

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

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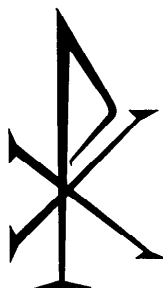
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COVER ILLUSTRATION

Swirling clouds of luminous gas and opaque dust intermix to form the magnificent Orion Nebula. Notice the obtrusions of interstellar dust into the gas clouds in the lower right portion of the photograph.

The Orion Nebula (M42) is a magnificent spectacle, as seen through the telescope. The very existence of this concentration of dust and gas is strong evidence for a young universe. This topic is taken up by Ronald Samec in his article in this issue of the *Quarterly*. The photograph is contributed by Ronald G. Samec, Rt. 2, Box 842, Tampa, Florida 33610.

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TREES INDICATE RECENT ORIGIN OF YOSEMITE VALLEY

WALTER E. LAMMERTS*

The trees in Yosemite Valley are about 300 years old. Nobody claims, of course, that Yosemite Valley is that young. Yet the evidence from trees, and other evidence, shows that Yosemite Valley is much younger than sometimes stated. While the formation is often ascribed to glacial action, it seems likely that it, like many other features of the Earth's surface, may have been caused by the violent erosion which happened at the end of the Flood, in conjunction, perhaps, with earthquakes.

For many years my vacations were spent in or near Sequoia National Park. The remarkable redwood trees in that park are undoubtedly thousands of years old. When I first visited Yosemite National Park in 1950 the comparatively young trees amazed me. For years there was no publication which adequately discussed the trees of Yosemite, and Park Rangers had various and conflicting stories as to why trees comparable to those of Sequoia National Park could not be found.

Then, in July of 1964, Robert Gibbens and Harold F. Heady published their remarkably fine booklet entitled, *The Influence of Modern Man on the Vegetation of Yosemite Valley*.¹ Evidently the trees are of three age levels:

(a) First, scattered black oak, ponderosa pine, incense cedar, white fir, and Douglas fir trees show ages of 250-300 years. These are relatively few in number.

(b) Then there is a somewhat more numerous stand of intermediate age, that is, 174 years plus or minus 10 years.

(c) Finally, the oldest trees in the young forest, which predominates today, are only about 100 years old.

The above is clearly shown in various photographs taken in 1866, 1943 and 1961. A series taken from Union Point is remarkably clear, as shown in Figures 1, 2, and 3. Note how very sparse the trees were in 1866.

Causes of Irregular Tree Age

Gibbens and Heady are of the opinion that the Indians kept trees from growing by their practice of continual burning. But because of disease the Indians fled from the valley temporarily during the years from 1800 to 1810. This allowed the intermediate stand to become established.

The very young forest of trees only about 100 years old owes its origin to two and possibly three factors. Most important was the discontinuation of burning again when the white man took over the park. Thus Galen Clark in his letter to the Commissioners dated August 30, 1894 wrote:

My first visit to Yosemite was in the summer of 1855. At that time there was no undergrowth of young trees to obstruct clear open views in any part of the valley from one side of the Merced River across to the base of the opposite wall. The area of clear open meadow ground, with abundance of luxuriant native grasses was at least four times as large as at the present time.²

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Most of the young forest is post-1851 or about 100 years old. Other factors included over-grazing; especially after 1870 when the trees began an even more rapid increase. Later, drying out of the marshes and swampy meadows, which J. D. Whitney described in 1866, also allowed trees to increase.

Gibbens and Heady then raise the very pertinent question of why older forests were not established in the period since the filling of Lake Yosemite, presumably about 10,000 years ago according to orthodox geological concept. Lake Yosemite must have been of exceptional beauty for it filled the entire length and breadth of the valley and so was about 5½ miles long. Imagine the beauty of an early morning reflection of the cliffs of both El Capitan and Half Dome as well as the sprays of Yosemite Falls plunging into this lake!

This lovely lake, according to Francois E. Mathes³ was gradually filled up by the Merced River and Tenaya Creek in the *same slow* manner that Merced Lake and Washburn Lake are now being filled up. However, it is more in line with evidence regarding the end of the glacial period, particularly in the later stages of glacial retreat, that *far greater* amounts of water flowed down these streams than now, even after the heaviest of snow-falls. Thus, according to Wallace S. Broecker, Maurice Ewing, and Bruce C. Heezen, "Evidence from a number of geographically isolated systems suggest that the warming which occurred at the close of the Wisconsin glacial times was *extremely abrupt*."⁴ (Emphasis added) Likewise Richard J. Russell, former president of the Geological Society of America, wrote:

In summary, shoreline irregularity and the alluvial filling of valleys indicate a recent general rise in sea level. Comparatively small areas of deltas and topographic instability along coasts, which is evidenced by rapid advances from delta fronts and anomalous features such as Sapanca Lake, suggest that the rise in sea level *has been rapid*.⁵ (Emphasis added)

Early Eyewitness Reports

Furthermore floods and rockslides contributed heavily toward filling the valley floor. According to Hutchings (1886):

On December 23, 1867, after a snowfall of about three feet, a heavy down-pour of rain set in, and incessantly continued for ten successive days; when every little hollow had its own particular waterfall, or cascade, throughout the entire circumference of the valley, each rivulet became a foaming torrent, and every stream a thundering cataract. The whole meadowland of the valley was covered by a surging and impetu-



Figure 1. Lower Yosemite Valley from Union Point, 1866. Note how very sparse the trees were even on talus slopes. The young forest had not started to grow.

ous flood to an average depth of nine feet. . . . Immense quantities of talus were washed down upon the valley during this storm, more than at any time for scores, if not hundreds of years, judging from the low talus ridges, and timber growth upon them. After this rainstorm . . . a wind sprung up and blew down over one hundred trees. In one spot of less than seven acres twenty-three large pines and cedars were piled crosswise upon each other.⁶

Other major floods occurred in 1890, 1919, 1937, 1950, and 1955. Certainly, before recorded history of the valley, many such storms coupled with the heavy flow of the Merced River with melting glacial ice must have rather rapidly filled up Lake Yosemite.

Most interesting is the 1866 statement by state geologist J. D. Whitney:

Along the banks of the river and over the adjacent rather swampy meadows we find . . . a dense growth of older . . . small trees of *Rhamnus* . . . A few willows, the Douglas fir (*Pseudotsuga menziesii*), and in the upper part of the Valley an occasional sugar pine. Where the Valley widens out, and the river banks become lower, so that sloughs and swamps are formed, the Balm of Gilead (*P. trichocarpa*) comes in. . . . On the drier and loose (sandy) portions the yellow pine (*P. ponderosa*) and incense cedar (*Libocedrus decurrens*) are the most abundant trees . . . the pines being usually from 125 to 150 feet high.⁷

These are the oldest group mentioned above.

It is my conviction that these forests show the extreme youth of Yosemite Valley. No doubt for many years during and immediately after the melting of the glaciers, great floods and destructive flows of ice and water kept forests from becoming established; and, only after the change-over to the comparatively mild climate we now have could forests get started.

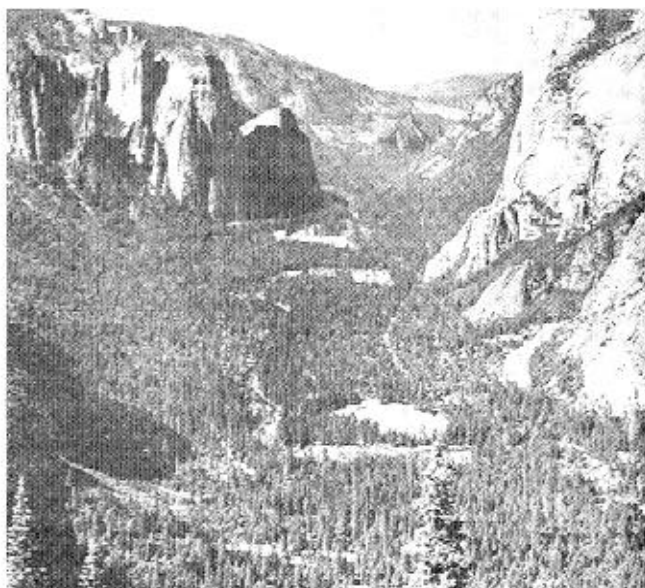


Figure 2. Lower Yosemite Valley from Union Point, 1943. The vantage point is a short distance to the left of the one used in 1866, the original view having been blocked by trees in the meantime. The young forest was only about 70 years old when this picture was taken.

Concepts on Valley Formation

Regarding formation of the valley, geologists such as Mathes postulate a slow formation of the river valley beginning about 60,000,000 years ago. He diagrams and describes this transformation to a U-shaped valley very clearly.⁸ However, as shown most effectively by Henry M. Morris, the rather thin coating of Miocene, Pliocene, and Pleistocene strata as yet unconsolidated could be rapidly carved out by the violently flowing Merced River. The High Sierra mountain uplift occurred after deposition of these stratified rocks.⁹

Mathes indeed concedes that glaciers alone cannot erode granite walls unless the granite already has a tendency to break into blocks. Thus the 14 mile Grand Canyon of the Tuolumne River has walls rising to 5200 feet. Yet the glacier filling this valley was unable to change the V shaped canyon walls into the U-shape of intensely glaciated canyons.

Mathes attributes this to the fact that the granite of the Tuolumne canyon wall is made up of a few monoliths that are hundreds to thousands of feet long, and so these gigantic blocks cannot be dislodged by glacial action. The granite of Yosemite Valley however is closely jointed; and these joints are "avenues" for percolating water, quite acidic from decaying vegetable matter. Weaker minerals are decomposed, thus further weakening the granite blocks. When frozen, water widens the seams.

