrees in science) and over 1600 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and is now recognized as probably the outstanding publication in the field.

**Activities** The Society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible.

# THE STRANGE HOATZIN

FRANK L. MARSH*

Shown here is a mature Hoatzin, an adult of the young bird shown on the cover. This bird, the *Opisthocomus hoazin,* inhabits northern South America. When full-grown, it is about the size of a medium turkey.

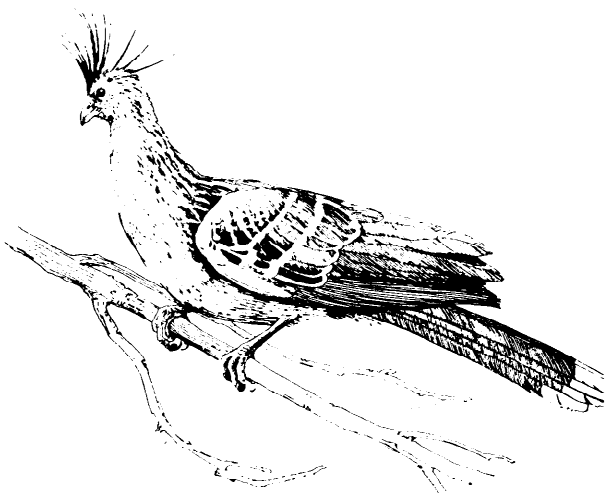
Of interest to creationists is the fact that it has certain features which are like those attributed to the extinct *Archaeopteryx.* This is especially true of the claws on the wings. Presence and use of the claws can be seen clearly in the picture on the cover.

It is often maintained, on the basis of these claws, and some other features, that the *Archaeopteryx* was a transitional form, between reptiles and birds. But the living Hoatzin, which is clearly a bird, has similar wing structures.

Incidentally, is it not true that some bats have functional claws on their wings? Is any evolutionist going to claim that the *Archaeopteryx* was not a reptile on the way to becoming a bird, but rather a bird on the way to becoming a bat?

An article by Cousins deals with the similarities of the Hoatzin and the *Archaeopteryx* at greater length.[1] Also, an article in the *National Geographic Magazine,* some years ago, described the Hoatzin in its natural habitat.[2]

This picture of the mature Hoatzin is from



*Fundamentals of Ornithology* by Josselyn Van Tyne and Andrew J. Berger, published in 1959 by John Wiley and Sons, Inc., New York, and is used here by permission of the publishers.

*Frank L. Marsh, Ph.D., is Professor Emeritus of Biology at Andrews University, and lives at 216 Hillcrest Drive, Berrien Springs, Michigan 49103.

### References

[1]Cousins, Frank W. 1971. The alleged evolution of birds (in) Symposium on creation III. Edited by Donald W. Patten. Baker Book House, Grand Rapids, Michigan, pp. 87-99.

[2]Grimmer, J. L., and M. W. Williams. 1962. Strange little world of the Hoatzin. *National Geographic Magazine,* 122 (3):391-400 (September).

# GOD'S PERSONALITY REVEALED BY NATURE†

WILLIAM J. TINKLE*

*It seems that, in nature, no sooner is a rule formulated than an exception is identified. Sexual reproduction, for instance, is the rule among the higher living beings; yet parthenogenesis occurs occasionally. If the nature of living beings were controlled by some mechanical process of selection, it would be hard to see why there should be so much variety. But since creationists hold that the nature of living organisms is due to a Creator who might be considered an Artist and likes variety, all of this variety in nature is what should be expected. In fact, it might be one of the predictions of the Creationistic viewpoint that the more closely nature is examined the more variety will be found. At the same time, these facts show that the Creator is not a machine-like being, but One to whom personality may be ascribed.*

### Some Leaves Fall, Others Stay

Looking at my wild flower garden I was impressed by the difference among plants growing in the same habitat. The garden is a mere strip at the foot of a wall shaded by overhanging trees but a considerable population of tiny perennials is crowded into it.

It seems that living things should reveal something about the Creator, just as, "The heavens declare the glory of God and the firmament showeth his handiwork."[1]

The harbinger of spring, *Erigenia bulbosa,* and Dutchman's breeches, *Dicentra cucularia,* lost their leaves late last spring, retreating into the compact packages which are called corms and bulbs, respectively. These tiny plants open their leaves to the sun early in the spring to make and store food, then "close up shop" until the next

†This paper represents, in part, an expansion on some ideas set forth in a note in *The Naturalist,* Escondito, California, Vol. 25, No. 1, Spring, 1965.

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spring. They are well fitted to live under deciduous trees, ripening seeds and storing food for the next year before leaves come out on the trees to limit their supply of light.

But no sooner is this principle established about the spring wild flowers of the woods than exceptions are noted. For the bloodroot, *Sanguinaria canadensis,* one of the first to blossom, holds its leaves until late in summer. And to excite wonderment as to how it is done, the liverleaf, *Hepatica triloba,* holds its leaves all winter. The leaves may turn purple and brown in spots but they still hold some precious protoplasm and chlorophyll.

Deciduous trees do not dry out during the winter when water is frozen in the soil and therefore unavailable. The leaves, from which water is easily lost, fall off and the leaf scars are covered by a corky layer. Conifer trees hold their leaves, but they are thick and narrow, giving little area for transpiration. Yet the holly tree, *Ilex opaca,* has broad leaves and holds them all winter. They are covered by a coating of cutin which prevents undue transpiration.

What do these various observations suggest as to the formation and control of the world? Is God machine-like, or a person (not with human limitations of course, but having personality)? A machine works only in one way. When I strike the key on the typewriter marked "h", the letter "h" appears on the paper in the typewriter. If there is a variation, it is due to my action, not the typewriter, unless the machine is broken, but then it is useless. God, on the other hand, accomplishes His work in various ways. It is a characteristic of clover leaves that they have three leaflets, yet occasionally one with four leaflets is found. A machine would make all clover leaves with three leaflets, if it made them at all.

### Variations in Reproduction

Now consider the complex process of reproduction for evidence as to the nature of God. It is a well-known fact that a machine does not reproduce itself. This, however, is not the point to which I am calling most attention. One might surmise that God had established some all-embracing principle in this process, and thus the production of a new generation would resemble the product of a modern, complex machine.

When Camerarius (1665-1721) established the fact that there is sex in plants,[2] it seemed that male and female parts are necessary throughout nature. Stamens, the "male" organs, form pollen grains while carpels, the "female" organs, form embryo sacs. The need for male and female animals was known previously of course.

But no sooner is a biological principle established than an exception is noted. It was observed that a queen bee that has not mated with a male (drone) lays eggs and (contrary to the rule) the eggs hatch—but when full grown the resulting bees invariably are drones. Then it was established that all drones come from eggs which are not fertilized by union with a sperm. In other words, a drone bee has no father. This unusual process, called parthenogenesis, is found regularly in aphids, rotifers, and a few other animal groups.[3]

After Gregor Mendel finished his famous work on peas in 1865, a former teacher asked him to cross varieties of hawkweed.[4] Mendel worked faithfully and ruined his eyes on the tiny flowers but could not interpret his results. No one at that time knew that hawkweed, like dandelion, reproduces by parthenogenesis.

In regular sexual reproduction there are two functions of the sperm: it brings in a set of chromosomes with certain genes, and also gives a stimulus to start growth. In parthenogenesis no sperm enters the egg and the start of growth comes as one event in a series of developments. Such a process is not likely to "evolve," being an unrelated and isolated occurrence.

Parthenogenesis was discovered by observation of plants and animals. It could not have been predicted by a study of scientific laws but rather, on the basis of scientific laws alone, would have been called impossible. Scientists, who find dealing with groups and generalizations (laws), most useful, tend to pass by, ignore, and even deny exceptions.

The birth of Jesus Christ was not by parthenogenesis; not a chance occurrence, but planned by God and carried out by the Holy Spirit.[5] But perhaps God, in the beginning, started this exceptional method to demonstrate that He is not bound or limited by methods which He used on more numerous occasions.

Another latitude in reproduction is vegetative growth from cuttings. In this method, usually a plant starts from a portion of stem placed in water or soil, but African violets and some begonias start from a leaf. The growth of a plant from a cutting is an exception to the rule of development from a seed. If there were a country where this vegetative reproduction had never been observed, scientists there might rule it out as an impossibility. They would say that roots start from roots, not from stems or leaves.

The origin of the first woman from a portion of the side of the first man[6] is considered by some persons, an impossible occurrence. If it had occurred many times, however, it could not be considered improbable. But an event does not have to occur twice in order to occur once.[7]

The Deists claim that God manifests Himself by setting up laws which govern the universe but that He does nothing more. They say indeed that nothing more is needed, for these laws are uni-

versal and cannot be broken. This ascribes a kind of mechanical action to God.

### Exceptions to Physical Laws

What could be more universal than the law of gravitation? According to the old rule of thumb, "All that goes up must come down." But fine dust from the volcano Krakatoa encircled the earth and remained in circulation many months. Dissolved sodium chloride or copper sulfate in water never does settle. When particles are very small the effect of gravity upon the particles is less than other forces, such as molecular motion.

Perhaps the reader has seen the insect called water strider, *Gerris*, skimming along on the surface of the water. By experiment I have found that it is heavier than water but it floats upon the surface film, because the water strider is not heavy enough to break the surface film.[8] In this instance also, the usual result from gravity is not noted; gravity is weaker than cohesion.

Deists make much of the regularity of the earth's movements. Indeed it is remarkable that days and years are predictable to a second of time. But modern researchers have shown that tiny particles, such as electrons, are not predictable as individuals. Individual motions of the myriads of particles that constitute a planet are canceled out, with the result that the planet's motion is regular.

### Conclusions

To one who looks upon nature without prejudice, it would seem that personal control is revealed. God is not limited to one method, but uses a principle or force at His discretion. It is true that He works with the amount of regularity necessary to bring about concord, but what about the statement that God's laws cannot be broken? God is not limited by laws which He himself has made.

Scientists have done much to help humanity and it is greatly evident, especially in traveling, industry, and the healing arts. But effects of the scientific pursuit upon the philosophy of life, I greatly regret to say, have not always been good. This is even more true of the religion of evolution, which often, though not necessarily, accompanies science.

The person who worships science to the extent that he thinks there can be no exception to natural law has a ceiling over his belief. It may be such a low ceiling that he deletes the strongest passages in the Bible and robs himself of the grace of God.

The members of the Creation Research Society have learned to employ science rather than to worship it; and to reject the religion of natural origins which sometimes accompanies scientific study.

But contemplation of God should not stop with nature. The Bible reveals much more about the personality of God; He will be found to be not only powerful and wise, but also loving and forgiving.

### References

[1]Psalms 19:1.
[2]Sturtevant, A. H. 1965. *History of Genetics*, Harper & Row, p. 2.
[3]Moment, G. B. 1958. General Zoology, Houghton-Mifflin, pp. 132, 264.
[4]Iltis, Hugo. Life of Mendel.
[5]Luke 1:26-38.
[6]Genesis 2:18-23.
[7]Might it be suggested that the method by which Eve was created is analogous to that of growing a plant from a cutting? In both cases a pure strain, in Eve's case the line of Adam, is preserved. Humanly speaking, it is not possible to keep a human "cutting" alive long enough to reproduce the necessary organs; but "with God all things are possible."
[8]Lluham, Rosalie. 1923. *Introduction to Zoology* through nature study. Macmillan, p. 316.

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**Statement of Belief** Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms.

We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. Subsequently a Revised Edition (1974), a Teachers' Guide and both Teachers' and Students' Laboratory Manuals have been published by Zondervan Publishing House. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientfically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

2. All basic types of living things, including man, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

3. The great Flood described in Genesis, commonly referred to as the Noachian Flood, was an historic event worldwide in its extent and effect.

4. We are an organization of Christian men of science who accept Jesus Christ as our Lord and Saviour. The account of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Saviour for all mankind. Therefore, salvation can come only through accepting Jesus Christ as our Saviour.

# A QUANTITATIVE COMPARISON OF THE CARBON IN THE BIOMASS AND COAL BEDS OF THE WORLD

HARRY V. WIANT, JR.*

*Calculations indicate the quantity of carbon contained in the coal beds of the world is 4.9 times greater than that in the present biomass on the earth, but only 1.4 times that which would be present if all land area were as productive as the tropical forests of today. The order of magnitude of these comparisons supports the creationist's position.*

Coal will probably become increasingly important with regard to meeting the energy needs of the world population. The great abundance of coal has been estimated at $7.39 \times 10^{12}$ metric tons. Of this quantity, about 52% is bituminous, 41% subbituminous and lignite, and 7% anthracite coals.[1]

One might question whether the biomass, the accumulated living organic matter, present on the earth at the time of the Noachian flood could have been sufficient to form such large amounts of coal. A comparison of the amount of carbon in the biomass and coal beds of the world may be of value.

### Amount of Carbon in World Biomass

The biomass of the world has been estimated at $1.86 \times 10^{12}$ dry metric tons.[2] Various analyses of dry organic matter show it to be about 49% carbon,[3] indicating the biomass present on the earth would supply $9.11 \times 10^{11}$ metric tons of carbon.

However, the vegetation on the earth is assumed to have been much more luxuriant before the flood, and fossils found in coal indicate tropical-like conditions must have prevailed. Assuming all the earth's land surface were as productive as the tropical forests of today, a biomass of $6.62 \times 10^{12}$ metric tons, or $3.24 \times 10^{12}$ metric tons of carbon, is calculated.[4]

### Amount of Carbon in World Coal Beds

Using average amounts of carbon in coal (69% for bituminous, 45% for subbituminous and lignite, and 92% for anthracite coals),[5] $4.49 \times 10^{12}$ metric tons of carbon are contained in the coal beds of the world. It should be pointed out that there may be double the amount of coal in the world as has been estimated, or there may be less than half that amount.[6] The order of magnitude of these figures, nevertheless, is of interest.

### Comparison of Carbon in Biomass and Coal Beds

Dividing the carbon found in coal beds by that available in the biomass ($4.49 \times 10^{12}/9.11 \times 10^{11}$) indicates the coal beds contain 4.9 times the carbon found in the present biomass. Assuming the earth's surface before the flood were as productive as our tropical forests of today, however, coal beds contain only 1.4 times the carbon of this potential biomass ($4.49 \times 10^{12}/3.24 \times 10^{12}$). This figure is particularly interesting to the creationist, especially when it is remembered that data used are based on rough estimates and more land area may have been present before than after the flood. Also, the pre-diluvial lands may have been even more productive than the tropical forests of today.

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[2]Smith, R. L. 1974. Ecology and field biology. Second Edition. Harper & Row, N. Y., p. 38.

[3]Kormondy, E. J. 1969. Concepts of ecology. Prentice-Hall, Englewood Cliffs, N. J., p. 21.

[4]Calculated, using table in Smith, *Op. cit.*, p. 38.

[5]Miller, E. W. 1965. The mineral fuels (in) Conservation of natural resources. G-H. Smith, Editor. John Wiley & Sons, N. Y., pp. 354-357.

[6]Whitcomb, J. C., Jr., and H. M. Morris. 1964. The Genesis flood. The Presbyterian and Reformed Pub. Co., Philadelphia, p. 162.

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# LET'S DEFLATE THE BIG BANG HYPOTHESIS!*

ROGER L. ST. PETER†

*The hypothesis that the universe is the product of a BIG BANG about ten billion years ago is challenged from several standpoints. It is shown to be in conflict with Einstein's special theory of relativity, and counter to the law of the conservation of mass-energy. In addition to this, semi-Newtonian calculations are submitted which indicate that the so-called PRIMORDIAL FIREBALL would vigorously collapse rather than violently explode. The gravitational collapse is irreversible by any known natural process, and a BLACK HOLE results. The big bang hypothesis is seen to fail as an explanation of the general expansion of the universe inferred from the galactic red-shift phenomenon.*

## Introduction

The big bang hypothesis is hailed as the "scientific genesis" of modern time. Some accept it because they feel it effectively does away with God as Creator of the universe. It is implicitly atheistic, and any theistic version of it is a patent contradiction in terms.

The main tenets are summarized in a physics text, as follows:

> According to the big bang theory, about $10^{10}$ years ago all of the matter and energy now in the Universe were concentrated in a single *fireball* in which the density was $\geq 10^{25}$ g/cm$^3$ and the temperature was $\geq 10^{16}$ °K. The radiation pressure was tremendous in this fireball and it expanded outward with explosive rapidity—the *big bang*. Those parts of the fireball that had the greatest relative velocities are now concentrated in the distant galaxies that we see (as they were $\approx 2 \times 10^9$ years ago) receding from us with high velocities. Thus, the general expansion of the Universe results in a natural way from the big bang theory.[1]

To this brief summary George Gamow, the main proponent of the big bang hypothesis, would add: In the beginning the vast infinite volume of space of the universe *was already* filled with a uniformly dense but very tenuous cloud of gas[2] which collapsed under its own gravitational force into a state of inordinately high temperature and density (the Big Squeeze).[3]

This superhot-superdense state was the so-called primordial fireball, which, Gamow said, was both infinite in mass and extent.[4] From it the present universe is supposed to have "evolved." The big bang hypothesis does not postulate any real *ex nihilo* creation;[5] instead, mass-energy is assumed to be eternal. Thus, the big bang belief is that the universe is the product of the IMPERSONAL x TIME x CHANCE.[6]

## Basis of the Big Bang Hypothesis

The observational basis of the big bang hypothesis is the galactic red-shift phenomenon. Briefly put, distant galaxies are observed to have remarkably great red-shifts.[7] A red-shift is the displacement of lines in a spectrum toward longer wavelengths. The amount of red-shift of a galaxy is proportional to its distance from the earth.[8] (Figure 1)

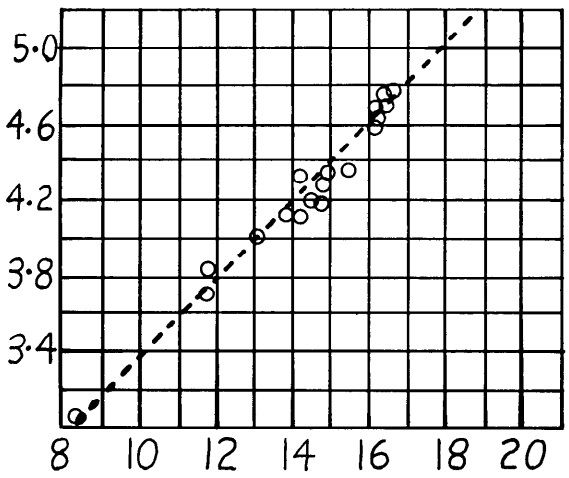


**Figure 1. The galactic luminosity-redshift relationship. Logarithm of the redshift (plotted vertically) vs. logarithm of the bolometric magnitude (plotted horizontally). From this relationship astronomers have inferred that the universe is expanding, and that the rate of recession of a galaxy is proportional to its distance from the earth. This inference is based on the Doppler effect.**

By means of the Doppler effect astronomers have inferred that the distant galaxies are receding from the earth at high speeds, which are said to be proportional to their distances from the earth.[9] The Doppler effect is the apparent change in the wavelength of light emitted by a source moving relative to an observer.[10] Light from an approaching source would appear shifted toward the violet end of the spectrum, while light from a receding source would appear red-shifted.

*The term "hypothesis" is not used in a rigorous way in this article. In scientific work all hypotheses are testable in some way. But the big bang "hypothesis" concerns origins which are untestable by scientific means. In this article the term "hypothesis" is taken to mean a guess or speculation.