As a result of such weathering: there have been many rockfalls even in historic times. At the toe of El Capitan there is over 100 feet of broken rock fallen from the cliff. In some recesses the debris reaches 2000 feet in depth! John Muir witnessed the rare spectacle of the downfall of a whole pinnacle called Eagle Rock, on the south side of the valley not far from Moran Point, at the time of the Owen's Valley earth-



Figure 3. Lower Yosemite Valley from Union Point, 1961. The young forest thickly covered many areas, and was about 90 years old when the picture was taken.

quake in 1872. His graphic account of the great avalanche of bounding rock resulting from the crash is an aid to comprehension of how very rapid erosion can be.

Comparison to Recent Event

A vivid idea of how violent rapid erosion can be, and no doubt was during the final stages of the melting of the Yosemite glacier, may be obtained from a description¹⁰ of the damage caused by a quake-induced rock slide into Lituya Bay in the gulf of Alaska on July 9, 1958.

Lituya Bay, according to W. H. Dall, was "a Yosemite Valley retaining its glaciers, its floor submerged six to eight hundred feet." The bay lies at the confluence of two major glaciers, the North Collins and the Lituya; and a smaller glacier, called the Cascade, lies between the major glaciers.

The highest wave in history, causing a "big splash," occurred on July 9th, and trimmed off vegetation to an altitude of 1700 feet! A Mr. Swanson described that apparently Lituya glacier had "risen in the air and moved forward so it was in sight. . . . It seemed to be solid, but was jumping and shaking. . . . Big cakes of ice were falling off the face of it and down into the water," After a while "the glacier dropped back out of sight and there was a big wall of water going over the point (the spur southwest of Gilbert Inlet.)"

Vegetation was severely damaged. More than 1700 feet above the normal water level, trees were trimmed or thrown over and destroyed. Many of them resembled redwood logs trimmed by the "hydraulic barker" used in lumber mills along the Pacific Coast, Figures 4 and 5 vividly show the enormous damage.

Quakes of this sort give some idea of what the action must have been like when Yosemite Valley was filled with a huge glacier yet suffered earthquakes comparable to the one observed by John Muir.

Conclusion and Considerations

Finally, California State geologist Whitney, for



Figure 4. Lituya Bay and the surrounding country before the rock slide and wave in 1958. Note the extensive glaciers in the mountains. The greyish areas were covered with trees.



Figure 5. Lituya Bay after the slide and wave in 1958. The black areas in the foreground were formerly covered with trees, but the trees were largely destroyed, as is mentioned in the text. Other differences in shade may be because this picture was taken at a different time of the year than the time at which Figure 4 was taken.

whom Mt. Whitney was named, was of the opinion that the valley floor sank many hundreds of feet during a massive earthquake.¹¹ Modern geologists do not accept this concept, but a reconsideration of Whitney's ideas would surely be a worthwhile project for the Creation Research Committee of the Creation Research Society.

In other words, just how much of Yosemite Valley's great beauty is actually due to slow glacial action as claimed by John Muir, and how much resulted from rapid and violent earthquake induced erosion? Violently flowing streams filled with huge chunks of ice and boulders might well have been potent factors. The "glacial boulders" now perched on rock pedestals several feet high, such as those on Moraine Dome, are considered by Mathes as evidence that ice over

500 feet thick moved over the surface of this and other High Sierra areas.

Yet, when I travelled from Avila, Spain to Segovia, I saw boulders perched on top of pedestals. Indeed other boulders, just as in the higher mountain area above Yosemite Valley, are very characteristic features of that landscape. Yet the glaciers of Europe never

reached Spain!

Surely a reconsideration of the so-called glaciation of the higher Sierra mountain areas is most logical. It is my hope that a more intensive study of the various questions involved in really explaining Yosemite Valley in terms of a recent time span of several thousand years may soon be undertaken.

References

¹Gibbens, Robert F. and Harold F. Heady. 1964. The influence of modern man on the vegetation of Yosemite valley. University of California Division of Agricultural Science publication Manual 36, pp. 1-34.

²*Ibid.*, p. 7.

³Mathes, Francois E. 1970. The incomparable valley. University of California Press Berkeley. Los Angeles, pp. 130-131.

⁴Broeker, Wallace S., Maurice Ewing, and Bruce C. Heezen 1960. Evidence for an abrupt change in climate close to 11,000 years ago, *American Journal of Science*, Vol. 258, pp. 429-448.

⁵Russell, Richard J. 1957. Instability of sea level, *American Scientist*, Vol. 45, pp. 414-430. (See especially pp. 419 and 420.)

⁶Quoted in Gibbens and Heady, *Op. cit.*, p. 30. (Reference No. 1).

⁷*Ibid.*, p. 7.

⁸Mathes, *Op. cit.*, p. 89. Mathes uses a most interesting series of illustrations to show the orthodox explanation of Yosemite Valley. Also see the excellent illustrations of various stages of the Valley on pages 2 and 3 as Plates 2, 3, 4, and 5. This may very well have been the way Yosemite Valley appeared during various stages of formation. But, since mountain uplift occurred during the Pleistocene, erosion was extremely rapid compared to the present. (For a complete discussion of Flood geology concepts as regards mountain uplift and erosion see J. C. Whitcomb and H. M. Morris, *The Genesis Flood*, pp. 121-122 and refer to Psalm 104:5-9, 127-128, and 151-153.)

⁹*Ibid.*, pp. 50-51.

¹⁰Hall, Mary R. 1965. The Biggest splash in history. Mineral Information Service, California Division of Mines and Geology, Ferry Bldg., San Francisco. Vol. 18, No. 12, pp. 217-219.

¹¹Whitney, J. D. 1868. The Yosemite book. Julius Bien, New York. 116 pp., 28 plates and 2 maps.

NOTICE OF BOOK RECEIVED

Physical Science for Christian Schools by Emmett L. Williams and George Mulfinger. Bob Jones University Press, Greenville, South Carolina 29614.

This book, intended for about the ninth grade, keeps the Biblical viewpoint in sight in the presentation of scientific studies. This work is mentioned at least to encourage teachers to investigate it during the summer. Readers should expect to find a full review in the next issue of the *Quarterly*.

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EFFECT OF RADIATION PRESSURE ON MICROMETEOROIDS, AND EXISTENCE OF MICROMETEOROIDS AS EVIDENCE FOR A YOUNG SOLAR SYSTEM

RONALD G. SAMEC*

Micrometeoroids are microscopic particles of dust, which exist in abundance in the solar system, in interplanetary space. The very existence of this dust, it is shown, provides evidence that the system is young, because the dust is being removed much more quickly than it could be replenished. Were the system as old as uniformitarians claim, the dust would have been all gone long ago.

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There is a large body of empirical evidence for the existence of vast amounts of cosmic and solar dust in subspace. The most available observational proofs are Zodiacal Light, the F Corona, the Gegenschein glow, and actual collections of dust after large meteorite falls.

Zodiacal Light

Zodiacal Light is a faint glow along the ecliptic (the path of the Sun), conspicuous at Northern U. S. latitudes, seen in the east before sunrise, or in the west a few hours after sunset.¹ Under favorable conditions it rivals the Milky Way in brilliance. This "false dawn" shows an absorption (dark-line) spectrum which is a faint mirror image of the solar spectrum, indicating the presence of a large concentration of tiny reflecting particles in the plane of the ecliptic.² In order to maintain this cloud 3×10^{14} g/yr of dust particles must be supplied due to radiation losses.

"F" Corona

Another manifestation of these reflecting bodies is the outer part of the Sun's corona, denoted as the Fraunhofer, or "F" Corona. This glow, which is observed as far as nine degrees away from the Sun, is seen during solar eclipses, or by the use of the corona-

graph, an instrument which simulates an eclipse.³ Spectral analysis yields the same results as in the case of the Zodiacal Light, indicating the presence of tiny reflecting particles, around one micron (10^{-4} cm.) in size. It is suggested that the Zodiacal Light is a mere extension of the "F" Corona (sometimes called the false corona) on the ecliptic.

Gegenschein

On dark nights a glow, extending about nine by eight degrees, can be seen centered on the ecliptic exactly opposite the Sun. This "counter glow" or Gegenschein is probably due to these microglobules viewed at full phase (as the full Moon) at full illumination.⁴

Collections of Micrometeorites

In 1883 a large fall of meteoritic red dust was collected at a height of 9,850 feet near San Francisco. Subsequent analysis of this dust by Nordenskiöld indicated meteoritic origin. After a bolide (an extremely large bright meteorite) fall in September, 1927, Rudaux also collected and chemically analyzed the consequent dust.⁵ In 1933 an especially rich collection of cosmic dust was made during a well-known meteor shower on October 9.⁶

Using air-borne magnets, Nininger, in 1940, extracted spherical particles with a mean diameter of 9×10^{-3} cm and a composition almost entirely of nickel. Based on the numerous and varied collections, most micrometeoritic globules range from 5×10^{-4} to 3×10^{-3} cm.⁷

Abundance of Micrometeorites

All of these preceding findings and observations indicate that a great abundance of micron-sized subspace particles exists in the solar system. Estimates of the number of micrometeoroids vary greatly, from 100 to 1,000 per cubic mile.⁸ However, probably a great range in the density of dust should be expected throughout planetary space due to meteoroid swarms; gravitational effects with comets, planets, etc.; and great concentrations in the asteroid belt.

Abundance of Cosmic Dust

Likewise, outside the solar system the vast distances of interstellar space are filled with immense quantities of dust and gas.⁹ In the Milky Way, alone, the total amount of cosmic dust is estimated at 3×10^8 earth masses (6×10^{35} g). Observations indicate that the sizes of these particles are on the order of 5×10^{-5} cm (micrometeorite size).¹⁰ The galactic density of these particles is generally one per cubic

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centimeter, while denser clouds (as in nebula) may exceed this figure by 1,000 times.¹¹

Composition, Density, and Albedo

E. L. Krinov stated that "particles of meteoritic dust maintain the composition and microstructure peculiar to meteorites."¹² Most meteorites are iron-nickel in content with a small abundance of silicates. Nordenskiöld indicated from his investigation of the San Francisco fall that the composition of the red dust was Fe-92.3% and Ni-7.6% (if oxides are converted to metals), which is analogous to the composition of iron meteorites.¹³ J. D. Buddhue, in carefully planned meteoritic dust collection experiments at various well-chosen geographic locations in the U. S. obtained a mean specific gravity of 4.422 (silicates and magnetite with traces of nickel).¹⁴ Usually the albedo (reflectivity as compared with a perfect reflector) is low,¹⁵ averaging probably 0.2. In composition and microstructure, cosmic dust (subgalactic) cannot be distinguished from meteoric bodies (interplanetary).

Radiation Pressure on Cosmic Dust

J. H. Poynting, in 1905, stated that "in all cases of energy transfer (including wave phenomena), momentum is passed on in the direction of transfer," producing radiation pressure by imparting momentum to particles in its path. Earlier work by Dr. Barlow showed agreement with this in actual laboratory experiments.¹⁶ H. P. Robertson (1968) restated this principle as simply, "Stellar radiation flushes particles out of the galaxy."¹⁷

In the case of motion in a field of uniform, unidirectional radiation in which the particle starts from rest at the origin of a radiation field, relativistic equations for our galaxy have been developed.¹⁸ These equations simply estimate the rate at which stellar radiation flushes particles out of the galaxy.

$$\frac{v}{c} = \frac{1}{1 + \frac{t}{RT}}, \quad \frac{1}{R} = \frac{10^{16} ad}{7} (\text{yr cm}^2 \text{g}^{-1}) \quad (1)$$

where a is the radius of the cosmic particle, d is its specific gravity, v is the velocity of recession, c the speed of light; and T is the time interval.

If the average micron-sized particle is $a = 5 \times 10^{-5}$ cm, with an average density of $d = 4.4$ g/cm, observations of cosmic dust in our galaxy show that these particles are in essentially static configurations; hence velocities should be small according to these equations. If $T = 6 \times 10^3$ yr. (6,000 years), which is the Biblical estimate for the age of the earth, $v = 6 \times 10^2$ cm/s or about 14 miles per hour. Cosmic dust is nearly stationary in this calculation.

However, on substitution of $T = 10^{10}$ yr. (10 billion years), which is the typical estimate for the age of the galaxy made by uniformitarians, then subspace velocity is $0.032 c$, about 21 million miles per hour since $c = 3 \times 10^{10}$ cm/s. It must be admitted that particles supposedly travelling at 21,000,000 miles per hour would not be "essentially static."

Age of the Galaxy

A particle traveling at $0.032 c$ would travel one light-year in 32 years and would leave the galaxy,

the diameter of which is about 100,000 light-years, in 1.6×10^6 yr, i.e., about two million years. Hence, in only a short time, compared with the supposed age of the universe, the galaxy would be swept clean of cosmic dust. How, using this model, could one possibly account for the heavy abundance of dust in the galaxy?

Poynting-Robertson

The second effect mentioned by J. H. Poynting in his 1905 article was that radiation pressure in the solar system causes particles to move in decreasing orbits, finally spiraling into the Sun.¹⁹ This is the well-known Poynting-Robertson effect.

H. P. Robertson states that isotropic (in all directions) radiation by particles in the solar system causes particles to experience more intense flux when it moves against radiation than when it moves with the radiation.²⁰ Further, the total force per unit mass acting on such particles moving perpendicularly to a radiation field would have both radial and tangential components.

Simply, a particle in orbit about the Sun is given an outward radial push by radiation pressure. The particle, moving at a constant orbital speed, cannot move to a more distant orbit due to Kepler's third law, if the gravitational pull is greater than the radiation pressure. However, due to the radiation field and isotropic re-radiation from the particle, the particle is influenced by a "bunching up" of waves in the direction of its motion and a spreading of waves behind it. This results in deceleration and consequent orbital decay (also due to Kepler's third law).

Relativistic orbital equations show that the orbit of a particle eventually shrinks under the influence of solar radiation; and the orbit also becomes more and more nearly circular.²¹ The amount of time t in which the radius of an orbit changes from its initial value r to zero (i.e., collision with the Sun) is given by the relation:²²

$$t = \frac{r^2}{4A}, \quad A = \frac{2.5 \times 10^{11}}{ad} (\text{g s}^{-1}) \quad (2)$$

As a secondary consequence of radiation, Dr. Poynting demonstrated that radiation pressure produces an observable effect on particles smaller than 10^{-3} inches in diameter since:

$$\frac{P}{G} = \frac{k}{a} \quad (3)$$

where P is the radiation pressure, G is the gravitational force, and k is a constant. For particles of size 10^{-5} inch, the radiation pressure and the gravitational force become equal, so that $R/G = 1$.²³ (So he thought then; later 10^{-5} was found to be somewhat large. See equation 4).

Robertson, likewise, found that:

$$P = \frac{k}{ad} \quad (4)$$

where $ad = 5.7 \times 10^{-5} \text{ g cm}^{-2}$ is the critical value at which radiation pressure exactly balances solar gravi-

tation. For ad greater than this value the particle spirals toward the Sun, for ad less it is repelled from the solar system.

Thus the Poynting-Robertson effect is insignificant for all but very minute particles. A particle as large as one centimeter would take 20,000,000 years to fall into the Sun from the Earth's orbit. For objects as large as planets, there is no effect at all. By a simple substitution, evidently 10,000 trillion years would have to transpire before the Earth would plunge into the Sun!

Age of the Solar System

Another interesting piece of information is the number of revolutions which a particle in the solar radiation field makes before striking the Sun from a distance of one astronomical unit (AU, the semi-major axis of the Earth's orbit or its mean distance from the Sun):

$$N \approx 2.8 \times 10^7 a \quad (5)$$

Again, by applying equation 2 to a typical micrometeoroid particle of size 5×10^{-5} cm, density 4.4, and original orbit of radius 1 AU, $t = 4.95 \times 10^{10}$ s, about 1,600 years. Thus all the average micrometeoroids at or inside the earth's orbit would have fallen into the sun in less than two millenia. To fit in with the age of 6,000 years, it must be that the particles which now exist around the Earth's orbit were originally trans Earth-Mars particles. They have since lost momentum and moved closer to the Sun, being now around the Earth's orbit.

If a typical micrometeoroid were located 2.8 AU from the Sun, in the center of the asteroid belt, which is the area of heaviest concentration of such particles, then by calculation, $t = 4.15 \times 10^{11}$ s, about 13,800 years. Such micrometeoroids, then, would have been engulfed into the Sun in less than 14,000 years. In fact, in less than 2.5 million years, the entire solar system from the Sun to Pluto would be sterilized of micrometeoroids.

Based on this simple algebra, it is evident that the entire solar system as well as the galaxy would be "vacuumed and swept clean" of subspace dust in a time period not even remotely resembling 10 billion years. Rather, these results fit in nicely with a universe of age 6,000 years.

Effect of the Solar Wind

It must be noted that the additive effect of the solar wind has not been considered. Solar wind consists of a massive stream of ions, principally protons, which are thrown out of the Sun at average velocities of 300 to 400 km/s (maximum 2,000 km/s), and have ion densities of 10 to 20 particles per cubic centimeter (maximum 10^4 /cm during heights of solar activity). These ions make an appreciable contribution to the decay of orbits.²⁴

Production of Particles by Disintegration of Comets

Observational evidence shows that meteoroidic matter is in a stationary state.²⁵ However, nearly a ton of interplanetary dust falls into the Sun each

second (80,000 tons per day). Due to this loss, Fletcher Watson, a noted planetary specialist, stated: "Obviously we must search for some means of maintaining a steady supply of new dust particles."²⁶ His first mechanism for maintaining densities of dust over vast cosmological ages was Comet Disintegration.

Rate of Ejection of Dust from Comets

Halley's comet is known to have lost 30 tons of material per second as it passed the Earth early in this century.²⁷ Dr. Fred L. Whipple, originator of the Comet Disintegration mechanism, has shown that a giant comet, having a nucleus 10 to 20 miles in diameter, does release 30 tons of matter per second during a close approach to the Sun.²⁸ Of this total, however, only a fractional part by mass is of micrometeoroid size. A more recent study by Lebinets (1970) indicates that the rate of ejection of dust of all long-period comets (usually more massive) is equal to a mere 10^{15} g/yr. (0.04 tons per second).²⁹

Moreover, only a small fraction of the dust survives the gravitational disturbances of the planets in order to contribute to "free" interplanetary space.³⁰ Watson's use of Halley's comet as an example of comet disintegration was a poor choice. Of the known comets, few are as large as Halley's; rather nuclear diameters are usually about one mile, and the mass 0.001 to 0.00025% that of Halley's. Finally, comets emit large quantities of mass only during the relatively short intervals when they are near the Sun.

Comets would not even be in existence today, if the universe were 10 billion years old, due to their short cosmic lifetimes and consequent disintegration into meteor showers. Due to the existence of meteor showers which have replaced dissipated comets, such as Comet Biela, one must conclude that a large percentage of particles produced by disintegration stay in the comet's solar orbit and are not available for solar accretion. For all these reasons, the disintegration of comets cannot be a major source of micrometeoroid particles.

Collisional Crushing

Collision crushing (particles involved in cataclysmic collisions) was Watson's second mechanism for meteoric production. He stated: "Perhaps 20 to 60 tons of material per second" are produced in this way.³¹ In the vicinity of the Earth's orbit there are 100 to 1,000 particles per cubic mile. At the upper limits of 1,000 per cubic mile, evenly dispersed particles in such a situation would be over 500 feet from their nearest neighbors. How many tons of material would be produced by collisions of particles with a mass on the order of 10^{-13} kg and diameters of 10^{-4} cm, spaced 1.5×10^5 cm apart? As for particles greater than 2×10^{-4} g that might produce micrometeoroids by collisions, 10^{-5} particles exist in one cubic kilometer in the vicinity of the Earth's orbit.³² Only ten bodies of this type exist inside a hundred-kilometer cube. Possible collisions would be decidedly rare.