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The fundamental assumption of the big bang hypothesis is that the universe is undergoing a general, large-scale, relatively uniform expansion. This assumption is vital to the big bang hypothesis. The idea that the universe is expanding has been *inferred* from the galactic red-shifts by using the Doppler effect.[11]

However, not all astronomers agree with the Doppler effect interpretation. One of these is Gerald Hawkins of Boston University.[12] Another is Gp. Horedt, who states: "It is shown that from the observational viewpoint no conclusive distinction can be made at present between expanding and static world models."[13] According to Horedt, the red-shift may not be caused by any actual recession of galaxies, but by the exponential decay or energy loss of photons of light.[14]

He also mentions problems of the discrepancy between observed and calculated mass-energy densities, singularities, and the immense forces needed to produce the expansion in the big bang models.[15] It is unsafe to be dogmatic that the universe is expanding, although for the sake of argument the expansion assumption will be granted in this paper.

It goes without saying that, if the Doppler interpretation of the galactic red-shift phenomenon is ever demonstrated to be incorrect, then the observational basis of the big bang is gone, since it is an attempt to explain an expanding universe.

The philosophical basis of the big bang hypothesis is the "vaporous verbiage" known as uniformitarianism. Briefly, this is the idea that the universe is a closed system where there is no God to alter the order of cause and effect.[16] It is a dogma of evolutionists that existing physical laws and processes are sufficient to account for the origin and all past changes in the earth and the universe.

By means of unwarranted extrapolation, the evolutionist attempts to do the impossible—to account for the present existing order and complexity of the universe where only a statistical thermodynamic equilibrium should exist, and to account for the existence of man as a personal, rational, conceptualizing being of great dignity where only impersonal, inanimate mass-energy should exist.[17]

### Circular Reasoning

It should be noted that the big bang is supported mainly by circular reasoning. Imagine the following during an astronomy class where the big bang concept is being taught:

Instructor: ". . . As we have noted, the universe is in a present state of expansion as the result of the big bang which occurred thirteen billion years ago."

Student: "Sir? How do we *know* that there was a big bang?"

Instructor: "Well, we know there was a big bang *because* the universe is still expanding as a result of the blast. . . ."

It takes little discernment to detect this line of thought. Yet this type of reasoning is often used to "prove" evolution.

### The Big Bang Is Not Science

One thing should be obvious at this point: *there were no human beings present to observe the creation of the universe. Since there were no observers, then the matter of creation is outside the legitimate realm of science.* Paul A. Zimmerman points this out very well:

> This shows clearly what cosmogonical thinking is. It is good, clean fun for an astronomer, a mathematician, a chemist, a physicist. It is an exercise in working out a logical scheme of proposed events which would lead to the formation of the earth and solar system as we find them now. It is a game, the rules of which are observed physical and chemical laws. But even if one wins the game by devising a perfect system that accounts for every detail of the properties of the heavenly bodies, he still will not have proven things did, in fact, take place as he deduced they might have.[18]

Without observational authority to back it up, the big bang hypothesis is nothing but a mental construct, a philosophical speculation, the product of the minds of men who have not observed the event "described." This clearly is not science.

Furthermore, the big bang hypothesis does not "fit" the *rules* of cosmogonical speculation. There is something about *observed physical laws* that tends to debar the big bang even as a tenable hypothesis. The rules in question, in this paper, are: (1) Einstein's special theory of relativity, (2) the law of the conservation of mass-energy, and (3) Newton's law of universal gravitation. The big bang concept clearly is counter to these observed "physical laws."

### Current Cosmological Confusion

To analyze the big bang hypothesis, one must select a model as a basis for making calculations and conclusions. But to do this requires having a set of "initial" values or conditions. One needs figures for the mass, density, temperature, and composition of the fireball at the instant the expansion began. There is confusion, however, about what these initial values are.

George Gamow called for a maximum density of $10^{14}$ g/cm$^3$ and an unspecified temperature.[19] Menzel, *et al.*,[20] call for an initial temperature of about $10^{12}$ °K. Jerry B. Marion[21] gives a density

and temperature in the neighborhood of $10^{25}$ g/cm$^3$ and $10^{16}$ °K.

Tayler mentions the proponents of a "hot big bang" favoring infinite density and infinite temperature.[22] But proponents[23] of the "cold big bang" (Zeldovich) favor infinite density and absolute zero (0 °K!).

There is also confusion about how long ago the big bang took place. Gamow seemed to have trouble making up his own mind about this. He has given figures of several billion years,[24] 4.3 billion years,[25] and 5 billion years ago.[26] Peebles and Wilkinson say it happened 7 billion years ago.[27] Marion wants 10 billion years,[28] and Sandage desires 18 billion years.[29] (I suggest that the big bang has never occurred, and that all of these dates and densities are irrelevant.)

### Big Bang and Special Relativity

According to Einstein's special theory of relativity, no material object having a "rest" mass greater than zero can equal or exceed the velocity of light in a vacuum.[30] The "massless" particles travel at the speed of light (photons and neutrinos). According to the theory, any object, which has a non-zero "rest" mass, as it approaches the speed of light increases in mass beyond all bounds.[31] Mass increase:[32]

$$m' = m_0/\sqrt{1-v^2/c^2} \qquad (1)$$

where $m'$ is the "relativistic" mass in grams, $m_0$ is the "rest" mass in grams, $v$ is the velocity of the moving object with respect to the observer's "rest" frame in cm/sec, and $c$ is the speed of light *in vacuo*.

As the object approaches the speed of light its mass, and *hence its resistance to further acceleration,* increases beyond all bound. Consider the left-handed limit as $v$ approaches $c$, (i.e. $v$ is still less than $c$):

$$\lim_{v \to c^-} m_0/\sqrt{1-v^2/c^2} = +\infty \qquad (2)$$

By definition an infinite mass cannot be accelerated by any finite force. Newton's second law can be written:

$$\vec{F} = \frac{d}{dt}(m\vec{v}) = m\frac{d\vec{v}}{dt} + \vec{v}\frac{dm}{dt} \qquad (3)$$

The effect of an accelerating force is to increase the mass as well as the velocity.[33] It is seen that as the velocity of the object gets closer to that of light, its acceleration slows down due to the increasing mass. Thus it is not possible for a finite force to accelerate a finite mass to exactly the speed of light in any finite period of time.

How is all this relevant to the big bang? In his book, *Matter, Earth, and Sky,* Gamow made it clear that he believed that the primordial fireball was both infinite in mass and extent.[34] In other words, the fireball at the beginning of the expansion *already filled* the vast infinite reaches of space! According to Gamow, this infinite fireball expanded uniformly.[35]

In a uniformly expanding fireball, the rate of recession of a particle from any given reference point is directly proportional to its distance from that reference point. Since an infinite fireball has nothing that can be properly called a center of expansion (an infinite fireball, by definition, has no center nor edge), one can arbitrarily select a reference point as the "relative center of expansion." Let everything recede from this point. Assume that the Hubble relationship[36] is valid, i.e. that the speed of recession is found by the formula

$$v = Kr \qquad (4)$$

where the velocity is $v$, $K$ is the Hubble constant (which isn't a "constant" because it changes with time—changed from 536 km/sec per megaparsec to 53 km/sec per megaparsec)[37] and $r$ is the distance of the receding particle from the reference point.

Suppose several particles are observed in the fireball receding from the earth at high speed. Let particle *one* be at a distance of, say, 65 million miles and moving at 0.5 times the speed of light; particle *two* at 130 million miles and 1.0 times the speed of light; and particle *three* at 260 million miles be receding at 2.0 times the speed of light, etc.

Since the expansion is uniform, a particle at $n$ x 130 million miles would recede at $n$ x 1.0 times the speed of light. It makes no difference if $n = 3.145926536\ldots$, or if $n = 6.023 \times 10^{23}$! Something an infinite distance away would have to travel at infinite speed. This is something to think about, since Einstein's theory is incompatible with this kind of fireball.

In fact, all the matter beyond the point

$$r = c/K \qquad (5)$$

would have to exceed the speed of light.[38] That is an infinite amount, since the fireball is infinite. (Only the finite amount of matter within this radius would be traveling at speeds less than that of light.) Einstein's theory rules this part of the big bang hypothesis out. Theoretically matter cannot exceed the speed of light in a vacuum. This means that an infinite fireball could not expand.

The big bang must involve a finite fireball, which has an actual center of expansion, and whose surface recedes from its center at less than the speed of light. Now that the necessity of a

finite fireball is seen, it is possible to make a meaningful analysis based on the cosmogonists' figures for the "initial" state.

### Big Bang and Conservation of Mass-Energy

In the calculations to follow, figures representing the initial conditions will be those from Jerry B. Marion.

According to Marion the source of pressure which caused the expansion of the fireball was furiously hot radiation.[39] Gamow certainly agreed with this, that radiation is very important to the big bang hypothesis. He stated:

> From the laws of classical physics, we can derive the fact that the density of radiation in an expanding volume will drop faster than the density of matter in the same volume. We then have to assume that *during the earlier stages of expansion the weight of the radiation in each volume of space exceeded that of the matter in the same volume.* During these epochs ordinary matter did not count, and the main role was played by intensely hot radiation.[40] (Emphasis in original.)

To this Gamow added the following note:

> If the edge of a cubical container is increased by a factor $a$, its volume will increase by a factor $a^3$, and the density of matter in it will decrease by the factor $a^3$. But the temperature of the radiant energy in the volume will decrease by the factor $a$ (Wien law), so that its density drops by the factor $a^4$ (according to the Stefan-Boltzmann law).[41]

Interesting! To find the "weight" (ponderable mass) of the radiation in the fireball, one need only invoke Einstein's famous principle of equivalence of matter and energy:[42]

$$E = mc^2 \qquad (6)$$

where $E$ is energy in ergs, $m$ is mass in grams, and $c$ is the velocity of light in cm/sec. Divide the energy density of the radiation (erg/cm$^3$) by the square of the velocity of light to get the density or "weight" in grams per cubic centimeter.

Radiant energy having ponderable mass is no trivial matter. This fact alone ruins the big bang hypothesis, for Gamow's statements above clearly mean nothing less than absolute and total annihilation (and not mere conversion or transformation to something else) of huge quantities of mass-energy.

According to the first law of thermodynamics, in any natural process, mass-energy is conserved. It may change its form from matter to energy or vice versa, but it is neither created nor destroyed by the natural process. This is the law of the conservation of mass-energy. The big bang hypothesis runs counter to this law of conservation.

### Calculation of Mass-Energy Loss in Big Bang

Using, as a specific example, the initial density and temperature specified by Marion, it is possible to compute how much mass-energy would have to vanish right out of existence according to the big bang hypothesis. Marion calls[43] for a density of matter of $10^{25}$ g/cm$^3$ and a temperature of radiation of $10^{16}$ °K. To compute the ponderable mass of the radiation in the fireball, the following assumption will be made: the radiation is isotropic blackbody radiation. The energy density, $u(T)$, of the radiation is:

$$u(T) = \frac{4\pi}{c} I(T) = \frac{8\pi^5 k^4}{15c^3h^3} T^4 = aT^4 \qquad (7)$$

where $u(T)$ is the energy density in erg/cm$^3$, $c$ is the speed of light, $I(T)$ is the specific intensity of the blackbody radiation,[44] $k$ is the Boltzmann constant, $h$ is the Planck constant, $T$ is temperature Kelvin, $a$ is the Stefan-Boltzmann radiation constant of 7.5634 x $10^{-15}$ erg/cm$^3$ deg.$^4$ The energy density of $10^{16}$ °K radiation is 7.56 x $10^{49}$ erg/cm$^3$, which corresponds to a ponderable mass of 8.40 x $10^{28}$ g/cm$^3$. That is 4.2 tons of radiation for each pound of matter! (Figure 2)

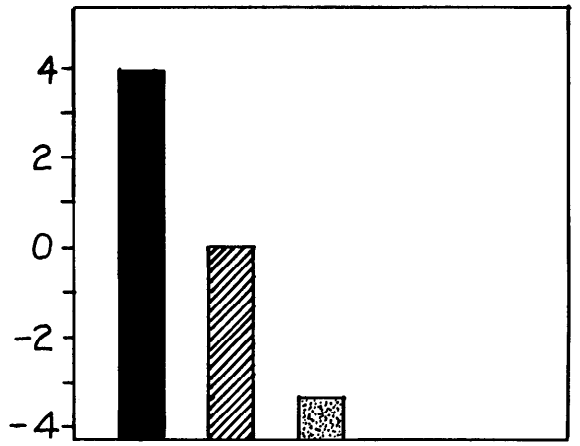


**Figure 2. Ratio of the density of so-called fireball radiation to that of ordinary matter in the universe. (Plotted vertically as a logarithm). Left: as it once was (8,400:1); middle: at some intermediate stage (1:1); right: as it is now (0.000446:1). According to the big bang hypothesis there were once tons of radiation for each pound of matter. But the reduction in energy density compared with that of matter indicates that the big bang does not agree with the law of the conservation of mass-energy.**

Now the question is, how much of this fireball radiation is there compared to the matter today in the universe? The average density of matter in the presently observable universe is estimated[45, 46] to be about $10^{-30}$ g/cm$^3$. This is about one hydrogen atom for each 1.67 cubic meters of space.

Much of the radiation in space now is starlight. But there is some microwave, blackbody, background radiation, which the big bang proponents are calling fossil fireball radiation (long sought but accidentally discovered).[47] This so-called fireball radiation is very nearly isotropic and has a temperature of a very cool 2.7° K, according to Marion,[48] which should embarrass supporters of the "hot big bang" because it is so cool.[49]

It should be noted that not all astronomers agree that this background radiation is a remnant of a primordial fireball. David Layzer and Ray Hively of Harvard University present an alternative to the "conventional interpretation" of the cosmic microwave background as fossil fireball radiation. They state:

> We postulate that the radiation was generated by ordinary astronomical processes (thermonuclear reactions in stars or gravitational collapse of objects of galactic mass) and subsequently thermalized by interaction with dust grains.[50]

As in the case of galactic red-shifts, so it is here; there is no monolithic bloc of opinion even among cosmogonists themselves—except perhaps that creationists are wrong.

By equation (7) the 2.7 °K blackbody radiation has an energy density of $4.02 \times 10^{-13}$ erg/cm$^3$, which corresponds to $4.46 \times 10^{-34}$ g/cm$^3$ of ponderable mass. Instead of 8400 pounds of radiation for each pound of matter, there is presently about 2200 pounds of matter for each pound of radiation.

Expressed as a ratio the change is apparent: from 8400 to 1 down to .000446 to 1! This is a reduction of almost 19 million times! That so much mass-energy could vanish without a trace is hard to acccpt.

It is therefore evident that the big bang hypothesis fails to agree with the law of the conservation of mass-energy. It fails to "fit" the "rules" Zimmerman has mentioned for cosmogonical speculation.

### Big Bang and Gravitation

Could it be that all this radiant energy would be "lost" in overcoming the gravitational potential energy of the fireball? Could it be that this lost radiation was converted into kinetic energy in the far off fast fleeing galaxies (provided they are really receding)?

This is a possibility if and only if there was enough thermal and radiant energy in the fireball to cause expansion in the first place. The proposed high density and temperature would result in incredibly high pressure, but the gravitation of all the matter and energy in the universe would also be very great.

For example, the sun, even though a hot mass of plasma, does not violently explode because the gravity produced by its immense bulk keeps it in hydrostatic equilibrium. In this case of the sun, the thermal forces that would tend to cause it to expand are counterbalanced by the gravitational force that would tend to cause it to collapse.[51] However, *the primordial fireball would collapse rather than explode!*

### A Model Fireball

Since it would be ill-advised to attempt to calculate forces in an infinite fireball, one would do well to use a finite model fireball. An infinite fireball is absolutely meaningless and is incompatible with the special theory of relativity.

Marion maintains that the fireball was a mass of furiously hot super-energetic protons, neutrons, electron-positron pairs, neutrinos, and photons.[52] This mass of nuclear gas was heated to $10^{16}$ °K, and had a density of $10^{25}$ g/cm$^3$ for the matter. It is assumed that the baryon composition is 50% protons and 50% neutrons.

If the big bang occurred 10 billion years ago, as Marion said it did, then one can assume that the Hubble radius (that distance from the earth, where the rate of recession of a galaxy in a uniformly expanding universe would be the speed of light) would not be more than 10 billion light years or $9.46 \times 10^{27}$ cm. Assuming that the space of the universe is Euclidean (zero curvature), the volume of the present universe would be about $3.55 \times 10^{84}$ cm$^3$.

Taking this volume and multiplying it by the mean density of matter ($10^{-30}$ g/cm$^3$), one gets a mass of $3.55 \times 10^{54}$ grams as the mass of the matter in the presently observed universe (about $1.8 \times 10^{21}$ solar masses).

All of this matter, if squashed to a density of $10^{25}$ g/cm$^3$, would fill a volume of $3.55 \times 10^{29}$ cm$^3$, resulting in the fireball having a radius of $4.39 \times 10^9$ cm. This model fireball is assumed to be uniformly dense throughout.[53]

### Calculation of Outward Versus Inward Forces in Fireball

The concepts of outward and inward forces need to be defined. An outward force is one that tends to cause the fireball to expand. In this case the outward force comes from the thermal energy of the hot gas and the radiation. The pressure of the gas and radiation tends to cause expansion. If there were no gravitational force in the fireball, the expansion would be very rapid indeed! But the big bang hypothesis fails to take gravity into account.

An inward force is one that tends to collapse the fireball by squeezing it to greater densities. In this case the inward force is strictly gravitational. Every one of the particles of matter and

photons of radiation in the fireball attract one another with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between them. This is the law of gravitation. In no case can the gravity of all the mass-energy in the universe be neglected.

To determine whether or not the fireball can expand, one need only to calculate the force outward produced by the hot gas and radiation and compare it to the force inward due to gravity.[54] In this case the comparison will be made at one point. Consider the fireball as made up of concentric layers or shells, each having a thickness of only one percent the total distance from edge to center, and take the point at the bottom of the outermost layer.

If the downward weight of all the matter and energy above this point is less than the upward force of the hot gas and radiation, then the outer layer will be accelerated upward at a rate proportional to the force remaining after the inward is subtracted from the outward, then by definition an expansion is indicated. But if the weight of the mass-energy in the outer shell exceeds the upward force then a collapse is indicated.

The amount of force that will accelerate this outer shell is equal to the difference between the inward and outward force,[55] and will carry the sign of the larger.[56] (Figure 3)

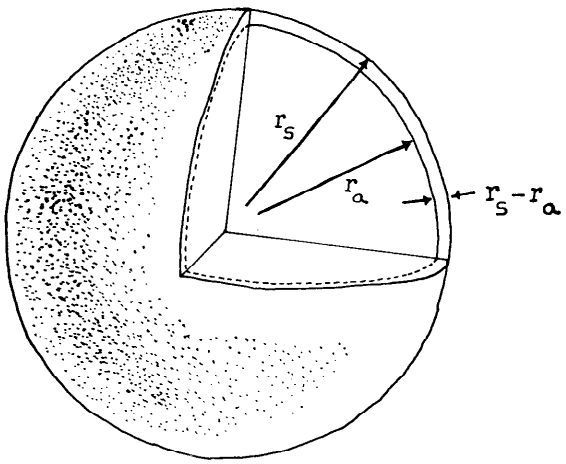


**Figure 3. The inward pressure, $P_{in}$, is the weight of the mass-energy above the radius $r_a$, which is 99% of $r_s$. The difference, $r_s - r_a$, is 1% of $r_s$, and is the thickness of the outer layer which contains about 3% of the total mass-energy in the fireball. The force of gravity is so great that the outer pressure of hot gas and radiation cannot blow the outer shell off.**

### Outward Force

The outward force is caused by the pressure of hot gas and radiation, and has at least three components: degenerate electron gas pressure, baryon pressure (the pressure of an ideal gas of protons and neutrons), and the radiation pressure. The equations of state in this discussion are standard, and can be found in the astrophysics texts listed in the references.