Crushing in the Asteroid Belt

According to Dohnanyi's statistical analysis³³ of crushing effects in the dense area of the asteroid belt

(total mass 10^{21} kg), particles of micrometeoroid size have lifetimes (intervals between collisions) on the order of 10,000 to 100,000 years with regard to catastrophic collisions. Particles of mass greater than 2×10^{-4} g have lifetimes of one million to billions of years.³⁴

If collisions are so rare even in dense regions, how does the production of micrometeoroids keep up with the gigantic amounts of dust lost to the Sun annually? Dohnanyi's calculations show a total crushing of 10^{12} kg of material for micrometeoroids ranging in mass from 10^{-18} to 10^{20} kg (objects 10^{-6} cm to 100 km in diameter); of which micrometeoroids contribute almost nothing (less than 0.01% by mass).³⁵

By using an average of 800 micrometeoroids per cubic mile over the entire solar system (which is probably a gross over-estimate) a total mass of 10^{19} kg is calculated. The existence of a dense cloud of dust about the Sun ("F" Corona, Zodiacal Light), in connection with the Poynting-Robertson effect on bodies smaller than 10^{-3} cm, shows that most of the 80,000 tons (7×10^7 kg) of material lost to the Sun daily consists primarily of micrometeoroids. Thus there is a yearly loss of 2.5×10^{10} kg of such particles.

If one extrapolates this loss backward into time for 10^{10} years (linear extrapolation, even though this function is inherently logarithmic), the solar system would have 26 times the present amount of dust. This would be enough matter to construct a giant minor planet, of diameter 210 km (larger than Juno); which is analogous to constructing the Earth out of beach sand a grain at a time!

Cosmic Eons?

It has been demonstrated that, in only 2.5 million years (a very short time on the supposed cosmic scale of 10 billion years), the entire solar system and galaxy

would be void of meteoric dust. This implies that there should be virtually no dust in the observable universe at present, except the puny amounts produced by recent collisions. Other calculations have shown that radiation pressure acting over vast cosmic ages would cause dust particles to have velocities approaching that of light.

Such wild extremes conflict directly with observations that sub-space particles are essentially static. Would it not be easier to cease to hypothesize possible continuous mechanisms for the "creation" of particles in vast amounts over eons of time, and accept the simple conclusions consistent with a young Earth?

Conclusion: a Young Earth

If the Earth, solar system, and galaxy are considered to be about 6,000 years old, only a small portion of the original micrometeoroids have been lost to the Sun (less than 0.2%). Also, the velocities of cosmic dust particles are now a mere 14 miles per hour, which does not differ appreciably from random motion. Thus, belief in a young Earth—and young universe—is in accord with the observed facts.

These topics have been a battleground for heated discussion, and this is especially so with respect to the Poynting-Robertson effect since 1903. The battles have occurred in discussions, articles, and books. Second Timothy 3:7 states that men (and surely this applies to evolutionists) are "ever learning, and never able to come to the knowledge of the truth." Again, at the end of the first epistle of Timothy, Christians are warned that they should be "avoiding profane and vain babblings and oppositions of science falsely so called." For the creationist, however, all such oppositions have no grounds; and true science can easily rest on the basis of the Word of God.

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EARTH'S MAGNETIC ENERGY PROVIDES CONFIRMATION OF ITS YOUNG AGE

THOMAS G. BARNES*

In previous papers the author applied Maxwell's electromagnetic theory and 130 years of real-time data to a proposed model of the earth's main magnet. The magnetic field was shown to be decaying exponentially with a half-life of only 1,400 years. This fact puts a severe limitation on the age of the earth. The present value of the power loss from the magnet was evaluated at 813 megawatts. This new paper employs those results to compute the total energy which will be lost during the remaining life of the magnet. Because there is no other source of energy, this is an indirect means of computing the total amount of energy in the earth's present magnetic field.

If this theory is valid, an overall check can now be made on the theory by getting an independent evaluation of the total energy in the magnetic field of an idealized "equivalent" magnet. This equivalent magnet, being permanent, does not involve the decay, conductivity, heat loss, etc., associated with the computation about the real magnet. Such a check has been achieved in this paper. This provides an unyielding verification of the decay properties of the earth's field, and of the implications of these facts for the age of the earth.

1. Introduction

In previous papers¹⁻⁴ the author proposed the theory of a freely decaying electric current circulating in the conductive core of the earth as the source of the earth's main magnetic field, a dipole field. Maxwell's electromagnetic field theory and more than a century of real-time decay data were applied to this model to deduce a severe limitation on the age of the earth's magnetic field and, by association, a severe limitation on the age of the earth. There has been no valid scientific challenge raised against this basic application of physics to the source of the earth's magnetic field, even though it imposes a ceiling of a few thousand years on the earth's age.

This present paper contains a new and independent quantitative confirmation of this theory of the source of the earth's magnetic field. This is accomplished by evaluating and comparing the total energy in the earth's magnetic field as governed by the proposed theory with that of a reference magnet that is totally independent of the electromagnetic processes involved in our theory.

The reference magnet is an idealized permanent magnet, a uniformly magnetized sphere of the same size as the earth's core and having a magnetic moment equal to the present value of the earth's magnetic moment. The earth's magnet is known to be an *electromagnet* and a decaying one, not a permanent magnet. There has been a measured loss of 14% of the energy in the earth's magnetic dipole field over the 130 year period of real-time observational data.⁵

If our theory is correct then the present total energy in this magnet should check rather closely with the energy in the reference magnet, but not precisely because there is a slight difference in the distribution of flux linkages in the two magnets. We shall show that these two energy values do check to within 9.6%, an amazing overall check on the multiplicity of steps and evaluations contained in our theory.

There is perhaps not one chance in a million for such a close check if our electromagnetic decay theory had not been a valid one. This means that we have established unyielding evidence for this theory for the

earth's magnetic field and for the consequent limitation on the age of the earth.

2. Present Value of Energy in Earth's Magnetic Field

Designating the energy as w and using the definition that power is the rate of flow of energy, one has the calculus equation

$$P = \frac{dw}{dt}$$

It was shown in the previously referenced papers that the solution to Maxwell's equations for this magnetic field contains the decay time constant T (the time for the magnetic field strength to decay to $1/e$ th, roughly 37%, of its previous value). Knowing that the *energy* in the magnetic field is proportional to the *square* of the magnetic field strength the following equation is deduced for the rate of dissipation of energy in the earth's core as a function of time t ,

$$\frac{dw}{dt} = P_0 e^{-2t/T} \quad (1)$$

where P_0 is the present value of power dissipation. Integration of this calculus equation from time zero (the present) to infinite time results in the equation for the total amount of energy that will be lost from now until the magnetic field is gone:

$$W = \frac{P_0 T}{2} \quad (2)$$

All of this energy is lost by the electric heating in the earth's core, produced by the electric current flowing there. Because this electric current is *induced* by the decaying process of the magnetic field, all of this energy comes from the magnetic field. Hence Equation 2 gives the energy w that presently resides in the earth's magnetic field, but which will in time be lost in the earth's core in the form of heat as the magnet decays.

This equation was used to compute the *present value of the total energy in the earth's magnetic field to be 2.52×10^{19} joules*, by substituting the present value of power being dissipated by the electric current in the earth's core $P_0 = 8.13 \times 10^8$ watts and the time constant $T = 6.21 \times 10^{10}$ seconds into Equation 2.⁶

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3. Total Energy in Field of Uniformly Magnetized Sphere

Elementary physics is then used to derive an equation for the total energy in the magnetic field of a uniformly magnetized sphere, to be referred to as the reference magnet. The sphere is an idealized permanent magnet with uniform intensity of magnetization M parallel to the polar axis and has a radius which is labeled a in Figure 1.

The current in a permanent magnet is *amperian* current, a dissipationless current associated with the atomic structure of the material. Amperian current yields the same amount of magnetic flux as an equal amount of real current, so the same equations hold for computing the energy in the magnetic field of the amperian current.

The equation for energy w in the field of a *single* ring or loop of current I that encircles a magnetic flux Φ is

$$w = \frac{\Phi I}{2} \quad (3)$$

The solution to the problem under discussion includes the same basic concept as that in Equation 3, but it is more complex because there is a *distribution* of current, not just one ring of current. In fact the amperian current that yields a uniformly magnetized sphere is a *surface current* that covers the entire surface of the sphere. That surface may be divided up theoretically into a multiplicity of thin circular rings of current. Each ring of current encircles the polar axis, the center of the ring is on this axis, and the current of the ring is on the surface of the sphere.

There is a different amount of flux through each current ring and a different value of current in each ring, but Equation 3 still gives the energy contributed to the field by *each* of these current rings. Specifying that part of the total energy contributed by each ring as dw and that part of the total current contained in each ring as dI , Equation 3 for each ring may be written as

$$dw = \frac{\Phi dI}{2} \quad (4)$$

A summation (integration) of this equation for all of the rings gives the total energy w . To do this integration one needs to express all of the quantities of the right side of the equation in terms of only one variable and that is the reason for the following steps.

The boundary relation⁷ between the *magnetization* M and the *amperian surface current density* dI/ds , for this sphere, may be expressed as

$$\frac{dI}{ds} = M \sin \theta \quad (5)$$

where θ is the polar angle and ds is the ring width. Since ds is an *arc length* on the surface of the sphere $ds = a d\theta$ and Equation 5 may be written as

$$dI = a M \sin \theta d\theta \quad (6)$$

Substituting Equation 6 into Equation 4 results in

$$dw = \frac{1}{2} \Phi a M \sin \theta d\theta \quad (7)$$

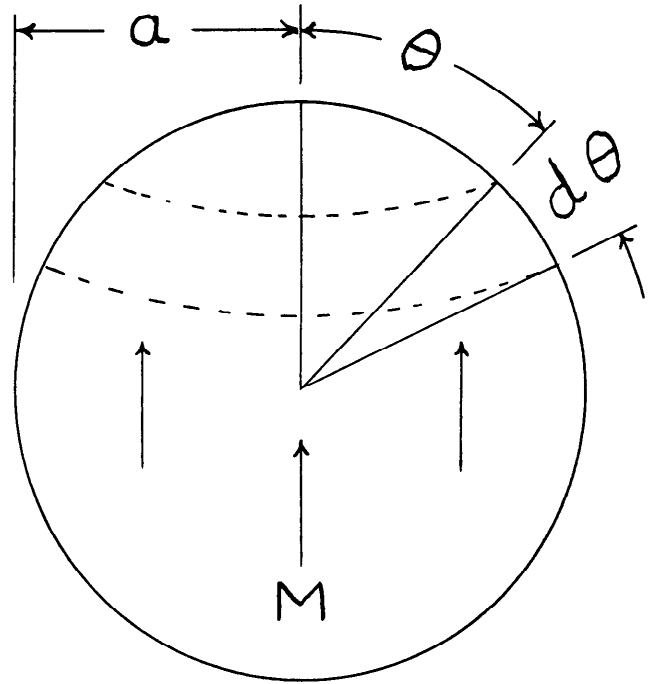


Figure 1. This shows the uniformly magnetized sphere, the magnetism of which is compared to the earth's magnetism. The angle θ corresponds to latitude; or, rather "co-latitude," measured from the North Pole, not from the Equator. The magnetization M is uniform, and in the direction of the axis, pointing North.

Now Φ should be expressed in terms of M . The defining equation for M is

$$M = (B/\mu_0) - H \quad (8)$$

where μ_0 is the permeability of free space. In this permanently magnetized sphere H may be neglected and Equation 8 reduces to

$$B = \mu_0 M \quad (9)$$

The *flux per unit area* B is constant over the area of every ring. The radius of each ring $r = a \sin \theta$. Hence the flux through each ring is given by the equation

$$\Phi = (\pi a^2 \sin^2 \theta) B \quad (10)$$

Substituting Equation 9 and Equation 10 into Equation 7 results in

$$dw = \frac{1}{2} \pi a^3 \mu_0 M^2 \sin^3 \theta d\theta \quad (11)$$

Integrating this differential equation over the polar angle limits from $\theta = 0$ to $\theta = \pi$ yields for the total energy

$$w = \frac{2}{3} \pi a^3 \mu_0 M^2 \quad (12)$$

It is desirable to express this energy in terms of the *magnetic moment* $\mathcal{M}$ instead of the *magnetization* M . In this uniformly magnetized case, the magnetic moment is equal to the volume of the sphere times the magnetization, that is to say

$$\mathcal{M} = \frac{4}{3} \pi a^3 M \quad (13)$$

Making use of the fact that $\mu_0 = 4\pi \times 10^{-7}$ and substituting Equation 13 into Equation 12 yields

$$W = \frac{3m^2}{2a^3} \times 10^{-7} \quad (14)$$

for the total energy in the magnetic field of this reference magnet in terms of the magnetic moment m and the radius a .

It is now possible to evaluate the total energy in the field of the reference magnet, when the magnet has the same magnetic moment as the present value of the magnetic moment in the earth, namely $m = 8.015 \times 10^{22}$ ampere meter², and has the same radius as the radius of the earth's core, namely $a = 3.473 \times 10^6$ meters. *The total value of the energy in the magnetic field of this reference magnet may be computed to be 2.30×10^{19} joules.*

4. Conclusion

A most rapidly decaying geophysical phenomenon must be given serious consideration as a limiting factor on the age of the earth. The energy in the earth's magnetic dipole field is decaying much faster than any other worldwide geophysical property. Its half-life is only 700 years.⁸ An elemental exercise in arithmetic coupled with some sense about a reasonable limit on the initial energy value shows that if the energy in the earth's magnetic field doubled every 700 years backward in time the earth's age could only be in the thousands of years, not millions nor billions. The author has suggested a plausible limit of 10,000 years.⁹

The only rigorous physical explanation of the earth's electromagnet is that of a freely decaying circulatory electric current source in the earth's conductive core, being induced through the decay of the original magnetic field which the author would assume to have been created in the beginning. Applying Maxwell's equations and the observable real-time data to this physical model the author has made the following evaluations of properties in the earth's core:

1) The conductivity of the core of the earth, 4.04×10^4 mho/meter.

2) The electric current density (amperes/meter²) as a function of any position in the core of the earth at the present time.

3) The total electric current circulating in the core of the earth at the present time, 6.16×10^9 amperes.

4) The present power loss in the core of the earth, 8.13×10^8 watts, all going into heat in the core.

In this present paper the author made use of the above results and, by means of an integration from the present to infinite time, made a forecast of the total heat energy that will be lost by this process in the future. That forecast value turned out to be 2.52×10^{19} joules of heat energy yet to be dissipated. According to the proposed electromagnetic decay theory, all of that energy will come from the present energy contained in the earth's magnetic field. Thus by this indirect route an evaluation was made of the total present energy in the earth's magnetic field, namely 2.52×10^{19} joules.

As an independent check, the total energy in the field of an idealized permanent magnet of like size

and magnetic moment was computed for reference. A value of 2.30×10^{19} joules was derived. These two independently determined energy values checked to within 9.6%. That is an excellent check. That much difference could be accounted for by the slight difference in energy that one might expect in the two models, due to their slightly different distributions of flux linkages. Indeed, this independent check does demonstrate unyielding evidence for the proposed theory of the earth's magnetic field and for the consequent limitation on the age of the earth.

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THE QUEEN OF SCIENCE EXAMINES THE KING OF FOOLS¹

DAVID J. RODABAUGH*

The treatment in this article is mathematical and the purpose is to demonstrate the following: (1) That evolution is so improbable as to be scientifically impossible; (2) That to extrapolate from present data to the remote past (four billion years ago) is impossible because the error term is too large; (3) That a careful analysis of population growth shows the creation model to be reasonable, but the evolution model is absurd. This last point is proved by using facts of Jewish history as the control. The creation model and the evolution model are then compared with the figures gathered from Jewish history. Two different population growth equations are analyzed in this fashion.

Introduction

The molecules-to-man evolutionist² demands an extremely old earth. He argues that, given enough time, present processes working at present rates are sufficient to account for the varied life forms which are now observed. Three observations are in order:

OBSERVATION 1. Given all the time that the evolutionist claims to need, one can show that the probability that a simple organism could be produced by the presumed process of mutations is so small as to constitute a scientific impossibility.

REMARK 1. In the first section of this paper the author will show that the probability that such a thing could have happened anywhere in the universe is less than 1 in $10^{2,999,942}$ (i.e., one followed by 2,999,942 zeros). The approach is somewhat technical and is not unlike that approach taken in other creationist publications.

OBSERVATION 2. Even if one were to assume the doctrine of uniformitarianism³ which the evolutionist demands, one can show that the extrapolation error bound is so large that any predictions of the conditions on the earth of four billion years ago, based on data gathered within the last several hundred years, are of necessity meaningless.

REMARK 2. In fact, the author will show in the second section below that assuming that all functions have the necessary derivatives (a most uniformitarian assumption) forces the error term to have a coefficient greater than $(4,000,000,000)^n/n!$ where n is the number of experiments conducted. Each experiment conducted must be involved in the calculation. This is rarely done. Such an error term means that until four billion experiments are completed, each experiment actually increases the coefficient in the error term! This section is also somewhat technical. It appears that this approach is somewhat novel in creationist literature.

OBSERVATION 3. Even if one assumes that the above problems do not exist, there are data that are inconsistent with an earth of a supposed age of billions of years—or even millions of years. In other words, there are clear (often ignored by humanistic evolutionists) evidences of a young earth.

REMARK 3. Compelling evidence will be presented from equations for population growth. Section 3 is a discussion of population doubling. In section 4 discussion involves what most consider to be a more accurate equation for population growth. In each case the well-documented history of the Jewish people is used as a control. The creation model/Biblical chronology is then tested as is the evolution model. Section 4 is fairly technical and is new to creationist literature. Section 3 is similar in approach to an old approach taken by Williams⁴ though his figures and formulas need revision.

In section 5, these approaches are compared to the one usually taken in recent creationist literature.

1. Probability

Evolutionists claim that, through the process of chance mutations, they can explain the appearance of all the varied life forms observed today.⁵

In fact, Ernst Mayr stated, "It must not be forgotten that mutation is the ultimate source of all genetic variation found in natural populations and the only new material available for natural selection to work on."⁶

Another evolutionist has said, "It remains to say that we know of no other way than random mutation by which new hereditary variation comes into being, nor any process other than natural selection by which the hereditary constitution of a population changes from one generation to the next."⁷

Generally, an accepted upper bound for the probability that a mutation is not harmful is 1/1000. Some researchers have estimated that well over a billion mutational steps would be required for many organisms to come into existence, but on a more conservative basis others have assumed that only one million mutational steps would be required. By well known rules of probability, the chance for such an organism to evolve by mutations is⁸

$$(1/1000)^{1,000,000} = 10^{-3,000,000} \quad (1)$$

The surface of the earth (including that land which is under water) is 196,950,000 square miles, or $5.614821088 \cdot 10^{15}$ square feet. By assuming one billion mutating systems per square foot, one could conclude that there are less than 10^{25} mutating systems on the earth.

Now, one million mutations constitute a trial, and would involve figures favorable to the evolutionist and the strongest case for his position.

Accordingly, let us assume that each system produces a mutant a second and that the earth has

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existed for 10^{18} seconds—over 30 billion years (i.e., one year = 365.25 days = 31,557,600 seconds). Since one million mutations constitute a trial, then there would be $10^{12} = 10^{18}/10^6$ trials per mutating system.