The degenerate electron pressure is the consequent of the Pauli exclusion principle. S. Chandrasekhar was the first to derive a relativistically accurate equation for this.[57] His equation will be used here, because the extreme density of the model fireball would indicate that the electrons would be degenerate, and their pressure would be related to the 4/3 power of their density.[58]

$$P_e = \frac{hc}{8H}\left(\frac{3}{\pi h}\right)^{1/3}\left(\frac{\rho}{\mu_e}\right)^{4/3} \qquad (8)$$

where $P_e$ is the degenerate electron pressure in dyne/cm$^2$, $h$ is the Planck constant, $H$ is the mass of one proton, $\rho$ is the density of matter, and $\mu_e = 2$ for a mixture of 50% $_1H^1$ and 50% neutrons. The electron pressure in Marion's fireball is 1.052 x $10^{48}$ dynes/cm$^2$.

The ideal gas law will be used to approximate the pressure of the heavy particles of the fireball (baryons). As it relates pressure to temperature it is[59]

$$P_b = NkT \qquad (9)$$

where $P_b$ is the baryon pressure in dyne/cm$^2$, $N$ is the number of baryons per cubic centimeter, $k$ is the Boltzmann constant, and $T$ is temperature Kelvin. In terms of density the above is

$$P_b = \frac{1}{\mu_b}\,\frac{\rho kT}{H} \qquad (10)$$

where $\mu_b$ is the "mean molecular weight" of the baryons ($\mu_b = 1$), and $H$ is the mass of a proton. The baryon pressure is 8.257 x $10^{48}$ dynes/cm$^2$.

Finally there is the radiation pressure. According to the Stefan-Boltzmann law the energy density is related to the fourth power of the temperature. As a result of this the pressure is[60]

$$P_R = \frac{1}{3}\,a\,T^4 \qquad (11)$$

where $P_R$ is the radiation pressure in dyne/cm$^2$, and $a$ is the Stefan-Boltzmann radiation constant of 7.5634 x $10^{-15}$ erg-/cm$^3$ deg$^4$. The radiation pressure is 2.521 x $10^{49}$ dyne/cm$^2$. Radiation acts like an ideal gas having one degree freedom of movement. It could be considered a photon "gas."

The total pressure produced by the hot gas and radiation is the sum of the individual components:

$$P_{out} = P_e + P_b + P_R \qquad (12)$$

The total outward pressure is 3.452 x $10^{49}$ dyne/cm$^2$, which, if gravity could be ignored, would be capable of blowing off the outer layer with an initial acceleration of 8.04 x $10^{12}$ cm/sec$^2$! The velocity of the expansion would become infinitesimally close to the speed of light within a matter of seconds, but gravity cannot be ignored.

### Inward Force

The question now is, outward pressure against what? The outward pressure or force in this calculation is exerted against a thin outer layer or shell of matter and energy having a thickness of one percent the total distance from edge to center, and about three percent of the total mass. This is a fair proposition. If the outward force is not sufficient to exceed the weight of this thin outer shell, then it is ridiculous to retain the big bang even as a tenable hypothesis of how the universe got here.

To more easily compute the force of gravity on the fireball, it is necessary to make one simplifying assumption, which George Gamow has already granted, that is that the fireball had a uniform density.[61] Now it is necessary to apply the equation of hydrostatic equilibrium and to invoke the principle of equivalence of matter and energy. The hydrostatic equilibrium equation:[62]

$$\frac{dP}{dr} = -\frac{GM'(r)}{r^2}\rho' \qquad (13)$$

since uniform density and temperature are assumed,

$$\frac{dP}{dr} = -\frac{4\pi G\rho'^2 r^3}{3r^2} \qquad (14)$$

$$= -\frac{4\pi}{3}G\rho'^2 r \qquad (15)$$

In differential form (note that $M$(r) is the mass inside radius $r$)

$$dP = -\frac{4\pi}{3}G\rho'^2 r\,dr \qquad (16)$$

which integrating from the surface, $r_s$, to some interior radius, $r_a$, yields

$$\int dP = \int_{r_a}^{r_s}\left(-\frac{4\pi}{3}\right)G\rho'^2 r\,dr \qquad (17)$$

$$P_{in} = -\frac{2\pi}{3}G\rho'^2(r_s^2 - r_a^2) \qquad (18)$$

if the special case of $r_a = 0$ (i.e. the center) the central pressure is the reduced form

$$P_c = -\frac{2\pi}{3}G\rho'^2 r_s^2 \qquad (19)$$

But if $r_a$ is the distance from the bottom of the outermost layer, then

$$P_{in} = -\frac{2\pi}{3}G\rho'^2(r_s^2 - r_a^2) \qquad (20)$$

but since in this case $r_a = 0.99r_s$, then $r_a^2 = 0.9801r_s^2$, and $(1 - .9801) = 0.0199$, which further reduces the shell pressure equation to

$$P_{in} = -\frac{0.0398\pi}{3}G\rho'^2 r_s^2 \qquad (21)$$

where $G$ is the universal gravitational constant, $\rho'$ is the density of the mass-energy of the fireball in g/cm$^3$, and $r_s$ is the radius of the fireball from edge to center (4.39 x $10^9$ cm).

According to Einstein's famous principle of equivalence of matter and energy, 9 x $10^{20}$ ergs of energy will exert as much gravity as one gram of matter. The tremendous quantities of thermal and radiant energy, even though a source of tremendous outward force, are also the source of great gravitation.

According to this principle, *every form of energy produces a gravitational field.*[63] This is not only true of the particles themselves, but also of diffuse energy fields and photons.[64] In fact radiation possesses some very particlelike properties:

(a) it exerts pressure like a gas made of fast lightweight particles (a photon "gas");[65]

(b) it has momentum (or else it could not exert pressure);[66]

(c) it loses energy when traveling upward out of a gravitational field (Einstein effect[67] demonstrated with the help of the Mossbauer effect[68]—photons, instead of slowing down, lose energy by means of a gravitational red-shift.[69]);

(d) and, it can be deflected by a gravitational field[70] (the bending of starlight passing near the sun has been observed during total eclipse).

This is bad news for big bang proponents. By invoking this equivalence principle, it is possible to see what contribution the ponderable mass of thermal and radiant energy make on the gravitational field.[71] The ponderable density, $\rho'$, is the sum of the density of the matter and the density of thermal and radiant energies divided by the square of the speed of light:

$$\rho' = \left[\rho + \frac{3\rho kT}{2\mu_b Hc^2} + \frac{a}{c^2}T^4\right] \qquad (22)$$

where the thermal energy density of the baryon gas is[72]

$$u_b(T) = \frac{3\rho kT}{2\mu_b H} \qquad (22')$$

and the radiant energy density is[73]

$$u_R(T) = aT^4 \qquad (22'')$$

This then makes the equation of central pressure to be

$$P_c = -\frac{2\pi}{3} G\left(\rho + \frac{3\rho kT}{2\mu_b Hc^2} + \frac{a}{c^2}T^4\right)^2 r_s^2 \qquad (23)$$

and the inward shell pressure to be

$$P_{in} = -\frac{0.0398\pi}{3} G r_s^2 \left(\rho + \frac{3\rho kT}{2\mu_b Hc^2} + \frac{a}{c^2}T^4\right)^2 \qquad (24)$$

For Marion's fireball this results in a central pressure of 2.574 x $10^{70}$ dyne/cm$^2$ and an inward shell pressure of 1.024 x $10^{69}$ dynes/cm$^2$. This shell pressure is the weight of the mass-energy above each square centimeter of the shell radius. This is the downward force crushing the fireball. It is clear that there is not enough thermal and radiant energy in the fireball to make a pressure that can overcome this titanic crush of the gravitational field of the fireball. The inward pressure is 2.97 x $10^{19}$ times greater than the outward pressure. A gravitational collapse is indicated.

### Limiting Mass for Hot Condensed Objects

It is interesting to note that the gravitational force would be sensitive to temperature changes in the fireball. It remains approximately constant until the temperature increase raises the density of the thermal and radiant energy to near that of matter. Then as the density of the energy equals, and then exceeds that of the ordinary matter, the gravitational force starts to increase proportionally to the square of the increasing energy density. See Figures 4, 5, and 6 for this relationship.

The author of this article has performed sufficient calculations to plot the curves on the graphs representing the ratio of inward force divided by the outward force for three different densities and several radii of various model fireballs.

There is a definite relationship to radius, density, and temperature in the fireball models. The smaller radii all favor expansions. The larger radii all favor collapse.

Also there is an optimum temperature favoring expansion. Any further increase of temperature beyond this point also increases the gravitational field on account of the increase in the density of the energy. Therefore, a critical or limiting mass for *hot* condensed objects exists!

Any mass greater than this limiting mass (which depends only on density and radius) cannot expand or even remain in hydrostatic equilibrium, but instead is doomed to gravitationally collapse no matter how hot it may be! The existence of such a limiting mass for *hot* condensed objects would definitely rule out the big bang hypothesis as being valid. This should not seem too hard to believe, since Chandrasekhar,[74] Wheeler,[75] and others already have proposed the existence of limiting masses for such *cold* condensed objects as white dwarf stars and neutron stars.

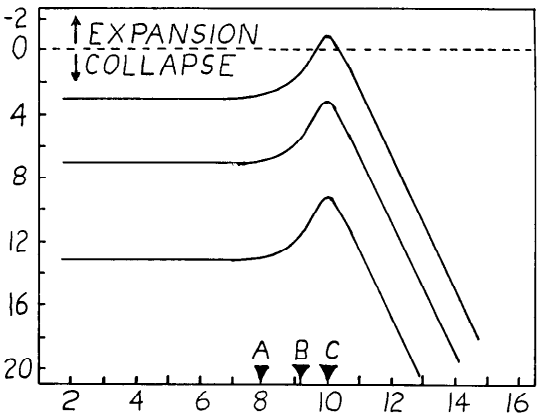


**Figure 4. Logarithm of the ratio of inward force to outward force in three model fireballs having a matter density of $10^5$ g/cm$^3$ vs. logarithm of the temperature. The three curves, from top to bottom, are for initial radii of 2.039 x $10^{11}$, 2.039 x $10^{13}$, and 2.039 x $10^{16}$ cm; and initial masses of 3.55 x $10^{39}$, 3.55 x $10^{45}$, and 3.55 x $10^{54}$ g. respectively. This takes into account matter only. (A) At 8.15 x $10^7$ °K, the baryon pressure exceeds the degenerate electron pressure. (B) At 1.49 x $10^9$ °K, the radiation pressure exceeds the baryon pressure. (C) At 1.04 x $10^{10}$ °K, the density of the radiation exceeds that of matter. The curve plunges rapidly due to the gravitational force of the energy content of the fireball, which is proportional to the square of its density.**

I am proposing the existence of a limiting mass for *hot* condensed objects. Because of this it is useless for big bang proponents to invoke temperatures in the magnitude of thousands or even millions of times hotter than the $10^{16}$ °K proposed by Marion. The increased temperature can only serve to dig a deeper grave under a greater gravitational field for the big bang hypothesis. The big bang should be discarded; a gravitational collapse is the only "fate" of the supposed primordial fireball.

### Escape from Gravity?

It is highly unlikely that any of the particles of the gas in the fireball will have sufficient kinetic energy to escape. How much energy would a particle (say a hydrogen atom) need to escape? Thermal energy of *one* particle, a hydrogen atom, is[76]

$$E_k = \frac{3kT}{2} \qquad (25)$$

This is the kinetic energy of a particle expressed as a function of its absolute temperature.

The potential energy of the gravitational field is the amount of energy the particle must over-

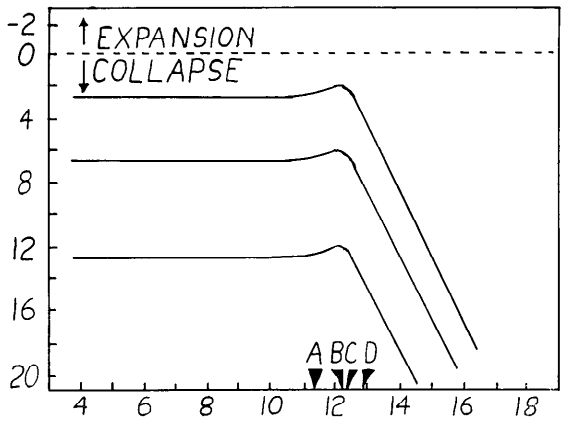


Figure 5. The same as Figure 4, but here the matter density is $10^{14}$ g/cm$^3$. This is the density specified by George Gamow. (A) At 2.75 x $10^{11}$ °K, the baryon pressure exceeds the degenerate electron pressure. (B) At 1.49 x $10^{12}$ °K, the radiation pressure exceeds the baryon pressure. (C) At 1.86 x $10^{12}$ °K, the density of the radiation exceeds that of matter. (D) At 7.27 x $10^{12}$ °K, the density of the thermal energy of the baryons exceeds the density of the matter itself. The masses indicated by the three curves are the same as in Figure 4; the initial radii, from top to bottom, are 2.039 x $10^8$ cm, 2.039 x $10^{10}$ cm, and 2.039 x $10^{13}$ cm respectively.

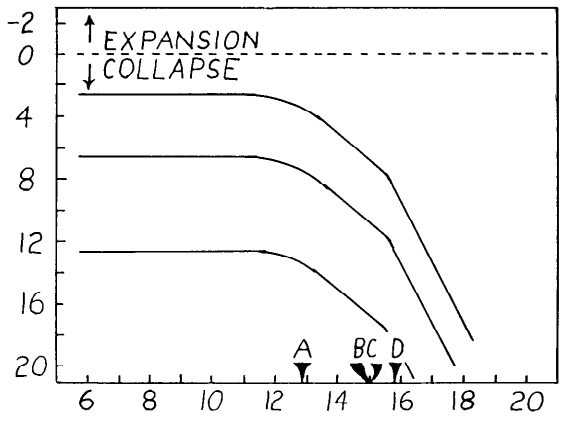


Figure 6. The same as Figure 4, but here the matter density is $10^{25}$ g/cm$^3$. This is the density specified by Jerry B. Marion. The masses indicated by the three curves are the same as in Figure 4; the initial radii, from top to bottom, are 4.39 x $10^4$ cm, 4.39 x $10^6$ cm, and 4.39 x $10^9$ cm respectively. (A) At 7.27 x $10^{12}$ °K, the density of the thermal energy of the baryons exceeds that of matter. (B) At 1.04 x $10^{15}$ °K, the density of the radiation exceeds that of matter. (C) At 1.27 x $10^{15}$ °K, the baryon pressure exceeds the degenerate electron pressure. (D) At 6.89 x $10^{15}$ °K, the radiation pressure exceeds the baryon pressure. This model has no optimum temperature favoring expansion unless one considers near absolute zero an optimum temperature! The inward force increases proportionately to the square of the increase in the energy density.

come if it is to escape. It is the amount of "work" that is done in moving a particle from a point on the surface of the fireball to a point infinitely far away. In this case the potential energy to be overcome is[77]

$$E_p = -\frac{GMm}{r_s} \qquad (26)$$

where $M$ is the mass of the fireball, $m$ is the mass of the particle trying to escape, and $r_s$ is the radius of the fireball from center to edge.

By using these two equations as an approximation, one should get a pretty good idea whether or not an average particle can escape. From equation (25) the kinetic energy of an average proton or neutron in a $10^{16}$ °K fireball is 2.07 ergs (which corresponds to a relativistic mass increase of 1.38 x $10^3$ times). This is about 1.29 x $10^3$ GeV of energy.

From equation (26) the energy needed for a proton or neutron to escape the fireball is 9.01 x $10^{13}$ ergs or about 5.6 x $10^{16}$ GeV. This is assuming a cold fireball where there is no thermal or radiant energy to increase the gravitational field whatever. That's something to think about—a $10^{16}$ °K hot particle cannot escape from a 0 °K fireball.

Even when all the ponderable mass of the energy is completely neglected, the energy needed to escape is 4.35 x $10^{13}$ times greater than what is available to a particle at that temperature. And if the ponderable mass of energy is included in the calculation, then obviously this difference will be even far greater. Considered from the standpoint of shell pressure and energy of escape, the conclusion seems inescapable: the primordial fireball must collapse rather than explode.

### Big Bang or Big Black Hole?

But what about the radiation? Could it escape and thus reduce the ponderable mass of the fireball to the point where the ordinary matter can escape? This also appears unlikely.

The gravitational field around the primordial fireball would be so intense that not even light quanta (photons) could escape. This state of affairs is known as a *black hole*.[78] This is the logical consequent of the Einstein effect, otherwise known as the gravitational red-shift phenomenon.

The idea is essentially quite simple: since photons have zero "rest" mass, they can travel only at the speed of light. But because photons do possess energy (and hence ponderable mass), they can be acted on by a gravitational field. So instead of slowing down as a particle of matter

would, a photon moving upward against a gravitational potential energy gradient will lose energy by means of a red-shift. This has been verified by the work of Rebka and Pound.[79, 80]

It is not necessary to resort to the sophistication of the general theory of relativity to illustrate this. This idea can be checked out quite well by ordinary Newtonian gravitational theory and quantum theory.

According to quantum theory, the energy of a light quantum (a photon) is a function of its frequency.[81]

$$E_q = h\nu \qquad (27)$$

where $E_q$ is the energy of a quantum in ergs, $h$ is the Planck constant, and $\nu$ is the frequency. According to the principle of the equivalence of matter and energy, the photon has a definite ponderable mass:[82]

$$m_q = \frac{E_q}{c^2} = \frac{h\nu}{c^2} \qquad (28)$$

where $m_q$ is the mass of a photon in grams. Inertial mass is equivalent to gravitational mass according to the general theory of relativity.[83] So gravity can act upon a quantum of light entering or leaving a gravitational field.

How much "work" must a quantum of light do in overcoming the potential energy of a gravitational field? If a light quantum moves a very small distance $dr$, against gravity of intensity $GM(r)/r^2$, it does work of amount $(h\nu/c^2)(GM(r)/r^2)$, its energy decreases by that amount, and thus its frequency decreases by an amount $d\nu$, given by

$$h\,d\nu = -\frac{GM(r)\,h\nu}{r^2 c^2}\,dr \qquad (29)$$

This is a differential equation for $\nu$ and $r$. It can be solved in one of the standard ways: by separating the variables and integrating each side. The result comes out in terms of the natural logarithms to base $e = 2.718\ldots$. The result perhaps looks better when put into terms of exponents of $e$, then the result is:

$$\nu = \nu_s e^{\frac{GM(r)}{c^2}\left(\frac{1}{r} - \frac{1}{r_s}\right)} \qquad (30)$$

Here $\nu_s$ corresponds to the distance $r_s$ from the center; at any greater $r$ the formula gives some $\nu$ less than $\nu_s$. In other words, there is a red-shift.