Putting these figures together, there would have been 10^{37} trials (i.e., 10^{12} trials per 10^{25} mutating systems) on this earth throughout the earth's history. The probability of the organism under discussion "evolving" is then $10^{37}/10^{8,000,000}$.

However, an evolutionist might contend that life just happened to appear on a "lucky" planet. Let us continue then.

Current estimates are that there are perhaps 100 billion galaxies.⁹ There are about 30 billion stars in the Milky Way galaxy, which is regarded as average. For this discussion, let us assume 60 billion stars in each galaxy. This means that there are about $6 \cdot 10^{21}$ stars.

To date, there is no evidence that life exists on any planet other than the earth. However, to be extremely generous, let us assume that each star has 15 planets capable of supporting life. Thus, fewer than 10^{23} such planets are assumed for the universe.

Therefore, throughout the universe throughout history there would have been fewer than $10^{37+23} = 10^{60}$ trials. The chance of success anytime on some planet is then $10^{60}/10^{8,000,000}$ or 1 in $10^{2,999,940}$ (i.e., one followed by 2,999,940 zeros).

There is no way to visualize such a number. Nothing in the experience of man would allow such an improbability. In fact, there are few books in which this number could be written (without the exponential shorthand). A typical book has 41 lines per page and fewer than 60 characters per line. If a person wrote one followed by 2,999,940 zeros, over one thousand pages would be required!

The author concludes that evolution is a scientific impossibility.

2. Extrapolation Error

Sooner or later, evolutionists try to extrapolate from available experimental data (derived within recent times) to four and one-half billion years ago. Such extrapolation must have error. The problem is to find the magnitude of such error. Least squares curve fitting is essentially without error bounds when used for extrapolation. In addition, the method involves the assumption that the exact nature of the function is known so that only a few constants need be determined.

The other approach would be to take some form of Lagrange or Hermite interpolation-extrapolation¹⁰. Only Lagrange will be followed. And before the error term can be given, some terms must be defined. Let us suppose that $f(x)$ is a function (of time) that determines some process. Let us further suppose that we have conducted n experiments and have obtained from our experiments the values $f(x_1), \dots, f(x_n)$ as observed values of the function $f(x)$ at the times $x_1, \dots, x_n$. If all data is used (to ignore data amounts to prejudicing the conclusion), to have an error term requires that $f, f', \dots, f^{(n-1)}$ be continuous in $[a, b]$ and differentiable in (a, b) where $[a, b]$ is the smallest closed interval containing $x_1, \dots, x_n$.

Such assumptions amount to assuming the ultimate in uniformitarianism. Without these assumptions, there is no way to estimate error—this means that such data can't be used for extrapolation.

With these assumptions, there is a value u in (a, b) so that the error is

$$f^{(n)}(u)p(x)/n! \quad (2)$$

The polynomial $p(x) = (x-x_1) \dots (x-x_n)$.

If f is a function of time where the time is expressed in years then each of the x -values are times. Since an approximation f at some time over four and one-half billion years in the past is desired, and each of $x_1, \dots, x_n$ are the dates of experiments (hence within the last several hundred years, then each $x-x_i$ is greater than four billion. Therefore, $p(x)$ is greater than $(4,000,000,000)^n$ and the coefficient of the error term is greater than

$$(4,000,000,000)^n/n! \quad (3)$$

As a consequence, any approximation of $f(x)$ based on extrapolation (and there are no methods with well defined error terms that are not such), for the purposes of talking of conditions on the earth four billion years ago, is meaningless.

3. Simple Approach to Population Growth

Now let us approach the question of population growth by considering the time it takes for a population to double. This approach should be justified at the outset.

Except for outside factors (such as recent advances in medical science), population growth is usually assumed to be exponential. The differential equation for population growth is usually

$$p' = ap \quad (4)$$

In this equation, p is the population expressed as a function of time. This equation is often stated by saying that the rate of change of the population is proportional to the present population. Such a problem is a standard exercise in most elementary differential equations textbooks.¹¹

By changing parameters, the solution to Equation 4 can always be stated in the form

$$p = 2^n s \quad (5)$$

Such a function is "exponential" for it is a constant (s) times some number (a "2" in this case) raised to a power. The constant s represents the initial population and n must be proportional to the time.

Another way to view Equation 5 is to start with a population s , and assume that if the population doubles n times, then the present population (if n represents the doublings to get to the present population), or at least the population after n doublings, is p . If d denotes the time it takes a population to double, and t represents the total time, then the following holds:

$$t = nd \quad (6)$$

which can be written in relation to Equation 5 as

$$p = 2^n s \text{ where } n = t/d \quad (7)$$

Actually, this is all the formula needed. The arithmetic was done on a Hewlett Packard electronic calculator, which performs simple calculations with 10 digits of accuracy.

First some reasonable values for d , the doubling period, are needed. Due perhaps to medical science, the population today is increasing more rapidly than it did in the past. The world population in 1971 is listed at 3.70 billion with an annual rate of 2% in the American Almanac.¹² This means that population is currently doubling every 35 years. For most of history, d is larger than that. In extending life expectancy medical science has contributed to a large reduction in the value of d . Consequently, the present value of d is not acceptable for this discussion.

The Jewish people have kept fairly accurate population statistics since 1899. Also, to some extent at least, the length of their history is known. For present purposes, the exact year of the origin of the Jewish people is not needed, since only an approximate figure will be quite useful. And further, it is important that this figure be derived from historians rather than from the Scriptures, since validation of the Scriptures is expected. Bright stated¹³ that the patriarchs lived 1700 B.C.-2000 B.C. While some historians would argue that the patriarchs began after 1700 B.C., none would put their date of origin any earlier than 2000 B.C.

Since Jacob had children of four women, it is necessary to consider not only the doubling rate based on an initial population of two ($s = 2$, Jacob and one wife), but also the rate based on an initial population of five ($s = 5$, Jacob and four wives). Population figures obtained upon study of a number of volumes of the American Jewish Yearbook¹⁴ are listed in Table 1. The doubling rates based on various assumptions as to initial population and date of origin are also given in Table 1.

Table 1
The Jewish Population

Year A.D.	Population (Jewish)	Values for the Doubling Periods (in Years)			
		Initial Population = 2		Initial Population = 5	
		began 1700 B.C.	began 2000 B.C.	began 1700 B.C.	began 2000 B.C.
1899	10,728,491	160.99	174.41	171.11	185.38
1904	10,932,777	161.02	174.42	171.13	185.37
1921	14,771,931	158.70	171.85	168.46	182.42
1937	15,524,621	158.90	172.01	168.64	182.55
1938	15,290,983	159.10	172.22	168.86	182.79
1939	16,181,328	158.58	171.65	168.27	182.14
1940	15,748,091	158.89	171.99	168.62	182.52
1948	11,373,350	162.57	175.94	172.75	186.96

The results of Table 1 can be summarized by stating that any value between 150 years and 200 years would be a reasonable value for d . The reader should notice that even the holocaust of Nazi slaughters did not significantly alter the value of d . The Jewish population at the end of 1939 was listed as 16,633,675, and that of 1948 as 11,373,350 in the 1949 Jewish Year Book. This is a 32% reduction in that period, yet d was affected only 2.3%. The figures in Table 1 then are extremely reliable.

These figures for the Jewish population are a base against which the two major models of man's origin

can be tested. Let us then find the values for the doubling periods for world population first for the creation model and then for the evolution model. In these tests, the Jewish population will be used as a control group against which to compare the figures for the creation model and those of the evolution model.

First, consider the creation model. The creation model meant here is one consistent with the Biblical record. According to this, every person alive is descended from Noah's three sons and their wives. This means an initial population of six ($s = 6$). Next, the Noachian flood must be dated. According to Williams,¹⁵ on the basis of Hale's chronology of the Septuagint (Greek Old Testament of long ago) the flood occurred at 3255 B.C. Ussher's date for the flood was 2348 B.C.

To avoid the effects (as much as possible) of modern medicine, the oldest reliable figure for world population will be used. Again according to Williams, the Berlin census of 1922 listed the world population at 1,804,187,000. As shown in Table 2, the doubling period (for this creation model) is in the range of 151.61 years to 183.82 years. Clearly, the Biblical chronology is reasonable.

Table 2
Creation Model/Biblical Chronology

Date of the Flood	Doubling Period (Years)
2348 B.C.	151.61
3255 B.C.	183.82

What is the situation regarding the usual evolution model? Evolutionists state that man has been on the earth in excess of one million years (some even double that figure). If man has existed for one million years then (using the population of 1922 A.D.), the doubling period throughout man's history has been 33,614.9 years. When such a figure is applied to the history of the Jews then, in 1899, there would have been only 5.42 Jews! Such a rate of population growth is clearly absurd.

To allow for even more latitude for the evolutionist, let us assume that man has existed for only 100,000 years. In that case the doubling period is 3,361.49 years. Now if a doubling period were applied to Jewish history then, in 1899, there would have been only 11.17 Jews! Recall that the correct figure is over ten million.

Table 3
Usual Evolution Model

Man's Existence	Doubling Period	Number of Jews Today If That Doubling Period Had Held in Jewish History
1,000,000 yrs.	33,614.9 yrs.	5.42 (assuming 5 to begin with)
100,000 yrs.	3,361.49 yrs.	11.17 (assuming 5 to begin with)

On the other hand, if the absurdly large value of 500 years for d is assumed, and if man has existed one million years, then the present population should be over 10^{602} (i.e., one followed by 602 zeros)! Now the universe could probably be filled completely with 10^{100} people. Yet, if the evolutionary chronology were

valid, over 10^{500} universes could be filled completely with people!