The exponential form of equation (30) reminds one somewhat of the formula for the decay of a radioactive isotope. That decay, it will be recalled, is characterized by a half-life, the time in which the amount of isotope is reduced to half of what there was at the beginning.

By analogy, it may be of interest to introduce (and "introduce" is right, for as far as is known the notion has not been used before) the notion of a "half-distance." At a half-distance, measured from the center, the frequency would be shifted to half of $\nu_s$. By putting $\nu = \nu_s/2$ into equation (30), going back to logarithms, and doing some rearranging, it is seen that:

$$r_{1/2} = \frac{r_s GM(r)}{GM(r) - 0.69\, r_s c^2} \qquad (31)$$

Here the half-distance is indicated by $r_{1/2}$.

In dealing with radioactive material it may be said, as a practical matter, that after 10 or 20 half-lives there is no activity left. Just so here, at a distance of some half-distances, there would, for practical purposes, be no radiation escaping.

The treatment above has been Newtonian and semi-classical. A more general treatment would give a sharper cut-off of radiation at some distance. So the more general treatment would make the present case even stronger; but it is much too long to be given here. Also, the more general treatment would have the effect of replacing the factor 0.69... by 1. That does not matter much; for most purposes it will be enough to consider orders of magnitude.

It will be noted that equation (31) shows that, according to the treatment used, there would be a finite half-distance provided.

$$GM(r) > 0.69\, r_s c^2 \qquad (32)$$

It will be convenient, for the remainder of the discussion, to use the results of the more general treatment; viz.: an actual cut-off at what was the half-distance, and 0.69 . . . replaced by 1. At the distance $R_h$ corresponding to the half-distance in the semi-classical treatment, there will be what is called an absolute event horizon.

At the horizon, radiation will be shifted down to zero frequency, i.e., extinguished. Such a horizon exists if $r_s$ is less than $GM(r)/c^2$; and an observer far outside the horizon would see nothing from within the radius $r_s$; no light from within it would reach him. This is the basic notion of a black hole: a system with gravitation so intense that light cannot escape.

For the model fireball based on Marion's temperature and density (ignoring the gravitational effect of the thermal and radiant energy) the radius of the absolute event horizon, $R_h$, would

be 2.63 x $10^{26}$ cm, or 2.78 x $10^{8}$ light years (assuming Euclidian space, of course). This is a big black hole!

So far it has been shown that there is an absolute event horizon at some very great distance. Could there be a horizon at some more modest distance $r_x$? From equation (30), it is plain that there can be. If $(GM(r)/c^2)$ $(1/r_s - 1/r_x)$ is greater than one, there would be a shift to zero frequency and hence a horizon; otherwise, no.

Suppose a light source were somehow placed in a fixed position at a distance of, say, $10^{25}$ cm from the center of the fireball (which is 3.8% of $R_h$). None of the light from that source would go beyond a distance of 1.040 x $10^{25}$ cm from the center. If there were an observer at 1.040 x $10^{25}$ cm, the event horizon for him would be 3.95 x $10^{23}$ cm away.

The distance to the event horizon is relative to the position of the observer, if the event horizon exists. The closer one gets to the fireball the less will be the distance between him and the event horizon. It would seem as though the event horizon were fleeing from before him as he gets closer, but that he is steadily approaching it.

But if he had left a friend behind further out in space, that friend might be shocked to see his buddy disappear into the never-never-land of another event horizon which would exist for the one who stayed behind. He would watch as his friend's signals got redder and redder, fainter and fainter, and then finally no signals at all. Light can go into a black hole, but it can never get out.

The author attempted to resolve the integral equation for the $r_s$ to be the surface of the fireball, and the $r_x$ to be the event horizon which is closest possible to the surface. This event horizon is so close to the surface that it could not be resolved with a calculator. The light can only travel a *very small* distance from the surface before it is infinitely red-shifted.

To find this distance one can go back to the differential form of the equation (29). Even if one neglects the change of gravitational force as it decreases with increasing distance, since the distance must be very small, this difference can be ignored and the field considered as being uniform.

When $\frac{GM(r)}{r^2c^2}$ dr is greater than one, then red-shift to zero frequency, i.e., extinction, is indicated. If one takes 3.55 x $10^{54}$ grams (exactly) as mass of the fireball, and 4.39 x $10^{9}$ cm (exactly) as radius of the fireball, then the distance light can travel before it is red-shifted to zero is only about 7.33 x $10^{-8}$ cm! Any observer further away than this would not be able to see the surface of the fireball. That gravity is so strong that light cannot even travel as far away as the thickness of the page you are reading. It cannot escape.

The primordial fireball, instead of exploding, would be a black hole from which neither matter nor energy could escape. There is no doubt in my mind that the big bang hypothesis is not valid. The law of gravity rules it out. The big bang is a modern myth.

### Deflation of the Big Bang Hypothesis

It has been argued, so far, that the big bang hypothesis conflicts with Einstein's special theory of relativity, is counter to the law of the conservation of matter and energy, and disagrees with the law of gravity.

Calculations have been submitted to demonstrate that the inward force due to gravity is so far greater than the outward force due to the thermal and radiant energy of the fireball, that no expansion is possible, and that none of the particles of the gas nor any of the photons of the radiation can escape.

The proposed models cannot expand, it has been suggested, because they are larger than a limiting mass for *hot* condensed objects. Instead of a violent big bang, there would be a catastrophic collapse as the immense gravitational field of the fireball would crush it to a "cosmic pulp."

My opinion is that the collapse would be irreversible by any known natural process. As the fireball collapsed, potential energy from the gravitational field would be converted to heat via the Kelvin-Helmholz process. This thermal energy would have ponderable mass also, which in turn would put an even tighter squeeze on the fireball.

This is a sort of regenerative effect, whereby gravitational potential energy would be converted into gravitating mass-energy by means of homologous contractions. The increasing heat and radiant energy would be unable to halt the collapse because of the limiting mass consideration. It would seem that the collapse might proceed to infinite density—a *singular state*.[84]

It should be noted, that in this discussion, the gas and radiation pressures were considered isotropic—i.e. equal in intensity in all directons. In a real situation this simply would not be so. Both the gas and radiation pressures would be strongly affected by the presence of the intense gravitational field. Outward bound particles would exert less pressure due to the tremendous deceleration of gravity. The photons undergoing red-shift would also exert less pressure.

Particles and photons headed inward would exert greater pressure due to traveling in the pre-

ferred direction of the gravitational field. This anisotropic gas and radiation pressure makes for a situation less favorable for the big bang than the calculations actually show.

Could the collapse reverse itself and become an expansion? No definite answer is available. I do not think it would.

On the basis of what is known about gravitation, it would seem that, as the radius of the collapsing fireball became closer and closer to zero, the ratio of the inward force divided by the outward force would increase beyond all bound. Even though at zero radius the outward pressure of a gas at infinite density and infinite temperature would be infinite, the inward force would be infinite also, but still greater.

It's like the limit of $x^2/x$ as $x$ approaches infinity. The limit has an infinite value, even though it's one kind of infinity divided by another kind. Go back to equation (21); in a collapsing fireball every time the radius decreases by a factor $a$ the density increases by a factor $a^3$.

It just doesn't look as if the collapse could reverse itself. The laws of nature don't seem to work that way.[85] All big bang proponents can do now is invoke "black magic" to get their hypothesis out of the black hole it's in.

Any further discussion of gravitational collapse can lead only to such esoteric contrivances as tensors, curved space-time, and zero world lines; constructs which form a part of the general theory of relativity—and that is far beyond the scope of this article.

Concerning the problem of collapse one should consult men who have done their major work in that field. Peter Bergmann says that a collapse to a singularity would take an infinite amount of time because of "relativistic time dependence."[86] This eliminates problems of infinite densities by saying it would take forever for a collapsing fireball to hit the bottom. As the gravitation around the collapsing object gets more intense, time would dilate asymptotically beyond all bounds.

Roger Penrose says that such a collapsing object would bend space around it, and that once the curvature of space becomes infinite, the object would be sealed forever in a burial urn of a Riemannian space—closed off from the rest of the universe.[87]

Cosmogonical thinking is a lot of "good clean fun," but to win one must play by the "rules." Proponents of the big bang hypothesis have failed to do so. Their position is meaningless irrationality. Creationism is still a viable alternative to this empty speculation.

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# SOME THOUGHTS ON THE CREATION OF TIME

A. J. "MONTY" WHITE AND PHILLIP J. BARKLEY*

*Christians are sometimes bemused by some of the questions asked by others. Such questions as, "Did God have a beginning?", "When did God begin to exist?", and such like. The authors suggest such questions are nonsensical.*

Man is used to thinking in terms of time. One of the primary units of time is the *year*—a year being the length of time for the earth to complete one revolution of the sun. Bennett[1] has pointed out that time could be measured in miles travelled by the earth in orbiting the sun. If this were done, then a 40 year old man would be about $2.3 \times 10^{10}$ miles old!

A year is subdivided into *days*—a day being the length of time that it takes for the earth to rotate once upon its axis. As is well known there are 365 days in a year (and 366 in a leap-year). Man finds it clearer to think in smaller numbers and so finds it more convenient to think of a 40 year old man rather than a 14,610 day old man.

The time periods of the year and the day are not arbitrary—they are divinely appointed as stated in Genesis 1:14:

> And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, *and for days and years.* (Emphasis added)

Furthermore, for convenience, man divided the day into 24 hours, and the hour into 60 minutes, and the minute into 60 seconds. The note under *Hour* in *Cruden's Analytical Concordance* is worth noting:

> The day was not divided into hours by the ancient Hebrews. Only the natural divisions of morning, noon, and evening were noted. After the Exile there was a somewhat clearer division which, it is supposed was learned from the Babylonians. The length of the hour was dependent usually upon the season, as people commonly reckoned it as the twelfth part of the natural day, from sunrise to sunset, and this would differ according to the season.[2]

As soon as God created matter, time must also have been created, because many of the properties of matter can only be explained in terms of time; e.g., the movement of electrons in their atomic orbitals, the vibrations and movements of atoms and molecules in the solid, liquid and gaseous phases. It is interesting to note, for instance, that the second is now defined[3] as the duration of 9,192,631,770 periods of the time it takes for the transition between two hyperfine levels of the ground state of the cesium-133 atom. Hence a day (which is 86,400 seconds) can be defined as 794,243,384,928,000 periods using the cesium-133 atomic clock.

The first act of creation was that of the heavens and the earth. Implicit in the statement of Genesis 1:1 "In the beginning God created the heavens and the earth" is the fact that "In the beginning" God created time. It is therefore nonsense to talk about "the time before the Creation" because there was not any. Time did not exist before the Creation. Similarly the earth, sun, moon, planets and stars did not exist before the Creation.

God, however, existed before the Creation. He is not bound by time as is man. The beginning is the time zero at which He began to create—hence the verses found in the Bible beginning, "In the beginning . . ."[4]

In view of the above arguments, the authors believe that it is nonsense to ask such questions as "When did God begin to exist?" and "Did God have a beginning?", when the questioner is referring to the existence of God in terms of time before the Creation. The Bible states clearly:

> In the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by him; *and without him was not any thing made that was made.*[5] (Emphasis added)

And that includes time!

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# THE LEBZELTER PRINCIPLE: A GENERATIVE IDEA

ARTHUR C. CUSTANCE*

*Lebzelter observed that a wide variation in physical appearance is often found in small groups of people living in comparative isolation, accompanied by a marked conservatism in cultural development. The cause for this variation in physical type is well understood and results from inbreeding: the reason for the cultural conservatism lies in the community's small margin of survival. Early human remains bear ample witness to both, a fact which precisely reflects just such a situation as must have existed immediately after the Flood and the subsequent rapid dispersion.*

## Introduction

In 1932 Viktor Lebzelter made the following proposal: "When man lives in large conglomerates, race tends to be stable while culture becomes diversified; but where he lives in small isolated groups, culture is stable but diversified races evolve."[1]

Stated in more general terms, this means simply that when population is small (as it must have been for some time after Adam and Eve began to multiply, and again after Noah's household emerged from the Ark), members of a single family may vary widely in physical appearance, but the group tends to remain highly conservative in culture and social behaviour. When the population is large, physical type becomes more or less stable and characteristic of the group, but considerable cultural variability appears.

Small pioneering groups of necessity live somewhat precariously and are accordingly more cautious about innovation. As V. G. Childe puts it, "The force (of resistance to change) in a community seems to be inversely proportional to the community's economic security. A group always on the brink of starvation dare not risk change."[2]

The precariousness of the situation would fluctuate. As each settlement finally become established with growth in population, more freedom in cultural behaviour would be allowable; but in each new fragment which broke away and assumed the role of fresh pioneers the cycle of conservatism would be repeated.

Such a pattern of dispersion would thus account for two things: first, the remarkable uniformity of cultural artifacts in every part of the world where early man has been found; and secondly, the extraordinary resistance to change which is characteristic of contemporary primitive people whose margin of survival has remained very slim.

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## Variability and Inbreeding

Meanwhile, in all such small inbreeding populations, genes for odd characters, because they have a far better chance of being expressed homozygously, contribute to the emergence of a marked variability in physical type. In isolated villages in the Highlands of Scotland a few generations ago, the high incidence of deaf mutism and other pathological conditions was attributed to this circumstance.[3]

This principle of variability of physical type in any small inbreeding population, especially when introduced into a new environment, has been observed very widely in the plant and animal kingdoms as well as for man. Sir William Dawson, the Canadian geologist, in 1903 had remarked that "new species tend rapidly to vary to the utmost extent of their possible limits and then to remain stationary for an indefinite time."[4] Dawson was not clear as to the mechanism, but the fact itself was commonly to be seen in the geological record.

We now know why. In 1952 Willard Hollander wrote: "The quickest way to expose lethal traits is by intensive and continual inbreeding."[5] And in 1963 Dahlberg was even more specific when he wrote: "When a recessive gene arises by mutation, it will only after some time occur in a *double dose* by means of intermarriage—soonest by a marriage of cousins. . . ."[6] And presumably sooner still by brother-sister marriage. The fact has been held by some authorities, notably by Ralph Goldschmidt, to account for the "explosive diversification" of new phyla, classes, orders and even families which appear "suddenly and without transitions" in the geological record.[7]

## Variability in Fossil Man

Remarkable variableness in physical appearance is observed in fossil man in the Upper Cave at Choukoutien, at Obercassel, and in the Palestine caves at Tabun and Skuhl. The range of skull types is amazing.

Speaking of the Choukoutien finds, Weidenreich reported that "the conditions in which the skeletons were found indicates that these individuals were members of one family." Yet he continues, "the surprising fact is (the existence of) the assemblage in one place, and even in a

single family, of types found today settled in far remote regions."[8] Represented at Choukoutien were ancient Neanderthals, and modern Mongoloids, Melanesians and Eskimos.

At Obercassel the same authority notes the finding of two skeletons from a single grave "so different in appearance that one would not hesitate to assign them to two races if they came from separate localities."[9]

And in the Palestine finds, William Howells described the skeletal remains as "an extraordinary variation." [10] Neanderthal and Cromagnon types were discovered in Palestine that clearly belong to the same group.

### Cultural Innovation Conservative

In the matter of cultural innovations, it can never be predicted precisely how the total living situation will be affected. Once a solution to the immediate problems of survival has been found, low level cultures with small reserves of energy tend to guard the old ways jealously. Goldenweiser speaks of culture change as being one of involution rather than evolution in all such cases,[11] where established patterns of decoration, weapon design, and ritual are permitted to be elaborated slightly but not in any basically novel direction.

A weapon, once designed, tends to be passed on from generation to generation virtually unchanged One such weapon which is quite exceptional, namely the boomerang, seems to have been a *very* early development and is found in essentially the same form in almost every part of the ancient world.

The boomerang is found in the very lowest levels in Tel Halaf in northern Palestine;[12] it is found at the lowest levels in Egypt;[13] and it is found in Europe during the Magdalenian times.[14] It is found in the New World among the Hopi Indians;[15] and in Africa it seems to be reflected in the shape of some of their throwing knives, which thus form an iron version of the wooden original.[16]

And, of course, it has persisted among the Australian aborigines; which means that this unique weapon was carried around the world by early man. And it does not seem likely that such a remarkable weapon was independently rediscovered or re-invented on a number of occasions. This is diffusion, in conservative hands.

The use of red ochre to paint the dead is another example of such diffusion for it hardly seems likely that such an idea would arise independently in the many places scattered around the world where it was evidently customary.[17] The practice was continued in Europe from at least Cromagnon times, in North America by native people until approximately 1100 A.D., and in Australia among the aborigines into the twentieth century. This is conservatism indeed, tied to a ritual which surely did not survive because it had any practical value. Nor does it seem sufficient to argue, as some authorities did once, that such similarities can be accounted for by the fact that man's minds work pretty much everywhere the same.

### Conclusions

In short, Lebzelter was surely correct in saying that, where population is small, widely divergent physical types should be expected, but with a high degree of cultural uniformity. And this should be expected particularly if the human race is derived from a single pair, and if some circumstances forced upon their immediate descendants an unnaturally hurried expansion into a world that was often either difficult or even inimical to human settlement. Such a circumstance accounts for the wide diffusion and long persistence of non-essential ideas to which history gives abundant testimony.

Such a scattering did occur after the world's human population had been reduced to eight souls by the Flood. Those who were thus scattered abroad would naturally continue to be driven into the more peripheral and less hospitable areas simply because those who commandeered the more favourable areas would multiply more rapidly and therefore be more powerful.

Fossil man, as commonly conceived, may very well be the *remnant* of this first wave and not the antecedents, a circumstance which would then very nicely account for physical diversity and cultural uniformity of early man. Lebzelter merely stated a principle for which the Biblical record provides the background, and modern scientific researchers the evidence and the mechanism.

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[12]See *American Journal of Archaeology,* April-June, 1933, p. 314.

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[14]Wendt, Herbert. 1955. I looked for Adam. Weidenfeld & Nicholson, London, p. 356.

[15]Murdock, G. P. 1951. Our primitive contemporaries. Macmillan, N. Y., p. 328, 329.

[16]Encyclopedia Britatnica, under *Boomerang.*

[17]On the widespread use of red ochre or hematite, see for Europe: V. G. Childe, *Dawn of European Civilization.* Routledge & Kegan Paul, London, 1957, pp. 6, 208, 254, 259, and in the New World: Sir William Dawson, *Fossil Men and Their Modern Representatives.* Hodder & Stoughton, London, 1883, p. 143. In Illinois from about 700-1100 A.D. so much red ochre was used in burials that the period has been termed "the Red Ochre Culture."

Red ochre was used on the living also in many parts of the world, perhaps as a kind of *ersatz* life-giving blood: in the New World, by the Crow Indians (G. P. Murdock, *Op. cit.,* p. 275); in Australia, by the aborigines (C. S. Coon, *General Reader in Anthropology.* Holt, N. Y., 1948, p. 226).

# IS THE BIBLE A BOOK OF SCIENCE?

H. L. ARMSTRONG*

It is sometimes argued that the Bible is not a book, or a textbook, of science. Such statements should be investigated.

Certainly the Bible is a book; and it deals, in many places, with things which might be considered under science. What is a textbook? According to a common dictionary definition: "a manual of instruction in any branch of study, work recognized as authority."[1]

According to scripture: "All scripture is given by inspiration of God, and is profitable for doctrine. . . ."[2] The Greek word translated "doctrine" could also be translated "teaching" or "instruction." So the Bible could be called a manual of instruction; and, in so far as it has occasion to touch on matters considered under science, it is a book, and by the definition a text-book, of science.

Of course, no one claims that it is primarily that. But just as the foolishness of God is wiser than the wisdom of men, so the incidental mention in Scripture may tell more than the long treatises of men. And the authority is there; who would say that a work inspired by God is not authoritative?

Again, by the text, all Scripture is profitable. No falsehood is profitable, in the true sense. So we have a syllogism in the second figure: no false thing is profitable, all Scripture is profitable, therefore no Scripture is false.

There are those who would abandon the Bible as a book of science, but retain it as a book of theology. After a little thought, is it not a strange proposal? For surely the matters dealt with in theology are more difficult than those considered in science. There are matters of science that are understood fairly well. But who would claim to understand the Atonement? Is it not strange to say that a book is reliable in complex matters, but not in much simpler ones?

Two points should be mentioned here, because of the way in which some recent versions have handled the verse mentioned. In the first place, Scripture is not just "inspired," as one sometimes sees; it is "inspired by God". The word "God" is definitely in the Greek, admittedly in a compound.

Again, the verse is sometimes (mis-) translated: "all inspired scripture is . . . etc." This might imply that some Scripture is not inspired. Now the same Greek construction is used in several other places in the New Testament; and, in many, the translation parallel to the one first quoted, (which is the rendition in the King James Version) is obviously the meaning.

A striking example is Hebrews 4:13. If one were to give, for the parallel Greek construction, an English parallel to the mentioned (mis-) translation, something like the following would be stated: ". . . all naked things are also opened unto the eyes of him. . . ." It is quite clear that that is not what is meant in Hebrews 4:13.

Other passages which have a parallel construction in the Greek are: Romans 7:12; I Corinthians 11:30; II Corinthians 10:10; I Timothy 1:15; I Timothy 2:3; I Timothy 4:4; and I Timothy 4:9. In all of these places it is fairly apparent that the reading parallel to the construction of the verse quoted is what is intended.

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[1]The Little Oxford Dictionary, Fourth Edition, The Oxford University Press, 1969.
[2]II Timothy 3:16.

# PANORAMA OF SCIENCE

### Competition Not Important in Nature

As is well known, Darwin made much of competition and survival; and his followers have followed. In the meantime, however, more and more evidence has appeared that Darwin vastly over-rated competition. Custance,[1] for instance, has pointed this out. Recently studies of plants have led to the same conclusion.[2] Wild plants, in and around Death Valley and in similar regions, were studied to see whether some would eliminate others. The conclusions include the following:

> . . . with few exceptions . . . an actual struggle between competing plants never occurs . . . competition plays no . . . role in environments . . . such as a tropical rain forest . . . competition is an overrated factor in the plant world. . . .

While these studies were on plants, it is mentioned, in passing, that ". . . even among zoologists the importance of competition . . . has been questioned. . . ." Which, of course, is what Custance said in the work mentioned.

Another point, which is of interest to creationists, comes up incidentally in this article. The author states that

> . . . only competition between organisms that have not reached the 100% level of adaptedness could result in differential survival, and it is remarkable in how few generations the 100% adaptedness can be reached in breeding experiments (examples: sugar levels in beets and sugar cane, growth rates in tomato plants).

In other words, as creationists have pointed out, any changes, within kinds, that occur, come about within a few generations; and certainly there is no evidence at all for changes between kinds, taking millions of years.

Other studies reported recently in this journal, have contained similar conclusions.[3]

Moreover, the same kind of thing has been found with bacteria.[4] And it holds true when the competition is that of predator and prey.

The bacteria *Klebsiella aerogenes* were grown in a culture, and the protozoa, *Tetrahymena pyriformis,* added as predators. After some fluctuations the numbers became stabilized, both prey and predator being present; and the numbers were: ". . . at a level that ensures the survival of both species."

It appears that the bacteria escaped the predators to some extent by living on the walls of the vessel. Some have wanted to call that "evolution," in that the bacteria "evolved" different behaviour.

But surely such a way of speaking would make the word "evolution" (even more) meaningless, by applying it to anything at all which might happen. Certainly this change in behaviour has nothing at all to do with what creationists have sometimes called "megaevolution."

Does all of this evidence not really show that, contrary to Darwinian notions, there are really no permanently and absolutely fit and unfit? Creatures, even as humble ones as bacteria, when becoming "unfit," can change their way of life until they become sufficiently "fit." But they remain bacteria, and of the same kind; what happens has nothing to do with the "origin of the species."

### How Quickly a Population Can Spread!

Those who believe in a universal Flood have to consider that men and animals increased from a few, after the Flood, to considerable numbers in a fairly short time. This is true no matter how one interprets the chronology after the Flood, if the Bible is taken at all seriously. It may be of some interest, then, to notice a theory, which has been proposed, which deals with the same kind of question, although this concerns only human beings.

It is proposed, to be exact (not that this aspect of the theory is new), that men entered North America by Bering Strait something more than 10,000 years ago. (Of course there is a tendency to assign too great ages to all these things.) Such migrants found abundant animals, including some, such as mammoths, now extinct, and spread rapidly, hunting these animals until certain kinds were exterminated.[5]

Creationists would be interested in some of the figures proposed. It is suggested, for instance, that the (human) population might have doubled every 20 years. For convenience Edmonton, Canada, is taken as the point from which the population could have spread out.

Those who travelled the farthest, it is estimated, would have reached the Gulf of Mexico from 300 to 400 years later, at which time the population would have been around 500,000. If the population continued to spread through Central and South America, it would, it is estimated, have reached the southern part of South America in about 1,000 years.

It is not my purpose to discuss this theory as part of the history, or prehistory, of the New World. Rather, I want to comment that a spreading of population, such as is proposed here, would be quite adequate to allow a population to spread after the Flood. (Such a spreading would also have allowed the population to spread through the whole world between the Creation and the Flood; but that is another matter.)

The distance from Mount Ararat to say northwestern Europe is not so much different from that from Edmonton to the Gulf of Mexico. About spreading in other directions perhaps less information is available. If the chronology is taken more or less literally, the time from the Flood to Abraham would be 300 to 400 years. And in Abraham's time the Near East, at any rate, seems to have been fairly well inhabited, but not crowded.

It would appear, then, that it would be valuable for creationists to give some thought to the spreading of populations after the Flood. Moreover, as has been pointed out before, the fact that a population can increase so quickly, but that there is no evidence of former crowding of people, is strong evidence for a young earth.

### Entropy Always—Repeat Always—Increases

The evolution which is alleged to have happened among living things, so that they became more and more ordered as time went on is, as has often been pointed out, contrary to the principles of thermodynamics, especially to the second law.

To get around this, those who want to support "evolution" sometimes claim that there have been in living things something corresponding to fluctuations in a physical system, and that the fluctuations gave rise to more order. The following statement by Pippard, a noted British physicist, is to the point here. (It will be recalled that the entropy, mentioned here, is a measure of disorder; thus "evolution" would require that the entropy decrease spontaneously.)

> . . . there is no net decrease of entropy. Although very few hypothetical experiments employing fluctuations have been analysed in such detail, it appears most probable that they all fail to violate the second law on account of the necessary entropy generation. . . . There is thus no justification for the view, often glibly repeated, that the second law of thermodynamics is only statistically true, in the sense that microscopic violations repeatedly occur but never violations of any serious magnitude. On the contrary, no evidence has ever been presented that the second law breaks down under any circumstances. . . .[6]

### Peculiarities in the Composition of Shells

Shells of shellfish grow with time, of course; and their composition and the way in which they grow may depend on the conditions at the time that a particular bit is added. Thus it appears possible that they might incorporate in their shells a record somewhat akin to those provided by tree-rings. It appears, however, that such records may need to be interpreted with much caution.

Some studies have shown that the concentration of calcium, and also of carbon and several other elements, varies throughout the shell in an oscillating way.[7] The shells were contemporary, not fossilized. It is concluded that:

> . . . additional data are needed to determine the significance of the variable calcium distribution in the shell . . . (there are) many metabolic and environmental factors influencing growth and calcification . . . the cause and effect relationships between environment and shell secretion are complex. . . .

This is mentioned here because there have been attempts lately to investigate the ages of deposits, and other things as well, by examining fossil shells. The information just mentioned serves to show that the matter is likely a complex one, and that some conclusions reached too soon are likely to be wrong.

Maybe some creationist will have an opportunity to study this matter. Indeed, it would be worthwhile also for a creationist to study the other matter, i.e., tree-rings; and to see whether, for instance, two rings can form in a year, or the ring formed in a bad year be so thin as to be lost.

The author of another study, which investigated the relative amounts of isotopes of magnesium, strontium, carbon, and oxygen in shells has concluded that whatever is found does not necessarily prove any particular age. For:

> . . . changes in Sr and Mg and possibly carbon isotope ratios are occurring in shells on the sea floor instantaneously (in terms of geologic time), and before permanent burial . . . techniques that assume original and unaltered composition should therefore be used with caution. . . .[8]

It is well known by now, and fairly generally admitted, that the dates indicated by the method which uses radioactive carbon may be quite unrealistic. There is more and more evidence to show that the same may be said of the other methods of dating.

### Comets Point to a Young Universe

Comets, especially those having short periods (others being observed only once, not enough is known about them to draw many conclusions), continue to make trouble for uniformitarian theories of the universe.

A researcher has looked into the notion, proposed especially by Oort, that there is some sort of reservoir of comets outside the solar system, and that comets are from time to time captured and brought into the system, to replace those which are known to disintegrate after a while.[9]

Results were not favourable to Oort's theory. It was concluded that: ". . . there appears to be a large observed overabundance of short-period comets. We conclude that the origin of these comets is not yet understood. . . ."

The author states that there are about 40,000 times as many comets as there should be according to the theory. Of course, that would mean that according to the theory most of the time there should be no short-period comets at all.

It may be that the comets provide one of the best pieces of evidence for a young universe. Is it possible that meteorites might provide similar evidence? For they are being removed from time to time; and as far as I know nobody has even suggested a reservoir of meteorites. Besides, there is the fact that there seem to be no meteorites at all buried in the old rock strata.

### Ultra-Violet Features Matched for Bees and Flowers

It seems to be established that some insects, bees, for instance, can see ultra-violet light, at least the near ultra-violet. One might wonder what it is that they see with it. It now appears that it may, indeed, help them to see things which are of interest to them.

Certain flowers, such as *Jasminium primulinum,* have been found to have patterns, generally on the rear, which appear in ultra-violet light. These were examined photographically, since, of course, human beings do not see the ultra-violet.[10] Presumably the insects find flowers by ultra-violet light, and also, maybe, find the right parts of flowers.

Here is another case, to be added to the many already known, of two kinds of creatures adapted to each other. How could this condition have evolved? If the bees are supposed to have "evolved" ultra-violet vision, their ancestors must have been getting along all right without it. And the same might be said about the ultra-violet markings on the flowers.

It is considered a test of a scientific theory to see whether valid predictions follow from it. On the basis of Creationism, one might predict that more and more of these mutual adaptions of creatures will be found, until eventually it is discovered that just about everything is adapted to just about everything else.

### "Fossil Record" Admitted to Be Faulty

Every now and then someone, speaking or writing presumably in favour of "evolution," has made a statement which is just the thing which creationists might say. Thus, the author of a recent article admits that ". . . although the fossil record forms our only direct evidence of the course of evolutionary . . . history, it is notoriously incomplete. . . ."[11]

Notice what this really says. The only evidence for evolution is whatever may be obtained from fossils. But the fossils are not as one would expect them to be if "evolution" had really taken place. (That is the only possible meaning of the statement that the record is incomplete.) Why, one could put this into a syllogism. If evolution had occurred, the fossils would be of such and such a kind. But the fossils are not of that kind. Therefore, evolution did not occur.

Is it not amazing that anyone, having made statements which lead so simply to a conclusion contrary to evolution, yet go on to discuss evolution without showing the least doubt?

This article contains information which may be of use to creationists. The author discusses the numbers of kinds of certain invertebrates at different stages in (alleged) geological history. One feature is that the number seems to fall off in the late Paleozoic and early Mesozoic (as I have said before, I use these names in the same spirit as that in which I use the pagan names of the days of the week), and then to rise again. This may give someone a clue toward fitting these matters into the history of creation and catastrophe.

### Marks of the Flood on the Ocean Floors?

The Deep Sea Drilling Project researchers have found "hiatuses" extending over "tens of millions of years" in "every principal ocean basin." Two, in particular, are said to be synchronous in all of the principal ocean basins. One of these occupies at least half of the Pliocene, the other at least half of the Oligocene; and possibly from late Cretaceous to middle Tertiary.[12]

As mentioned before, there is considerable evidence for some cataclysm around the end of the Cretaceous (by the ordinary reckoning of the geological ages). Is this more evidence for the same thing, or something related? Is it not likely that all this evidence really points to something that happened during the Flood, or to a certain stage of the Flood?

The article author proposes there may have been erosion by bottom currents, which removed certain parts of the sediment. That seems somewhat far-fetched. As for the worldwide synchronism, it is suggested that that had to do with changes in the sea level.

An interpretation in terms of the Flood, of course, takes care of the synchronism. And consideration of what happened then could explain what was actually observed. The reason for calling it a hiatus is largely that certain things were not found. But apart from uniformitarian theory there is no reason to suppose that "missing" things should be found.

### Glaciers or Floating Ice?

It has been suggested here, from time to time, that some of the marks which are commonly ascribed to glaciers during the ice ages might really have been caused by floating ice, at the end of the Flood.

Some studies of the floor of Lake Superior show valleys and grooves.[13] It is suggested that these were: ". . . probably formed by scouring by icebergs during an earlier . . . stage. . . ."

One of the problems with which Flood geologists must deal is that of fitting in the ice ages, to such an extent as there were such things. There seems to be a growing opinion that they fit onto the end of the Flood. Certainly more work is needed on this matter. The consideration of possibly analogous cases, such as that mentioned here, may help.

### Misleading Concentrations of Isotopes?

While radioactive materials, and the products of their decay, continue to be used in attempts to determine the ages of rocks or of fossils and other remains, evidence continues to accumulate to show that many things can happen to make such methods give false results. A recent report, which may have some bearing on these matters, has to do with the amounts of various isotopes found in sediment from the bottom of the Pacific Ocean—or, rather, in the water which was included in the sediment.[14]

Observations were made in the course of the Dragon expedition of the Scripps Institution of Oceanography, on sediment from the eastern equatorial Pacific. In water from cores of sediment taken from the bottom, concentrations of radium 226 and 228 and of thorium 230 and 228 were found one to three orders of magnitude higher than in sea water.

It is suggested that this state of affairs may have arisen through migration of the material. Be that as it may, suppose that the sediment had hardened, or been raised above the water, still keeping at least some of its excess of radioactivity. It is plain that anything deduced from the study of the amount of radioactivity in such material could be very questionable.

Is it not likely, then, that there are many deposits with histories that are not known well enough to make it possible to say just what has happened to them, but which similarly contain anomalous amounts of radioactivity?

### When Is an Artifact Not an Artifact?

In the Calico Foothills, California, cherts (a kind of flint) have been found, in shapes which might have been scrapers or other tools, and which some researchers have thus considered to be artifacts. L. S. B. Leakey and many others have investigated these stones. The age assigned to the deposit in which they are found is around 500,000 years, which, if the stones are artifacts, would make them very old for the New World.

Authors of some recent studies, however, doubt whether the stones are artifacts at all.[15] It is reported that:

> . . . as being possible artifacts . . . 200 or more have been selected as being the best examples. Authorities . . . are divided in their opinion as to the origin of these flints because none is an obvious artifiact. . . .

Later it is said:

> . . . the evidence for artifacts remain uncompelling . . . normal natural processes are adequate to explain the origin of all of the phenomena . . . more testing . . . should be done by uncommitted investigators. . . .

Other alleged artifacts, it is urged, e.g. circles of stones which some want to call hearths, could be explained naturally.

The admission that some investigators have not been uncommitted, i.e. not unprejudiced, is interesting.

Generally, it may be said that here is a case in which things which some have called artifacts are open to much doubt. Is it not likely that the same is true of other alleged artifacts of primitive men, which have not yet been challenged?

### Varves, Bands, and Layers

As is well known, there are rocks which contain very many thin bands or layers, which are sometimes called "varves." Uniformitarian theorists have wanted to maintain that each layer took a year for formation.

There are, however, other possibilities. It has been suggested, for instance, that the Liesegang phenomenon, which can be observed in chemistry, might cause the bands in a quite short time.

For that reason, some references to that phenomenon, or to "chemical waves" generally, which have appeared not so long ago, are cited here.[16-19] Since the matter is a rather special one, no attempt will be made to give a summary here, but those interested might find it worthwhile to consult the articles listed below.

### Rock Formation Moved Millions of Years!

Creationists know on what flimsy foundations the "geological column" and the "geological ages" rest; it is sometimes of interest to see the flimsiness becoming apparent. It is reported that certain rocks in Pakistan, which had been considered to be Carboniferous or Permian, are now seen to be Cambrian.[20] The evidence adduced consists of fossils: *Hyolithids* and others.

One wonders then: how many other formations of rocks may there be, in which there are fossils

which, if they were found, would cause the entire system to be dated much earlier, by the uniformitarian dating?

In particular, how many such examples might be found in those parts of the world which are not very extensively explored? Might it be found eventually (as, indeed, has been suggested), that the uniformitarian geological column, invented to fit limited observations in Europe and North America, simply does not fit the facts in many places?

### Meteorological Effects Now a Clue to Former Times?

The more the weather is studied, the more unexpected things are found which influence it. Thus, it appears that there are, in the North Pacific Ocean, large areas of anomalously warm or cold water. These areas circulate around the ocean, with a period of about five to six years. It is believed that they have a considerable influence on the weather in the western part of Canada and the United States.[21]

This discovery is mentioned here because it may help creationists in thinking about the Flood, the ice age, and the connection between the two.

There is good reason to suppose that the ice age (there may well have been only one, and not as severe as is often supposed), came at the conclusion of the Flood, or even began during the later part of the Flood.[22]

Conditions during the Flood, and soon after when possibly only part of what is now dry land had emerged from the water, should have been superb for the circulation of warm or cold water.

Conditions could have been warm in some places, leading to much evaporation, and cold in others, leading to precipitation in the form of snow.

So circulation, of the kind just mentioned, may have had a great part in helping to build up the ice. This whole matter needs far more study.

### Footprints in the Stones of Time

Existence of human footprints in stone, along with those of dinosaurs and other extinct animals, has become so well known through the film, "Footprints in Stone," that it is not necessary to describe the facts here. There are, however, some points which might be noted.

The situation is complicated by the belief that at one time some prints were carved artificially. However, any such prints seem to have been taken away and sold. After all, why would anyone go to all the work of carving a print, and then just leave it in the rock to erode away? Besides, as has been mentioned, some prints were found when the layers of rock covering them were removed. They could not have been carved artificially in such a situation.

Some have wondered whether the prints might be caused by erosion, and just happen to look like human feet. But it seems hard to believe that such chance happenings would cause prints in a linear pattern showing a regular stride. Again, surely chance would now and then give a print with six toes, or a right foot to the left of the left one. There seems to be no evidence for such things.