To summarize, after analyzing a population with known history (a control group), and testing both the creation and evolution models, the following conclusion is reached: **The creation model is reasonable and the evolution model is absurd.**

To avoid the implications of the above discussion, evolutionists usually propose a position that might be called the evolution-equilibrium model. In this model, it is presumed that human population leveled off at three million until man began to farm, and then the population increased to the present size. The usual date given for the origin of (widespread) farming is about 12,000 years ago. Such information results in Table 4. As can be seen from the table, even this model leads to an absurdity.

Table 4
Evolution-Equilibrium Model

Duration of Widespread Farming	Doubling Period	Number of Jews if That Doubling Period Had Held in Jewish History
12,000 yrs.	1,299.80 yrs.	39.99 (assuming 5 to begin with)

Clearly both evolution models are absurd. The creation model is, however, most reasonable.

4. More Complex, Accurate Approach Population Growth

Boyce and DiPrima¹⁶ and May¹⁷ have suggested that a more accurate growth equation for human population is

$$p' = ap - kp^2. \quad (8)$$

This equation takes into consideration the fact that a population essentially grows exponentially until it approaches an equilibrium. At near equilibrium, growth slows down.

Actually, if m is defined as $m = k/a$, and the notation $\exp(x)$ is used for e^x , then the solution to Equation 8 is

$$p = c \exp(at) / (1 + cm \exp(at)) \quad (9)$$

where, if $p(0)$ is the initial population,

$$c = p(0) / (1 - mp(0)). \quad (10)$$

Some explanation of the constants a , k , and m is in order. From the definition of m , the constant $k = am$. Thus, only the values of m and a need be determined.

It is not difficult to show that $1/m$ is the maximum population possible (the equilibrium population) and that the population tends to $1/m$ as t tends to infinity. Boyce and DiPrima have suggested 25 billion as the value for the maximum population.¹⁸ This gives $m = 4 \cdot 10^{-11}$.

The value for a must be determined from some control group just as the doubling period was determined from a control group in the previous section. In fact, until the population nears the equilibrium, a is approximately inversely proportional to the doubling period.

At times, it is convenient to write Equation 9 where $\ln$ is the natural logarithm as

$$at = \ln(p / (c(1 - mp))). \quad (11)$$

First, the values for a based on Jewish population figures and known facts about Jewish history will be computed. The reader can consult section 3 for reasons for using the figures of 1700 B.C. and 2000 B.C. for the dates of Jacob's life, and for considering initial populations of two and five.

It seems unreasonable to assume that the equilibrium population for the Jews is 25 billion. Rather in computing the figures in Table 5, 160 million has been used as the equilibrium figure for Jewish population. (The reader can verify that, if 25 billion is used the figures are not significantly different. Actually, the position taken in this paper would have been favored.) This figure is about 10 times the 1939 population figure, just as 25 billion is close to 10 times the 1939 world population. (For the population of a given year, see Table 1.)

Table 5
The Jewish Population

Year A.D.	Values of the Constant a (Times 1,000)			
	Initial Population = 2 began 1700 B.C.	Initial Population = 2 began 2000 B.C.	Initial Population = 5 began 1700 B.C.	Initial Population = 5 began 2000 B.C.
1899	4.325	3.992	4.070	3.757
1921	4.394	4.058	4.141	3.824
1939	4.400	4.065	4.149	3.833
1948	4.284	3.958	4.033	3.726

From Table 5, one can conclude that a is between $3.726 \cdot 10^{-3}$ and $4.400 \cdot 10^{-3}$. The difficulty is that it is hard to give such an abstract constant any meaning. One way to give meaning to such figures is to ask when, given a certain value for a , the world's population should have reached equilibrium. Usually, this means that the population is 99 per cent of equilibrium; whereas, the date when human population should have been 99.99 per cent of equilibrium has been computed in Table 6 (current population growth proves that the world's population is not even near this level yet). Our results are Table 6.

Table 6
Time It Would Take Human Population to Reach 99.99 Per Cent of Equilibrium

Value of a	Time to Reach 99.99 Per Cent Equilibrium
$3.726 \cdot 10^{-3}$	8711 years
$4.400 \cdot 10^{-3}$	7377 years

In other words, applying data from the control population to human population growth, the human population would have reached equilibrium in less than 10,000 years.

Following the treatment of section 3, let us now test the creation model and the evolution model to see which model gives reasonable figures. The reader should understand that a figure is reasonable if it is in some way consistent with known facts about the Jewish population (the control group).

Data obtained from the creation model are listed in Table 7. According to these figures, the creation model is quite reasonable.

Table 7
Creation Model/Biblical Chronology

Date of Flood	Value of α	Time for Population to Reach 99.99 Per Cent of Equilibrium
2348 B.C.	$4.589 \cdot 10^{-3}$	6833 years
3255 B.C.	$3.785 \cdot 10^{-3}$	8285 years

What is the situation with regard to the usual evolution model? An interesting relationship between the figures in Table 8 and the corresponding figures in Table 3 is noticeable.

According to Table 8, if man has existed for one million years, and if population satisfies Equation 8, then in 1899 there would have been only 5.42 Jews! This when there were five to start with! Unfortunately for the evolutionists, the more refined differential Equation (8) does not "deliver" them from the absurdities of their model.

Table 8
Evolution Model

Man's Existence	Value of α	Number of Jews Today If That Value Had Held in Jewish History	Time to Reach 99.99% Equil.
1,000,000 yrs.	$2.070 \cdot 10^{-5}$	5.42	1,568,000 yrs.
100,000 yrs.	$2.070 \cdot 10^{-4}$	11.20	156,800 yrs.

Finally, results for the evolution-equilibrium model are given in Table 9. This model presumes that population leveled off at three million until 12,000 years ago when it shot up resulting in our present population. At this point, calling the evolution model absurd is monotonous though highly appropriate.

Table 9
Evolution-Equilibrium Model

Duration of Widespread Farming	Value of α	Number of Jews If That Value Had Held During Jewish History	Time to Reach 99.99% Equil.
12,000 yrs.	$5.395 \cdot 10^{-4}$	40.98	25,250 years

One can conclude that, no matter which equation one uses for population growth, the evolution model cannot be defended, but the creation model is quite reasonable.

5. Comparison of Approaches

Regular readers of creationist publications are no doubt aware of the fact that each of the approaches to population growth used above differs somewhat from the approach taken by Henry Morris;^{19, 20} wherein equations are derived from a truncated geometric sum. The basic equation is

$$p = 2(c^{n-x+1})(c^x - 1)/(c - 1) \quad (12)$$

where one assumes that n is the number of generations, x is the average life-span expressed in generations, each family has an average of $2c$ children, and of this family of $2c$ children, c are boys and c are girls. Often $x = 1$ so that Equation 12 becomes

$$p = 2c^n \quad (13)$$

Even Equation 12 can be reduced (assuming x remains constant) to

$$p = qc^n \quad (14)$$

where q is defined by

$$q = 2(c^{-x+1})(c^x - 1)/(c - 1) \quad (15)$$

Therefore, both Equations 12 and 13 are simply different forms to the solution to Equation 4. That is, they are both exponential type equations.

Though the approach in section 3 of this paper is logically equivalent to that used by Henry Morris, the approach taken in this article has the following advantages:

1. The concept of doubling is more easily grasped.
2. In section 3, only values for s and n are needed. Even the two in Equation 13 is an assumed value. Thus the approach discussed here seems to involve fewer assumptions.

3. Repeated use has been made of a control group with known history, which is recognized as well established, even by those who reject the Biblical record.

Because of these advantages, the approach of section 3 is recommended for use before popular audiences.

References

- ¹Mathematics is often called the Queen of Science, and it is a consequence of this article that evolution is the King of Fools.
- ²Throughout, this is what will be meant by the term, "evolutionist."
- ³That is, that present processes working at present rates are sufficient to account for all that has happened in the geological and biological worlds in the past.
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- ⁶Mayr, Ernst. 1970. *Populations, species and evolution*. Harvard University, p. 102.
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- ¹⁶Boyce and DiPrima, *Op. cit.*, p. 58, problem 7.
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THE YOUNG EARTH†

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It is shown that the claims for a great age of the Earth, seen so often in uniformitarian literature, are obtained by selecting arbitrarily certain processes by which to attempt to judge the age of the Earth, and ignoring others which have, a priori, as great a likelihood of being reliable. As a matter of fact, most of the possible ways of estimating the age of the Earth give results much less than those demanded by uniformitarian theorists. Of 74 possible ways of determining the age of the Earth considered here, about one-third give results of no more than 10,000 years. Even these results, in many cases, are upper limits; moreover the nature of the process involved is often such that the results are inherently likely to give too great an age.

Introduction

There are only two possible basic models of origins, evolution and special creation. Proponents of the evolution model postulate that the origin and development of all things are attributable to natural laws and processes which are still in operation. According to the creation model, all the basic systems and categories of the natural world were brought into existence by special processes of creation which are not in operation today.

Since presently-operating processes of biologic change proceed so slowly, if at all, that evolution (in the sense of the development of more complex organisms from less complex) is non-observable, it is obvious that an immense amount of time is required for the evolution model. It is necessary, therefore, that geochronometric methods be developed which yield great spans of time, if the evolution model is to be retained.

On the other hand, long ages are not required for the creation model. Although the basic non-Biblical scientific creation model does not necessarily preclude long ages, great spans of time are not required as is the case with the evolution model. Therefore, geochronometric methods which yield young ages do not have to be rejected by proponents of the creation model.

Since there exists an almost infinite number of processes in the world, and since each of them involves changes with time, each of them might potentially be used to measure time. It is significant that, in the standard literature, only those processes are discussed which involve such slow changes as to yield long ages. Processes which operate more rapidly, and therefore yield younger ages, are normally either ignored or explained away.

Actually there are only a few processes which provide time enough to satisfy evolutionists. There are many more processes which will indicate a young earth and which, therefore, can be acceptable only in the framework of the creation model. Some of these are discussed in this paper.