Some sincere creationists have hesitated to make much of these prints, lest they later be discredited. Indeed, care must be exercised in selection of evidence. Yet if anyone of the uniformitarian school were to object, one could point out that the Piltdown man has definitely been discredited, while the Java and Peking men are doubtful. But no uniformitarian has consequently suggested that researchers should make nothing of any apparent fossil man.

Or, if it should be said that there are not very many footprints (actually, there are a good many cases[23, 24]) then one might point out that far-reaching conclusions about the origin of birds are supposed to be drawn from very few fossils of the *Archaeopteryx*.[25]

Moreover, since the dinosaur prints are generally accepted as genuine, why not the human prints?

It should be possible to distinguish whether a print did actually result from someone stepping in mud, or whether it was carved or eroded after the mud had hardened into stone. For in the former case the mud would have been pressed down under the print; in the latter there would be no such effect.

This was investigated with certain tracks taken from the Paluxy River, near Glen Rose, Texas. The piece of stone containing the tracks was sawn in two, to expose the cross-section of the rock under the track.

Figure 1 shows two typical tracks: dinosaur and human. Figure 2 shows two tracks, human and probably sabre-tooth tiger, which were actually cut in two. It might be remarked, incidentally, that to find sabre-tooth tigers in company with dinosaurs is as surprising, to one who holds the uniformitarian view, as it is to find human and dinosaur tracks together.

Anyway, the tracks definitely showed a pressing down or compaction under them, which indicated that they had been made in mud which hardened later. Both showed this effect; it so happened that the tiger track gave a rather better photograph, which is reproduced in Figure 3. The curvature of the layers under the track can be seen readily; note also, about the top middle, where the (possibly half-hardened) mud cracked.

The human tracks, in particular, showed also under the track some metamorphism of calcium

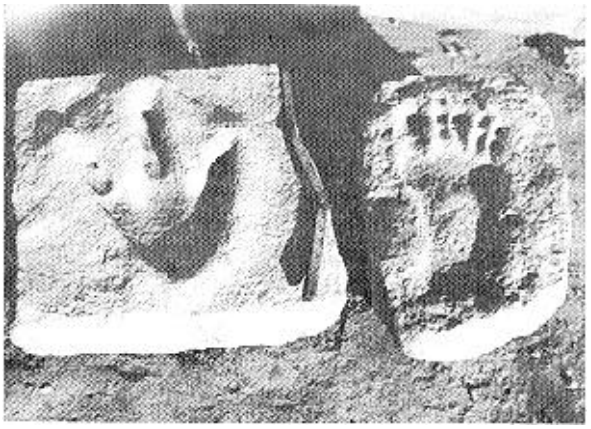

**Figure 1. A three-toed dinosaur track, and a human track, cut from the bed of the Paluxy River by Al Berry, about 1937. *Photo by C. L. Burdick.***

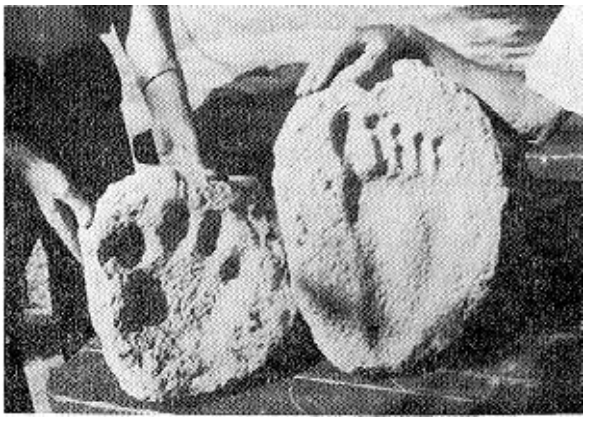

**Figure 2. A human track and a tiger track, possibly a sabre-tooth tiger, from the Paluxy River, Glen Rose, Texas. These are the tracks which were sawn in two. *Photo by C. L. Burdick.***

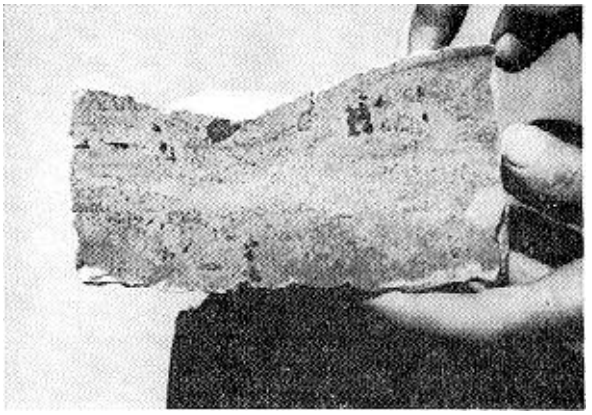

**Figure 3. A cross-section, after the sawing, through the tiger track shown in Figure 2. Note the curvature of the layers, and the crack, caused by a weight pressing down on the material when it was still soft. Such marks would not be found in a carving. *Photo by C. L. Burdick.***

carbonate into calcite, apparently induced by the pressure. This, again, would be inexplicable in a carving.

Most disciplines need—and receive—revision every few years. But some phases of geology, and in particular the notion of the geological column—the evolutionary diagram, really—have escaped revision for so long that they are in danger of being "sacred cows." But many recent geological discoveries, such as these footprints, are telling a different story; and they help to verify the authenticity of the Mosaic account of Creation in the Book of Genesis.

-Submitted by Clifford L. Burdick

### More Precambrian Fossils

Fossils continue to be found from time to time in rocks assigned, according to the uniformitarian scheme, to the Precambrian or Proterozoic, where, it is supposed, there should be none.

Two recent finds are by the U.S. Geological Survey in the Sierra Ancha mountains of central Arizona, about August 1972; and by Mr. R. J. Anderson, a consulting geologist, on the south shore of Lake Superior, West of the Porcupine Mountains, two miles west of Maple Creek and about nine miles east of Little Girls Point, at the extreme western end of Michigan's Upper Peninsula, in May, 1967. The formation at the second site is the Nonesuch, a fine, laminated, greenish grey siltstone, about 600 feet thick where the find was made. The Nonesuch formation is Upper Keweenawan.

At both of these sites the rocks are counted to be rather more than one billion years old, according to the conventional scheme.

The fossils both seem to be some kind of arthropod. It may be noted that an arthropod is really a quite involved creature, which would be expected, by any evolutionary scheme, already to have a long ancestry. Probably it is for this reason that there seems to be a reluctance to accept these finds as fossils.

In that matter, of course, uniformitarian theorists are merely finding themselves unable to get out of their own straightjacket.

For creationism, on the other hand, there is no trouble. Creationists believe that the difference between the various strata is not so much due to their age as in the circumstances under which they were deposited. There is no reason why an odd fossil might not be found in rocks which, generally speaking, contain few.

Surely the better a theory, or view, is able to accommodate new discoveries, the better a theory or view it is. On this basis, creationism is clearly a better view than any rival.

-Submitted by Clifford L. Burdick

**Alleged Evidence for Evolution Questioned**

A few months ago, an author proposed to show that, in Eocene strata in Wisconsin, there is a fossil record extending over five million years, showing a branching phylogeny which exhibits gradual phyletic evolution, overall size increase with iterative evolution of small species, and character divergence following the origin of each new lineage.[26]

Darwin's problem in demonstrating "gradual evolution" through natural selection was that he found new forms appearing suddenly in the fossil record. In the paper under consideration, the author starts by restating Darwin's problem. Darwin tried to explain away his problem by saying that there were too many gaps in the fossil record. He thought that in another hundred years or so the record would be so complete that a smooth graduated development, or evolution of biological life recorded in it, would become evident.

Some biologists have tried to meet the embarrassment by claiming that evolution took place by sudden leaps or jumps. That, of course, is edging pretty close to fiat Creation as recorded by Moses in Genesis. But Gingerich, in the paper mentioned, tries to uphold Darwin's original views, and to make the system more plausible by claiming to find evidences of gradualism in the phylogeny of the Eocene mammal *Hyopsodus*. *Hyopsodus* is an extinct beast with long body and short legs.

The *Condylarths* are archaic ungulates which are important because they were abundant in the early Tertiary, and because the group is supposed to include ancestors of the living *Artiodactyla* and *Perissodactyla* (cattle with an even number of toes or hoofs—and horses). Wyoming has long been Yale's "Happy Hunting Ground" for fossils since the days of Marsh and Cope.

The stratigraphical area of search was about 15 by 40 miles in the Antelope Creek—Elk Creek —Fifteen Mile Creek drainage area, mostly badlands type of formation with very little vegetation, which makes prospecting easier. The average thickness investigated was about 1,700 feet. However, the author states that 90 new localities have been searched for fossils. The average time interval covered, that for the sedimentation to take place, is estimated at about five million years.

In the actual fossils, the size of the molar teeth was the principal criterion for species differentiation, or "evolution." It appears that this would be quite a shaky criterion since young specimens would have smaller teeth, and races could differ without evolutionary evidence.

Badlands formations are usually soft, poorly consolidated formations along drainage areas or streams, where gravels and silt were swiftly deposited during times of flood waters, not necessarily the Noachian Flood, but during the tail end of glacial melt and subsequent high water. There is evidence of many such torrential runoffs in the American Southwest.

Measuring geologic time by the thickness of rocks or sediments was quite the vogue in the days of Chamberlin around the turn of the century, but Twenhofel and others pointed out the fallacy in that system of time computation:

> The thickness of the strata is not a measure of the rate of deposition or of time. A thin layer of sediments of any kind may have taken as long a time to deposit as many meters of the same or some other kind of sediment at a different time or place.

There seemed to be separate species of *Hyopsodus* appearing up through all the assumed time-spans with little or no variation. Of eleven species represented, six became smaller and only five larger, the author claimed. However, the large and small races may have lived at the same time, for the computation of age on a uniformitarian model is questionable, especially so along streams and drainage areas.

Charles Schuchert of Yale also commented on the weak link of time estimation based on the thickness of sediments:

> We do not know the mean rate at which any kind of deposit accumulates; that local rates in sedimentation vary immensely among themselves is well known from the accumulations now going on.

—Submitted by Clifford L. Burdick

**Theory of Evolution of Primates Questioned**

> You might well feel baffled and unhappy if a student of human evolution answered your question as to why human beings walk around on only two legs by saying: 'Because in man's ancestral lineage, individuals who could not run away from predators left fewer offspring'. For though it may be a true proposition, it explains nothing since thousands of other mammals faced the same survival problem, yet none developed bipedal locomotion.

So begins Matt Cartmill in his article showing that primate traits cannot be explained simply as an adaptation to arboreal life.[27] Creationists reject the above "explanation" because its explanatory force depends on the law-like generalization: "Natural selection favours bipedal locomotion in any mammal species that has predators"; and this generalization is false.

*Brief History of Arboreal Theory*

Mivart, a creationist who opposed Darwin, proposed a list of primate traits which included a complete bony ring around the eye, well developed occipital lobe at the cerebral cortex, and a grasping hind foot with an opposable clawless first toe.

G. E. Smith (1920) suggested that shrew-like terrestrial creatures which entered into an arboreal way of life were ancestral to primates. Vision gradually replaced smell because distant edible fruits could be more easily seen than smelled. The hand assumed the grasping function previously served by the mouth and lips.

His student, F. W. Jones, claimed that the front limbs used for reaching out and grasping new support branches became the hands specialized for food-gathering. As the mouth lost importance, it became smaller; and the eyes moved closer together in the flattening face.

Specialization of the hind limbs for support led to a more upright position with correlated changes in the axial skeleton.

But other arboreal mammals such as opossums, shrews, palm civets, and squirrels lack these features which arboreal life supposedly favored. Jones' explanation for this was a postulated period of adaptation in each lineage to terrestrial locomotion thus reducing thumb and first toe and replacing flat nails by claws. These changes blocked the specialization of the forelimbs for prehension.

Cartmill correctly observes that, thus stated, Jones' thesis is inconsistent, for he postulates that primitive mammals were small-eyed terrestrial beasts as regards the brain, nosing their way through the world; yet as regards the hands and feet he assumes that arboreality was primitive, and that early mammals were neither terrestrial nor typically quadrupedal.

The late W. E. LeGros Clark skillfully concealed this inconsistency in his reformulation of the arboreal theory. The now discredited theory that tree shrews are primitive lemuroids (primates) was invoked by him to explain their incipient primate-like morphology and unspecialized squirrel-like climbing habits, and their clawed feet showing only minor adaptations in the joints and muscles of the hind feet.

Lemurs have flattened nails, grasping first toe and thumb, and eyes closer to the centre of the face; and they developed from tree shrews, according to Clark. Cartmill then shows with most convincing illustrations that contrary to Clark's thesis, nonprimate types such as the tree squirrels *(Scurinae)* are just as well adapted to arboreal living as animals having primate-like traits. They have eyes facing laterally, only a 60° visual overlap, nose as large as rodents, and all digits (except little thumb) bearing claws, which are sharper and more recurved than those of land squirrels.

The thumb and toe are not opposable or even very divergent. Yet they can leap 13 to 17 body lengths from tree to tree comparing favorably with the 20 body lengths for the jumping lemuroid *(Propithecus verrauxi).*

LeGros Clark's followers might argue that tree squirrels are under selection pressure to develop primate traits, but sufficient time has not elapsed to effect the changes. But, says Cartmill, one should still expect the tree squirrels to show some slight primate-like traits.

Actually arboreal squirrels differ from terrestrial squirrels only in the longer fourth digit and larger carpal pads. There is no tendency to enlargement of the thumb, or reduction of the claws. To return to the shrews, there is no evidence that selection pressure favors primate-like morphology, for in many respects shrew-like morphology is superior for climbing, especially on nonhorizontal surfaces with large radii of curvature, as well as on tree trunks.

Cartmill then observes that the close-set eyes and grasping extremities typical of living primates are adaptations to some activity other than simply running about in trees. Arboreal life *per se* cannot be expected to transform a primitive tree shrew into a lemur, and Clark's version of the arboreal theory is not adequate.

He further believes that most of the supposed arboreal features inferred for ancestral mammals by Matthews and his followers are either chimerical or irrelevant. Most of those who have believed that primitive mammals were lemur-like have also thought that terrestrial habits select for fast running ability and thus for simplification and stabilization of the limbs, the final stage in the process being the horse.

But Cartmill points out that just because placental ancestors could not have been like horses does not mean that they were very much like lemurs. There is no evidence in the Triassic formation that the "ancestors" of mammals found there had clawless, grasping feet or hands.

*Visual-Predation Hypothesis*

The close-set eyes, grasping extremities, and reduced claws characteristic of most post-Paleocene primates may have been adaptions to a way of life like that of the marsupials *Cercartetus* and *Burramys.* These animals forage for fruit and insects in the shrub layer of Australian forests, and their claws are much reduced.

Visual convergence and correlated neurological specializations are interpreted as predatory adaptations similar to those seen in cats and owls. The grasping feet allow the prosimians such as cheirogleines and lorisiforms to move cautiously up to insect prey, holding securely to small branches while using both hands to catch the prey.

Cartmill observes that arboreal life *per se* does not encourage loss of olfactory acuity with resultant reduction in size of snout. He really has no satisfactory explanation for this reduction, pointing out merely that the close approximation of medial walls of the two eye orbits would

necessarily cause it. This actually is a design argument, i.e., in order to create animals with close-set eyes, the snout has to be reduced, eventually becoming a nose.

If by the word "adaption" Cartmill means changing a feature of the body so as to make it suitable for a special use or situation, creationists would have no disagreement with him. Only creationists would use the word "design" instead of "adapt." Creationists believe these creatures have their bodies designed for habitat where they now live, either originally at Creation, or by adaption following the curse placed upon all of His Creation by God following man's sin (Genesis 3:14-19).

As regards the fossil record Cartmill admits that his visual-predation concept does not hold up. The earliest primates had teeth adapted to a herbivorous diet instead of one consisting of insects, according to F. S. Szalay. Also, E. L. Simons claims that four of the six Tertiary primate families have molars like those of the carnivorous *Tarsius*.

The evidence suggests that unknown lineages leading to Eocene "primates of modern aspect" must have branched off from the Plesiadapoid lineages by mid-Paleocene. For the unknown Plesiadapoids are not directly related to Eocene prosimian families. *Plesiadapis* in fact had clawed digits resembling those of a squirrel.

It is most interesting that such a keen student as Cartmill has to appeal to "unknown lineages" in order to try to harmonize his concept of primate "evolution" with the fossil record. It is my prediction that such fossils, i.e. ones with teeth adapted to an insectivorous habit but otherwise with ancestral primate traits will never be found.

—Submitted by Walter E. Lammerts

### Does Nature Really Select Selection?

Darwin's theory of evolution has been criticized on the grounds that it is more often used to make retrodictions than predictions. About six years ago the neutralist theory of evolution was propounded; and it is considered to lead to predictions and to experimental tests of predictions. It leads to description of expected amounts and patterns of genetic variation in natural populations. The issue now is whether it is sufficient to explain most genetic variations, including (presumed) evolutionary genetic substitution in natural populations.[28]

According to neutralists many mutations that occur in the DNA of members of natural populations, and eventually become fixed, are adaptively neutral. That is, the organism would experience neither enhanced nor diminished fitness to survive in a given environment. Random mating would establish certain mutations and eliminate others; and the result is called genetic drift.

To assess the phenomenon of genetic drift investigators compared amino acids of hemoglobin or cytochrome C and the entire DNA molecules of different species. It was found that the sequences varied greatly in the species investigated. Since the sequence is a function of DNA sequences that code for the protein, the variations are measures of genetic variation.

Entire DNA molecules from various species also varied greatly both in amount and similarity of sequences. Cells of certain amphibians have 10 to 20 times as much DNA as do cells of closely related species. From these studies investigators concluded that mutations accumulate at a steady rate; and according to T. Jukes the large number of seemingly neutral mutations fixed in species are not a consequence of natural selection but evidence for the neutralist concept.

Again, non-interbreeding populations should have different patterns of variation. Variation can be predicted in terms of population size and the rate at which neutral mutations arise. Most measurements of variations are based on comparative studies of amino acid sequences of specific proteins. Gel electrophoresis is used, since proteins that differ in charge or molecular weight move at different rates through a gel in an electric field; and they are detected by a specific dye.

This type of analysis of a wide variety of organisms from the fruit fly to mouse and man revealed a great amount of electrophoretic variation; as much as thirty-eight per cent of the genetic loci of *Drosophila pseudoobscura* being involved. But genes that control an organism's form, behavior, or physiological control have not been studied. Thus variation distribution among soluble enzymes is quite different from that of blood group proteins.

Other techniques show even more variation. Thus L. Throckmorton's group using heat stability as a test found 32 variants of the gene for the enzyme xanthine dehydrogenase as compared with only eleven as determined by electrophoresis.

*Natural Selection*

F. Ayala argues that genetic drift is not sufficient to explain the distribution of variation he observed in 70 populations of *D. willistoni*. He found that frequencies of genetic variation were the same in the different populations. Partial explanation of this may be the migration of individuals from one population to another, only one individual per population being sufficient, according to Mariyama and Kimura.

Ayala's rebuttal is that many of the populations had chromosomal inversions thus barring any recombination of genes from these chromosome regions. Also, for any two species the frequencies of genetic variants were the same at about one-

half the genetic loci and completely different at the remainder.

Moreover Ayala found different sets of identical gene frequencies when different pairs of species were compared. He claims that if migration affects gene frequencies, they should be the same at all loci of pairs of species compared. Ayala believes that his work proves that a great deal of variation is maintained (fixed) as a result of natural selection. Others claim that the data can be interpreted to fit either theory.

Kolata concludes that regardless of the final judgment on the role of neutralism versus natural selection, the stimulation of provocative experiments shows that neutralism is a valuable theory.

*Importance for Creationists*

Creationists may very well consider the drift theory to be a refusal to assign any reason for the origin of species. Also, from the creationist point of view, organisms would be expected to have many genes for characteristics having no survival value.

Thus, according to creationist thought, many species were created merely for the sake of variety in order to make a most interesting world. For instance, human beings might very well get along in a world without flowering plants such as roses, carnations, or lilacs; but it would surely be a much more monotonous one.

Similarly, variation within species would seem to be both to provide for survival under differing environmental conditions, and also just for variety. Thus, in roses, many species exist: some capable of surviving even in the cold prairie regions of Canada such as Saskatchewan. Others are found in sub-tropical areas.

Some varieties of *Rosa rubrifolia* can survive even in Alaska, while other species extend down into the United States and would die if subjected to the extreme temperatures of the Canadian prairies. In addition, they show much variation in features which can hardly have any survival value (as in the neutralist theory).

Plant breeders have been able to take advantage of these variations and develop a remarkable array of beautiful roses, such as the Prairie Princes originated by Dr. Griffith Buck of Iowa State University at Ames, Iowa, from the species *R. laxa* Retzius.

Evidently the Creator loves variety, which is fortunate; for what a monotonous world this would be if all people looked alike!

—Submitted by Walter E. Lammerts

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# BOOK REVIEWS

*God's Method in Creation* by William J. Tinkle. 1973. The Presbyterian and Reformed Publishing Company, Box 185, Nutley, New Jersey 07110 (The Craig Press). 93 + vii pages. Price $1.50.

Reviewed by H. L. Armstrong.*

The author has been well known for many years for his work in showing that the facts of nature agree far better with Creation than with any sort of "evolution." Here is set forth the evidence for such a view, in a form very suitable for the general reader.

Tinkle begins by noticing that design in nature is obvious—so obvious that those who do not want to admit that there is a Designer find it necessary to try to explain away the design. Then follow some remarks on science as a means for investigation of regularity and design, on the limitations of science, and on the relation between science and philosophy.

Since the author is an authority on genetics, it is natural that he should devote some space to questions concerned with that study, in which it is shown that the genetic system of any living being gives every evidence of being something which was carefully designed, not something which came about by chance.

As for the alleged natural selection, it is shown that the extent to which selection can be carried is limited. Experiments, such as Johannsen's, which show this clearly and which should be better known than they are, are discussed.

Not only do living things show evidence of design, but their "home," the earth, has plainly been designed to be suitable for them. This fact is pointed out and illustrated. Indeed, this fact, like many other evidences of design, is clearer now than it was in Darwin's time. The recent interplanetary studies have shown plainly what a unique place this earth is.

The question of vitalism versus materialism, which everyone who thinks about these matters will feel although he may not formulate it, is considered briefly. The author argues that since any strict materialism is clearly inadequate, we must accept a form of vitalism. But this form, of course, is not the exaggerated vitalism which can so easily turn into pantheism.

Since it is so widely claimed that there is "proof of evolution," it is necessary to investigate such alleged proof. As for the fossils, the fact that any argument from them is of necessity somewhat circular is pointed out. Moreover, Creationist interpretations of the fossils, which are at least equally plausible, are proposed.

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The other alleged pieces of evidence are really of use only if evolution be already granted; and even then they are nothing like as strong as they have been thought to be. The great ages often claimed for the earth, in order to give time for "evolution," may fall into this class; and it is shown why these alleged ages must be taken with a very large "grain of salt."

The work concludes with some consideration of how these matters affect a Christian whose Christianity means something to him. Such interpretations as the gap, the "day-for-an-age," and theistic evolution are shown to be unnecessary concessions to "evolution."

The style of writing, with its quiet wit, its clarity, and its wide use of the literature, will appeal to readers. The book can be highly recommended to anyone wanting a clear, reasoned, but not highly technical statement of the case for Creation.

*Populations, Species, and Evolution* by Ernst Mayr. 1970. Harvard University Press, Cambridge, Massachusetts. 453 pages. $4.95 Paperback.

Reviewed by Allen B. Cornell*

Those familiar with leaders of modern evolutionary thought will recognize the name Ernst Mayr. A book by him is bound to be among the leading present day works in that field.

Perhaps this book's greatest value to a creationist is that it serves as a rather detailed explanation of the modern synthetic theory of evolution. It is vital that creationists keep abreast of modern evolutionary thought and be continually ready to refute the false concepts presented.

In a manner typical of the present time, Mayr dismisses creation with the words, "Darwin . . . found overwhelming evidence that was completely irreconcilable with the creationist explanation. . . ." Later he says that present arguments deal with details in the synthetic theory of evolution, and not with whether or not it is true.

He goes into detail in describing a species. His biological concept of a species is a practical concept for many areas of biology. Of course any species concept is bound to be somewhat arbitrary and numerous different definitions of species can be found. His concept is most applicable to higher animals and not applicable to most microscopic organisms.

This book emphasizes natural selection. Though I acknowledge an effect of natural selection in

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this world, it appears that Mayr overstates the case in calling natural selection "creative." He compares it to a breeder selecting certain individuals from a population. Even so, one must recognize that those working in areas of plant and animal breeding are not able to "create" anything.

He differentiates and discusses biological isolation and geographic isolation. He catagorically presents the evidence that some variation is taking place at the present time. He argues that geographic isolates can undergo change to the point that they become reproductively isolated and hence are valid species according to his species concept.

Though the author deals primarily with variation on the species level, in the next to the last chapter he attempts to apply his findings to the transpecific level. Having pointed out the impossibility of the late Richard Goldschmidt's macrogenesis concept, by discussing the "hopelessness" of Goldschmidt's so-called "hopeful monster," Mayr then tries to defend large changes by claiming that they are simply accumulations of small changes.

He proposes to answer questions dealing with the origin of a new structure. He lists as difficult problems the bird feather, mammalian middle ear, fish swim bladder, insect wings, and the sting of aculeate hymenopterans. His proposed modes of origin are intensification and change of function of an existing structure. He claims that there is never a stage in which the incipient structure is not of selective value.

I see no value in halfway flight feathers or insect wings, nor can I conceive of a series of small changes adding a couple of bones to the middle ear. He concludes his answer to these questions by saying, "A new function can be performed by a structure that evolved for a different reason."

Even if such a change of function were possible, an explanation would still be needed as to how that structure "evolved" for the different reason. When he says a structure "evolved," I wonder if he means it came into existence or that it just changed function *ad infinitum.*

Later in the same chapter, Mayr speaks of a real difficulty in that ecological "space" is not continuous, and says, "The terrestrial insectivores and the aerial bats are separated by an adaptive discontinuity, and so are the diving petrels and the penguins."

Having demonstrated that living things do not make sudden large changes so as to "jump across" such a discontinuitiy, the author obviously wants the reader to believe that such discontinuities were slowly "walked across." One could just as sensibly speak of walking across the Grand Canyon. The demand for creation is clearly seen in such discontinuities.

His last chapter is a rather typical discussion of "human evolution." He grossly overstates the case when he says, "No one doubts any longer that *H. erectus* is a direct descendant of *A. africanus.*" Evolutionists who have recently stated alternative views would include Le Gros Clark, Robinson, Dart, Broom, and the late L. S. B. Leakey. It is interesting that he attributes the claimed halt in increase of human brain size to a departure from polygamy.

Though Mayr presents a good study of variation, his attempt to defend "transpecific evolution" helps pinpoint vital weaknesses of the "evolutionary hypothesis."

☆ ☆ ☆

*The Center of the Earth* by Andrew J. Woods. 1973. Institute for Creation Research, San Diego, California. 18 pp., 6 tables, and 4 figures. Price $1.50.

Reviewed by George F. Howe*

Does the reader realize that Bible lands in general lie at the geographic center of the earth's land surface? Before someone says "So what?", or even "Ho, hum!", he should read this little treatise in which Mr. Woods provides computer backing for the afore-mentioned thesis, and Dr. Henry Morris adds a discussion of some broad implications.

While these authors admit that this question is not exactly central to Biblical apologetics ("Admittedly none of these arguments are very compelling, and the Scriptures cited do not necessarily teach what we have inferred from them," p. 3), they assert that ". . . the probability that the earth's center would happen to fall in these Bible lands is only one chance out of 450." And again, "This is highly significant from a statistical point of view, even more so in light of the Biblical inferences to this effect, and is strong evidence of divine planning" (pp. 5 and 6).

They suggest practical value to the findings by way of calculating the geographical center of land surface to assist in locating world centers of commerce, education, transportation, and communication—"The location of the center of the earth is thus desirable not only esthetically and theologically, but also scientifically and economically." (p. 4)

This is an excellent little volume, with only a few minor shortcomings.

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In analyzing the title, the reader must realize that actually the authors are dealing with the geographical center of the earth's *land surface,* not the geometrical center of the earth. Since Dr. Morris wrote the first third of the volume, it is surprising that his name does not appear as coauthor.

Any thorough study of the World's surface land masses would seemingly lead to consideration of how those masses got into their present shape and distribution—continental drift versus land bridges, etc. However, the authors have all but avoided such aspects of the problem. Also, the first three books in this series of technical monographs are priced at about four or five cents per page while "The Center of the Earth" runs closer to eight cents per page.

This little treatise ought to be of certain supplementary value in teaching courses of geography at Christian and other institutions as it shows how modern computer methods can be applied to a very basic geographical problem. With fuel shortages becoming more and more important, this booklet is even more timely now than when the research was carried out a year or two ago. This same computer program could be applied with profit to identification of the most profitable locations for holding state, federal, or private organizational meetings.

Likewise, this work signals a worthy recognition that Christians in science can and should be willing to push out into subjects which lie at the periphery of the spheres of Bible apologetics and special creationism. The attitude of the Puritans which made their science so thorough was that all nature is the handiwork of the Creator and that man may investigate any problem—large or small—to the glory of God.

☆ ☆ ☆

*Quantum Mechanics in a New Key* by A. Landé. 1973. The Exposition Press, Inc., 50 Jericho Turnpike, Jericho, New York 11753. 131 + vii pages, Price, $6.50.

Reviewed by H. L. Armstrong*

While it may seem that there is little connection between Creationism and quantum mechanics, yet there are several reasons why it may be worthwhile to consider this book briefly.

First of all, some readers, as teachers, may have occasion at least to remark on the matters considered here. Secondly, many strange philosophical views have been proposed on the strength of the common "Copenhagen" interpretations associated with quantum mechanics. It is suggested here that such interpretations are not necessary, and that it is time that they were deflated. (Moreover, there are parallels between the case expounded here, and situations with which Creationists are quite familiar.)

Proponents of the Copenhagen viewpoint, which has been dominant for more than 40 years, hold that the objects with which quantum mechanics deals have certain wave-like aspects, and certain particle-like aspects; and that these two aspects are complementary. The author was formerly of the Copenhagen school, but became dissatisfied as he found that answers, given by proponents, to many questions were evasive, unclear, or just wrong.

Eventually, with the help of a principle which had been proposed by the American physicist Duane about 1923, but which had been little noticed, Landé has developed a solution to the problem of complementarity which rids it of the paradoxes with which it had been "infested." The treatment proposed here leaves particles as particles and waves as waves.

Landé uses an underlying statistical basis for his treatment, in which the behavior of things arises supposedly from randomness. Many creationists may not care for such an interpretation, believing that, as Einstein put it: "God does not play dice with the world." But, of course, it can be quite legitimate to stop with a statistical treatment, which is adequate for the job being undertaken, without denying an underlying purpose.

Landé has been proposing his interpretation for 10 years or so now, and seems to have had difficulty, at times, in getting a hearing. This experience is very familiar to most creationists, who can feel much sympathy with the author when he remarks that: "Few things are so immutable as the addiction of groups of scientists to ideas by which they have won fame, ideas turned now into vested interests."

He reports that: ". . . the editor of . . . (a) . . . journal still tries, at this late hour, to protect his readers from Duane's and other people's poison"; and he goes on to remark that:

> . . . one always blames the Pythagoreans who concealed the irrationality of the square root of two. But one must accuse Pythagoras himself even more for sacrificing a hundred oxen to celebrate his famous theorem because, since that time, all oxen get jittery when a new truth is discovered.

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# LETTERS TO THE EDITOR

## A Suggestion

*The Editor will continue to accept letters concerning items which have been published in the C.R.S. Quarterly. However, since this is a Christian endeavour, sometimes a better way to deal with questions might be as suggested in Proverbs 25:9 and in St. Matthew 18:15-17.*

*Would it be helpful if anyone wishing to raise a question about an item in the Quarterly were first to write to the author? The author might then wish to publish a correction or explanation, acknowledging that the matter had been called to his attention. Or, the author and the person raising the question might write a joint letter on the matter. Sometimes, of course, a letter submitted in the usual way might be better.*

*There are points both in Scripture and in science on which differences of opinion are possible; and it is by discussion that differences may be resolved. So the continuation of free discussion is very important. But let us take every care to avoid wasting our efforts or spoiling our charity by falling into squabbles.*

—THE EDITOR

## Diversity of Opinions Found in Creationism

Opponents of the creationist movement have often charged its proponents with rigid adherence to a very narrow and dogmatic view of earth history as taught in the Bible and with a refusal to consider contrary evidence.

The March, 1974 issue of the *Creation Research Society Quarterly*, quite to the contrary, apparently exhibits wide divergence of views among creationists, with respect to the duration of earth history, the degree of "evolution" possible in living organisms, and the geological effects of the Genesis flood, all of which are critically important aspects of the Biblical framework.

With respect to chronology, Lammerts and Howe,[1] in their paper on plant variation, and Clementson,[2] in his paper on radiocarbon dating, accept and effectively support an Ussher-type chronology of only about 7,000 years or so of earth history. Nevins[3] and Northrup[4] would extend this to perhaps 9,000 years, and Wonderly[5] to "at least several hundred thousand years."

On the matter of the degree of evolution, Northrup seems to allow a very wide latitude of post-flood mammalian "evolution" during the Cenozoic and perhaps also the Mesozoic. Lammerts, on the other hand, finds so little evidence of variation that he postulates a special creation after the Flood, of the distinctive racial characteristics in both plants and man! Moore[6] likewise finds no evidence of significant variation even in thousands of generations of bacterial reproduction.

The greatest divergence, however, is on the identification of the effects of the Genesis Flood in the geological column. Nevins attributes only the Paleozoic and Mesozoic strata to the Flood, and Northrup only the Paleozoic.

Wonderly, on the other hand, evidently thinks the Flood produced only certain superficial deposits in the late Cenozoic, the other strata (in particular the Permian deposits in Texas) all being pre-Flood. As Nevins points out, however, there are many other creationists, including the writer,[7] who believe that only the deposits of the Pleistocene and possibly the Pliocene are post-Flood, all the other fossiliferous strata having been formed during the Flood.

All of these points of view deserve consideration. The geological data are complex and certainly do not lend themselves to a simplistic interpretation, by either the uniformitarian or catastrophist approach.

Catastrophism clearly is required to at least some degree; even uniformitarian geologists agree on this. There are almost no types of geologic formations (and this especially includes "evaporites," volcanic structures, regional sandstones, etc.) which have any parallel in present-day phenomena at present-day rates.

On the other hand there is no reason to discard *uniformity* in so far as the basic laws of nature are concerned. Neither is there any justification for postulating multiple global cataclysms, as Velikovsky and other naturalistic catastrophists are doing.

While, as scientists, creationists must study as objectively as possible the actual data of geology, as Bible-believing Christians, we must also insist that these be correlated within the framework of Biblical revelation. This restriction requires rejection of the traditional uniformitarian approach, to which Wonderly's approach seems to come very close. Moreover, it requires a very skeptical attitude toward multiple creations or multiple catastrophes, which Lammerts' and Northrup's suggestions respectively seem to approach.

As for the latter two views, it might be said that, since the Bible does not explicitly preclude multiple creations and multiple cataclysms (neo-Cuvierism ?), these notions do not contradict Scripture. An argument from silence, however, is always tenuous, and this is especially true in this case.

The Bible emphasizes strongly the uniqueness of the creation period (Genesis 2:1-3; Hebrews 4:3, 10, etc.), and the deluge period (Genesis 8:22-23; 9:9-17). It stresses that willful ignorance of the effects of these two (only two!) periods of earth history is the basis of the latter-day philosophy of evolutionary uniformitarianism (II Peter 3:3-6).

Creationists need to be no less cautious in suggesting special divine intervention in nature

on the basis of so-called scientific evidence than do evolutionists in repudiating all such interventions. There is surely an economy of the miraculous in God's orderly world.

As far as the post-Flood dispersion of man and animals is concerned, the only miracle recorded in Scripture is the confusion of tongues at Babel (Genesis 11:9). This divine judgment was adequate to enforce man's segregation into family groups, with resultant inbreeding in small population units. No further miracles would have been needed to account for the rapid appearance and fixing of distinctive tribal physical features, hitherto latent genetically, but unexpressed somatically in the larger gene pool of the previous large interbreeding population.

Something of the same phenomenon would have been experienced in the animal realm, except that the animals immediately obeyed God's injunction to multiply and fill the earth, not requiring enforcement by a divine chastisement as did man.

Neither is there need to postulate a proliferation of mutations due to the stress of repeated physical convulsions in the earth after the Flood. The flora and fauna of the antediluvian world were surely abundant and variegated; many species of these became extinct after the Flood because of the vastly changed topographic and climatologic conditions, but there is no need to believe that new genera developed after the Flood.

The idea, for example, that the horse "evolved" from *Eohippus* to *Equus* in the post-Flood period would be an unwarranted concession to "evolutionary" thinking. Many new varieties soon became established after the Flood, no doubt, but that is probably all. The Flood did not change God's dictum of reproduction "after its kind" (Genesis 1:11, 24).

God told Noah to build an ark of tremendous size (Genesis 6:15), and it has been shown that the ark was easily large enough to hold representative pairs of all known species of land animals, living or extinct. There was no need for either post-Flood creation or post-Flood "evolution" of new types.

The question of cataclysms has also been unnecessarily complicated. If, for example, all Cenozoic strata are post-Flood, how is it so few, if any, fossils of mammals are found in the "flood" deposits of the Paleozoic and Mesozoic? If, as Northrup thinks, even the Mesozoic strata are the results of later cataclysms, why are some dinosaur fossils not found in the "flood" strata of the Paleozoic?

Here is a remarkable anomaly. The Bible describes in detail the devastating global cataclysm of the Noachian deluge, indicating especially its destructive effects on dry-land animals, and says nothing whatever about hypothetical post-Flood cataclysms. Yet, by Northrup's interpretation, the post-Flood cataclysms must have been tremendously greater in their destructive effects on these land animals than the Biblical flood, at least as far as the fossil record shows.

Biblical writers are strangely silent about these later cataclysms if they really took place. The reference in Genesis 10:25 to the "dividing of the earth" is very questionable, in context more likely referring to the division of the nations by their languages.

There may be references in the Book of Job to phenomena associated with the ice age, but any other catastrophes have to be inferred only by means of highly imaginative exegesis. Velikovsky-like planetary "encounters" are certainly not encountered in Scripture, except on the basis of wishful thinking.

If, indeed, the tremendous thicknesses of both continental and marine deposits, with all their great fossil graveyards, that are identified as Mesozoic or Cenozoic must be understood as post-Flood deposits, then the perspicuity and the relevance of the Genesis record of earth history are considerably lowered.

Is it really necessary to adopt such a compromising approach? Perhaps the problem is that the complexity, as well as the duration, of the Flood itself has been underestimated.

Although it was primarily a hydraulic cataclysm, it is clear from the Biblical account that there were also great tectonic, volcanic, and other geophysical phenomena associated with it. There was undoubtedly a vast complex of currents, tsunami waves, tidal bores, erosion, deposition, re-erosion, landsliding, and all kinds of hydraulic activity.

The depth of water need not have been excessive, since the antediluvian mountains were much lower and gentler than those uplifted after the Flood. Consequently, there could certainly have been parts of the globe that were alternately inundated, re-exposed, and re-inundated during various periods of the Flood year. The possible variety of deposits and sequences of deposits during such a cataclysm is practically limitless, and it seems unnecessary to invent later cataclysms to account for this variety.

Furthermore, residual catastrophism, in the form of continued earth movements and volcanic activity, as well as glaciation in the high latitudes and altitudes, and pluviation in the lower latitudes and altitudes, together with great winds, would certainly have continued for years after the Flood, perhaps even for many centuries.

These phenomena are not to be understood as separate global cataclysms, however, but as continuing effects of the one cataclysm.

Such phenomena are apparent in Pleistocene formations and perhaps certain other late Teritary formations, but seem inapplicable to the earlier strata. Whether continental drift also may have been a component of these post-Flood effects remains an open question at this time.

The detailed field studies described by Nevins and Northrup, as well as those by Moore and by Lammerts and Howe, are to be highly commended. We need many more such studies, everywhere around the world. It seems better, however, to seek to interpret them not by questionable twists of Biblical exegesis, or by hypothetical subsequent cataclysms or creations, but by a more imaginative reconstruction of the variegated activity of the one creation and cataclysm clearly described in the Bible.

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[1]Lammerts, W. E., and G. F. Howe. 1974. Plant succession studies in relation to mircoevolution, *Creation Research Society Quarterly,* 10 (4):208-228.
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[3]Nevins, S. E. Post-Flood strata of the John Day Country, Northeastern Oregon, *Ibid.,* 191-204.
[4]Northrup, B. Comment on Stuart Nevins' paper, *Ibid.,* 205-207, and 288.
[5]Wonderly, D. Critique of Capitan limestone article, *Ibid.,* 237-241.
[6]Moore, J. P. A demonstration of marked species stability in Enterobacteriacae, *Ibid.,* 187-190.
[7]Whitcomb, J. C., and H. M. Morris. 1961. The Genesis flood. Philadelphia, Presbyterian and Reformed Publishing Co., pp. 288-330.

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### Reply Concerning Entropy Prior to the Fall

Dr. Emmett Williams and Dr. Henry Morris rather severely criticized my paper[1] on "Entropy Prior to the Fall," charging that I was guilty of making a uniformitarian extrapolation of present physical conditions into the period before the fall and the imposition of the curse. A rebuttal is in order.

I am thankful that we have in this *Quarterly* a forum in which men of like precious faith can, as brethren, examine and discuss important issues for better understanding and grasp of the truth. Let me begin by saying that though I have never met Dr. Williams, I highly regard him for his contributions to creation science, both in the *Quarterly* and as a member of the excellent team of creation scientists on the faculty of Bob Jones University.

And I wish to express my respect and admiration for Dr. Morris for the total devotion to the Scriptures which has characterized his leadership and contributions to the creation science movement, and in his present work as Vice-President of Academic Affairs of Christian Heritage College and Director of the Institute for Creation Research. However, I feel that the criticisms offered by my two brethren have failed to weaken my original thesis.

It was the purpose of the original paper to deal with principles, not persons. Nevertheless, it is now necessary to document explicitly the reason for writing on the subject of entropy prior to the fall. If others had not adopted and propagated a dogmatic theory about entropy prior to the fall, it is unlikely that I should have been led to address myself to the subject.

However, the view has been adopted and published that the law of entropy was imposed on the creation at the time of the curse as part of the curse.[2] It is clearly implied that prior to the fall the law of entropy was not in effect. This proposal involves theoretical difficulties which I felt should be examined and dealt with before any easy assumptions are made about the absence of entropy and the second law of thermodynamics in the Edenic order.

I shall now reply to the criticisms made by Dr. Williams and Dr. Morris:

1. The Scriptures tell us explicitly that certain drastic changes occurred with the imposition of the curse: e.g., man's environment became hostile[3] and the entire creation was made subject to vanity and the bondage of corruption.[4]

2. The Scriptures do not tell us explicitly that the laws of physics were changed. Perhaps they were in some manner, but such a conclusion is an inference which depends upon interpretation of the Scriptures.

3. There is presently 100% efficient transfer of heat from hot to cold bodies.

4. But it is not possible to transform all of a quantity of heat into work by means of a heat engine, because of the principle described by the second law.

5. I have not discovered one word of Scriptural evidence that the second law did not describe physical-chemical processes in Eden. On the other hand, the account in Genesis 1 and 2 leads one to believe that the physical order of Eden did obey the same physical laws as does the present order.

6. Yes, the second law is a human mental construct designed to describe the uniform behavior of matter in the present natural order. And the

demonstration in my original paper that it is the second law of thermodynamics which describes a rational, reproducible physical world now has not been challenged by my two critics.

Dr. Williams, however, proposes that heat could have flowed from hot to cold objects in Eden without any entropy changes being involved. Let us examine this proposition. Assume that a team of science-minded angels make observations of heat flow in Eden and discover that heat always flows from higher to lower temperatures.

In the process of interpreting their data they define an extensive (i.e., proportional to the size of the system) thermodynamic property S, of a physical system by the equation $\Delta S = Q/T$, where $Q$ is the heat absorbed by a system and $T$ is its absolute temperature.

Then they think about a very large isolated system $(A + B)$ composed of two subsystems $A$ and $B$ at temperatures $T_A$ and $T_B$ where $T_A > T_B$. The angels ask the question, "If $A$ and $B$ are placed in thermal contact for a short time, what will be the $\Delta S$ of the system $(A + B)$?" The angels reason that heat will flow from $A$ to $B$, so

$\Delta S_A = -Q/T_A$

$\Delta S_B = Q/T_B$

Then $\Delta S_{(A+B)} = \Delta S_A + \Delta S_B = -Q/T_A + Q/T_B$

But since $T_A > T_B$, $Q/T_A < Q/T_B$

Therefore, $\Delta S_{(A+B)} > 0$

Thus, the angels conclude from their observations that in Eden: 1) Heat always flows spontaneously from higher to lower temperatures. 2) Spontaneous heat flow within any closed system is always accompanied by an increase in the property S.

But this is identical with what is observed in the present world, and the angels' hypothesized property S is identical in mathematical form with what we call entropy.

My point is simply this: As soon as one admits that heat flowed from higher to lower temperatures in Eden, he necessarily admits also that the second law of thermodynamics described heat transactions in Eden. There is no escape from this conclusion. And if creationists or the angels give a name other than entropy to the property S in Eden, the actual facts are in no wise altered.

It can also be shown that, given the law discovered by the angels, the maximum thermal efficiency of heat engines in Eden would be under the same restriction as in this present world. Spontaneous processes would always result in loss of available energy.

I have no doubt that extension of this analysis to the thermodynamics of chemical processes would lead to similar conclusions. As soon as the rational law of heat flow is admitted, the campaign to abolish entropy in Eden is lost.

7. On the other hand, if in Eden heat did not flow from hot to cold—if the reverse were true, or if there were no order at all to Edenic thermodynamics—we should have an irrational, crazy Eden which would seem to be a nightmare to live in. Certainly the Scriptures give no such impression.

8. Most people would feel that the six "unknowables" offered by Dr. Williams are pretty far out, but in any event, none of them affects the validity of the above logic relative to entropy in Eden.

9. Dr. Williams and Dr. Morris have not really answered my contention that the second law gives us a reproducible, rational natural order now, and apparently in Eden. The alternative is to postulate for Eden a totally supernatural order in which there is no natural order and all processes are directed by spiritual laws or forces and powered by spiritual power.

The Scriptures, in my opinion, tell of such a state in the heavenly kingdom, but not in Eden. In this connection the fruits referred to in Revelation 22:2 must be interpreted spiritually, but this is entirely suitable to the context.

According to I Corinthians 15:44-46,

> . . . There is a natural body, and there is a spiritual body. And so it is written, The first man Adam was made a living soul; the last Adam was made a quickening spirit. Howbeit, that was not first which is spiritual, but that which is natural; and afterward that which is spiritual.

One should infer from this passage that Adam was created a perfect but natural man, not the spiritual man which we shall be in heaven. The Edenic order must have been a perfect natural order, not a supernatural order such as will exist in the heavenly kingdom.

Dr. Morris questions my proposal that the effects of random processes upon genetic mechanisms were prevented by special divine constraints, calling it a "semantic maneuver." The fact is that there is Scriptural evidence for just such a special constraint.

The tree of life which was in the garden appears to have been designed for such a purpose. As long as Adam did not sin he did not suffer spiritual death, so why should such a tree have been provided if there were not some physical effect which had to be constrained, neutralized, or corrected to preserve life forever?

Note that when Adam sinned he died spiritually at once. But in order that he should not live physically forever he had to be removed

from the garden, "lest he put forth his hand, and take also of the tree of life, and eat, and live forever."[5]

In biochemistry there is additional suggestive evidence. There appear to be in all living cells special enzymes and mechanisms for the repair of certain types of damage to the DNA molecules which bear the genetic information essential to the life and propagation of the organism after its kind.[6] These may be just the remnants of a much more complete built-in repair system possessed by living things in the beginning.

The tree of life really existed in Eden. DNA repair mechanisms still are operating. But Dr. Morris' tentative, tongue-in-cheek proposal, that "now vanished 'converters' and 'governors' " substituted for friction and thermodynamic equilibria, remains pure speculation with no hint of Scriptural or physically observable evidence. The same may be said for his proposal that "perhaps *both* energy and entropy were conserved in all processes, with every decay process balanced elsewhere by a corresponding growth process."

Moreover, such speculations, if correct, would surely require a totally redesigned and recreated physical universe having a complexity far exceeding that of the present universe. Of such there is no suggestion in the Scriptural record in Genesis.

Dr. Morris is certainly correct when he states that drastic discontinuity occurred between Eden and the present natural and spiritual order on earth. But I believe that one should be more careful about dogmatic assertions about the Edenic order for which there are no Scriptural data.

In my original paper, and in this rebuttal, I have tried to relate my remarks to such data. On the other hand, I could find no clear Scriptural support for the positions taken by Dr. Williams and Dr. Morris. Does it not appear that their arguments are to a considerable extent offered in defense of a particular concept, namely, the idea that since the second law and entropy are the backbone, so to speak, of the effect of the curse on the natural order, entropy therefore could have no part in Eden?

If this idea had not become pervasive in creation-science circles, I should not have concerned myself with the problem. I am happy to agree with Dr. Williams and Dr. Morris that it is best not to speculate or extrapolate into the Edenic period, but it was not I who started such an enterprise.

Now it is surely appropriate to ask that more careful consideration be given to all of the implications when speculations are extended into the period prior to the fall. Creationists should make sure that explicit Scriptural data are not overlooked, and that the logical consequences do not contradict the Scriptural data.

Let me close by saying that if the original paper gave the impression that I was implying scientifically established validity for an extrapolation into the Edenic period, I hereby submit myself to Dr. Morris' wise admonition and wish to correct the impression.

However, I think that the language of the proposal at the close of the first paper is tentative, not dogmatic. It was the offer of an alternative proposal to encourage "further and more careful analysis" of the problem. Perhaps this objective has been attained.

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[1]Kofahl, Robert E. 1973. Entropy prior to the fall, *Creation Research Society Quarterly*, 10 (3):154-156; Williams, Emmett L. 1973. Response to Robert Kofahl, *Ibid.*, 156-157; Morris, Henry M. 1973. Another reply to Robert Kofahl, *Ibid.*, 157.

[2]Morris, Henry M. 1970. Biblical cosmology and modern science. Craig Press, Nutley, New Jersey, p. 19, footnote 4.

[3]Genesis 3:17-19.

[4]Romans 8:20-22.

[5]Genesis 3:22.

[6]Watson, James D. 1970. Molecular biology of the gene. Second Edition. W. A. Benjamin, Inc., New York, pp. 292-295; Richardson, C. C. 1969. Enzymes in DNA metabolism, *Annual Review of Biochemistry*, 38 (795).

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### Comment on Thermodynamics Before and After the Fall

These remarks concern articles in the *C.R.S. Quarterly* for December, 1973, pages 154 to 157.

Dr. Kofahl, in his article, wrote, in summary, that: "if relationships involved in the second law of thermodynamics were not in effect prior to the Fall, the thermodynamic order essential to the existence of physical life would be absent. . . ."

Dr. Williams replied that he sees "no compelling reason that conditions described by the second law had to exist before the Fall," and that Dr. Kofahl makes the assumption "that the present is the key to the past."

I do not think it very profitable to speculate, as Dr. Williams then did, about hot and cold blooded animals, body temperatures of man and animal, difference in temperatures on earth, metabolism, chemical makeup, etc., under Edenic conditions. One can note, however, as follows:

(a) that both man and animals were herbivorous upon leaving the ark (Gen. 6:12 N.E.B.)

(b) that Noah was the first to eat meat which before had been used only sacrificially (Gen. 9:3

N.E.B.).

(c) that dogs do not eat grass because they feel sick: dogs like to eat grass.

(d) that carnivorous animals in the wild necessarily eat meat only.

(e) that during the last world war carnivores lived on vegetation (at least in German zoos).

(f) that in 1860 African baboons, deprived of their customary roots and insects by agricultural over-expansion, were driven to kill cattle for food.

(g) that dried whale meat was used for cattle feed in the Faeroe Islands until quite recently.

(h) that squirrels eat birds and insects besides acorns and nuts.

(i) that, contrary to what Simpson has maintained, horses did not "evolve" from browsers to grazers. Horses are both browsers and grazers.

(j) that both man and animal were created omnivorous, with their present dentition, metabolism, chemical makeup, and with stomach and intestine adaption to food consumed.

Dr. Morris in his reply stated: "Some creationists are opening a 'can of worms' when they yield to pressures from uniformitarianists to try to make the creation period commensurate with the present period"; and that:

> There is no way, except revelation, by which we could determine how processes functioned in the Edenic period. The curse affected the "whole creation," bringing it under the "bondage of decay" (Romans 8:21-22) with all its present processes.

The question here is, what is meant by the word "decay"?

Since flora and fauna died before the curse, St. Paul could not have meant the word as meaning death but as meaning deterioration, thorns, thistles, sickness, and hard labor. A cosmos created for eternity was now under the bondage of deterioration. Sir Julian Huxley say: "Man is deteriorating thanks to genetic defects." (*Psychology Today,* November, 1973, p. 30.)

The above arguments involve three questions: 1) When God finished creating, did this not include all the laws of nature? 2) While all of creation was supernatural, was not the result one of natural order at and after creation? 3) Was there death before the fall, and if so, to what extent? I invite consideration of the following series of thoughts:

Step one—A blossom must die before a fruit can form. A seed must die before a tree can grow. Or must one believe that in Edenic times fruit appeared without a previous blossom, or a new tree without the dying of a seed?

Step two—An oyster produces more than 125,000,000 eggs in a season. If none had died there would have been about $10^{80}$ of oysters in eight years, enough to crowd the water out of the ocean and make it cover the earth.

Step three—If, by God's command, all living forms had been allowed to increase and none had died, there would soon have been wholesale death by starvation. Or must one believe that God countermanded His command to increase at a certain time?

Step four—Man's metabolic and chemical body makeup needs colon bacteria for proper functioning; and such bacteria die. To ascribe this to the curse takes more extrapolation than to believe that God made man with normal, natural bodily functions.

Step five—In the natural process of procreation, millions of male sperm die. Or must one believe that this also was a result of the curse, and that procreation during the Edenic period was supernatural?

My conclusions are as follows:

1) God completed all the work which He had been doing and rested on the seventh day. (Gen. 2:2-3, N.E.B.)

2) Thus the laws of thermodynamics were also completed at creation time.

3) That the state of nature, while brought about by supernatural means, was complete and of natural order and perfection.

4) That the second law had to be effective on flora for a continuous replication of food for man and animal from the beginning of creation.

5) That it was operational also on fauna from the beginning of creation.

6) That for this reason the curse did not include any pronouncement of death to snake, cattle, and wild creatures (Gen. 3:14 N.E.B.), but to man only (Gen. 2:18 N.E.B.).

7) That the second law was nonoperational on man only until after the fall and curse.

8) That only man was created in the image and likeness of God.

9) That God made only man to live forever—body and soul.

A case of law, Commonwealth vs. Green (*Decisions of the U.S. Supreme Court,* Vol. 295, page 573), states as follows: "A presumption of fact is an inference which a reasonable man would draw from certain facts which have been proven. The basis is in logic and its source is probability."

To be a theistic evolutionist one must believe that God "evolved" man from animal 1,500,000,000 years after He had initiated life (amoeba), and the animation of its chemical precursors, which was the beginning of life 1,500,000,000 years before. It would follow, then, that from the beginning of creation to the ap-

pearance of man was an "evolutionary" period of 3,000,000,000 years before God rested from all He had made.

However, if the present is the key to the past, then there was no "evolution" in the past, since there is no evolution as such at the present, but only replication of kind.

And if time and space, light and energy, are constants and not subject to process, then from the beginning of creation, days were periods of twenty-four hours. Algae are still algae and animals do not torture or try to exterminate each other, while man does.

It seems thus unreasonable to call "evolution" either factual, problematical, or even logical from available data. Its all-embracing doctrine of uniformitarianism is too contradictory. It is self-defeating.

On the other hand, Adam and Eve were not in the Garden of Eden just over a weekend. To believe that there was death before the fall and curse, except for man, does in no way give support to the doctrine of theistic evolution, at least so it seems to me.

Cordially,
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## In Retrospect

It is evident that there is still room for thought, and searching of the Scriptures, on the matter discussed by writers Kofahl and Jansma. In summary, should these questions be considered?

(1) Should creationists distinguish between the second law as it means that heat flows from hot to cold and so on; and as it means that things deteriorate? If it is possible that the law did not apply at all before the fall, is it also possible that the first aspect applied, but not the second? And could a similar suggestion be made about the increase of entropy?

(2) Would it be possible to consider that before the fall the law still applied, but that human beings were much less restricted by it? A turtle, one might say, is less restricted than a stone by the law of inertia; a bird is less restricted than a turtle by the law of gravity. St. Thomas Aquinas considered that, before the fall, in the state which he called "natural justice," by God's grace any natural deficiency could have been accommodated.

(3) Could the multiplication of animals have been taken care of, without having them die, by the same means as would have applied to man, had he not fallen?

(4) It seems clear from Scripture that, had there been no fall, men would not have died. Nothing to the same effect seems to be said about plants, although redwood trees or bristlecone pines might seem likely candidates for "immortality." Is the problem, then, to decide where the boundary lies?

(5) Is it possible that the boundary would be determined thus: the creatures called "living souls" in Genesis would have been immortal had there been no fall, the others not?

—THE EDITOR

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