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Requirements for a Geochronometric Process

It should be emphasized that it is impossible to determine with certainty any date prior to the beginning of historical records—except, of course, by divine revelation. Science, in the proper sense, is based on observation, and the only records of observations are found in historical records. Natural processes can be used to **estimate** prehistoric dates, but **not to determine** such dates. The accuracy of the estimates will depend on the validity of the assumptions applied to the use of the process in making such calculations.

Assume, in the general case, a simple process in which there are two main components, one "parent" and one "daughter" component—call them A and B , respectively. The initial magnitude of these components at zero time (that is, the time when the particular system came into existence) are A_0 and B_0 . After an additional time T these magnitudes have changed to A_T and B_T . The average time-rate at which A changes into B during the time T is R_T . The instantaneous rate may either be constant or may change in some fashion with time, in which case it may be expressed in functional form as

$$r_t = f(A_0, B_0, t) \quad (1)$$

since it may possibly depend on the process components as well as on time.

If the process is not a closed system, then there may be changes in A and B which result from extraneous influences, other than those expressed in the normal rate function. Let such changes be represented by the quantities Δa and Δb , where Δa may be either positive or negative and represents the modification in A brought about during the time T by such external influences. A similar definition applies to Δb .

When all these quantities are put together, the following equations express the effect of these changes in A and B .

$$A_0 \pm \Delta a - (R_T)T = A_T \quad (2)$$

$$B_0 \pm \Delta b + (R_T)T = B_T \quad (3)$$

Subtract Equation 3 from Equation 2

$$(A_0 - B_0) \pm (\Delta a \mp \Delta b) - 2R_T T = (A_T - B_T) \quad (4)$$

then the time T is calculated as follows:

$$T = [(B_T - B_0) + (A_0 - A_T) \pm (\Delta a \mp \Delta b)] / [1/2 R_T] \quad (5)$$

This equation is relatively simple, involving only two components in the chronometric system. Many processes would involve more than this. Some, of course, might involve a change in only one component.

To solve Equation 5 and find the duration T , it is obvious that all the terms on the right-hand side would have to be known. The problem, however, is that only A_T , B_T , and r_T (the present magnitudes and rates) can actually be measured.

There is no way in which the average rate R_T can be determined unless the functional relationship expressed in Equation 1 is known. Mathematically this average rate could be expressed as follows:

$$R_T = (1/T) \int_0^T r_t dt \quad (6)$$

As was just remarked, this cannot be calculated, however, unless the equation for r_t is known. It is customary simply to assume that $R_T = (r_T)$ as it is measured at present. In other words, it is arbitrarily assumed that the process rate has been constant throughout the period T . This is an unrealistic assumption since, in the real world, there is no such thing as a process rate which cannot be changed.

Furthermore, there is no way in which Δa and Δb can be determined, since there is no way of knowing what extraneous influences may have affected the system in the prehistoric past. The common assumption is that the system has always been a closed one and thus both Δa and Δb are zero; but this assumption is likewise unrealistic since, in the real world, all systems are open systems.

Similarly, there is no way of knowing the initial amounts, A_0 and B_0 , of the parent and daughter components, since no scientific observers were present to measure them at the appropriate time. Again, however, it is commonly assumed that there was no daughter component present initially, so that B_0 is zero; and that the initial parent component has been modified only by the amount corresponding to the present daughter component, so that $A_0 = B_T + A_T$.

If all these assumptions are made, Equation 5 becomes:

$$T = [(B_T - 0) + (B_T + A_T - A_T) + (0 + 0)] / [1/2 R_T] \\ = B_T / R_T \quad (7)$$

Since both B_T and R_T can be measured, it is thus easily possible to calculate T . However, the resulting date is obviously only as accurate as the assumptions.

To recapitulate, any geochronometric calculation is based on at least the following assumptions:

- (1) Constant process rate (or known functional variation of process rate).
- (2) Closed process system (or known external effects on the open system).
- (3) Initial process components known.

It is significant that not one of these three vital assumptions is provable, or testable, or reasonable, or even possible! Therefore, no geochronometric calculation can possibly be certain; and most of them are bound to be vastly in error.

Estimates of the Earth's Age

Since the magnitude of the error in the assumptions obviously will vary quite widely from process to process, one would expect to get a wide range of

"apparent ages" from different processes. This turns out to be the case.

Some few systems, such as certain uranium-lead minerals, have yielded a time of over three billion years for the age of certain ancient rocks. Other systems, such as the earth's decaying magnetic field, give an apparent age of about 10 thousand years for the earth as a whole. All sorts of ages for the earth are implied by different processes.

In every case the same three assumptions are made—namely, the assumptions of a constant rate, a closed system, and zero initial daughter component. As stressed above, these assumptions are quite likely wrong. The evolutionist may reject the young age indicated by the decay of the magnetic field on this basis; but so may the creationist reject the old ages given by uranium decay, on the same basis. The same assumptions have to be made in every case.

To illustrate the extreme variability of such processes, a list of dates obtained from different processes is given in Table 1.

In addition to the typical uniformitarian assumptions noted above, it is also assumed that each process may be applied essentially to the earth as a whole. That is, it is assumed that all major components of the earth—the ocean, the atmosphere, the magnetic field, the crust, etc., were formed at essentially the same time. Some processes deal with the ages of extra-terrestrial components of the universe, none of which could be significantly younger than the earth.

Space does not permit discussion of all of these in this paper, but references are given in the table to allow the reader to examine more detailed discussions of each. One should note also that these calculations are based on the actual measured data, and are in no way related to the imaginary "geologic ages" of evolutionary thinking.

In Table 1, then, are listed 74 different processes for calculating the age of various integral parts of the earth, and thus, presumably, of the whole earth. All processes yield an age of much less than a billion years, whereas the present standard evolutionary estimate is approximately five billion years.

The geochronometric methods in favor at the present (that is, those which give long ages, such as uranium-lead, rubidium-strontium, and potassium-argon) have not been included in the tabulation, nor are they discussed in this paper. However, it has been shown elsewhere^{1, 5, 6, 7} that these, too, can easily be reconciled with a young earth.

The most obvious characteristic of the values listed in the table is that of extreme variability—all the way from 100 years to 500,000,000 years. This variability, of course, simply reflects the errors in the fundamental uniformitarian assumptions. The processes have all been affected in various ways and to varying degrees: (1) by influences extraneous to the respective systems; (2) by changes in the process rates; and (3) by the unknown initial values.

Some of the estimates are obviously far too large. The half-billion years for the earth's crust determined by present lava flows, for example, is based on the assumption that all the earth's crust was formed in this way, whereas everyone would agree that actually very

Table 1
Uniformitarian Estimates—Age of the Earth

(Unless otherwise noted, based on standard assumptions of closed systems, constant rates, and no initial daughter components.)

Process	Indicated Age of Earth	Reference	Process	Indicated Age of Earth	Reference
1. Efflux of Helium-4 into the atmosphere	1,750-175,000 years	1	39. Origin of human civilizations	5,000 years	7
2. Influx of meteoritic dust from space	too small to calculate	1	40. Formation of river deltas	5,000 years	8
3. Influx of radiocarbon to the earth system	5,000-10,000 years	1	41. Submarine oil seepage into oceans	50,000,000 years	9
4. Development of total human population	less than 4,000 years	1	42. Decay of natural plutonium	80,000,000 years	10
5. Influx of uranium to the ocean via rivers	10,000-100,000 years	1	43. Decay of lines of galaxies	10,000,000 years	11
6. Influx of sodium to the ocean via rivers	260,000,000 years	1	44. Expanding interstellar gas	60,000,000 years	12
7. Influx of nickel to the ocean via rivers	9,000 years	1	45. Formation of Carbon 14 on meteorites	100,000 years	13
8. Influx of magnesium to the ocean via rivers	45,000,000 years	1	46. Decay of short-period comets	10,000 years	14
9. Influx of silicon to the ocean via rivers	8,000 years	1	47. Decay of long-period comets	1,000,000 years	15
10. Influx of potassium to the ocean via rivers	11,000,000 years	1	48. Influx of small particles to the sun	83,000 years	15
11. Influx of copper to the ocean via rivers	50,000 years	1	49. Maximum life of meteor showers	5,000,000 years	15
12. Influx of gold to the ocean via rivers	560,000 years	1	50. Accumulation of dust on the moon	200,000 years	15
13. Influx of silver to the ocean via rivers	2,100,000 years	1	51. Deceleration of earth by tidal friction	500,000,000 years	16
14. Influx of mercury to the ocean via rivers	42,000 years	1	52. Cooling of earth by heat efflux	24,000,000 years	16
15. Influx of lead to the ocean via rivers	2,000 years	1	53. Accumulation of calcareous ooze on sea floor	5,000,000 years	17
16. Influx of tin to the ocean via rivers	100,000 years	1	54. Influx of lithium into ocean via rivers	20,000,000 years	18
17. Influx of aluminum to the ocean via rivers	100 years	1	55. Influx of titanium into ocean via rivers	160 years	18
18. Influx of carbonate to the ocean via rivers	100,000 years	2	56. Influx of chromium into ocean via rivers	350 years	18
19. Influx of sulphate to the ocean via rivers	10,000,000 years	2	57. Influx of manganese into ocean via rivers	1,400 years	18
20. Influx of chlorine to the ocean via rivers	164,000,000 years	2	58. Influx of iron into ocean via rivers	140 years	18
21. Influx of calcium to the ocean via rivers	1,000,000 years	2	59. Influx of cobalt into ocean via rivers	18,000 years	18
22. Leaching of sodium from continents	32,000,000 years	2	60. Influx of zinc into ocean via rivers	180,000 years	18
23. Leaching of chlorine from continents	1,000,000 years	2	61. Influx of rubidium into ocean via rivers	270,000 years	18
24. Leaching of calcium from continents	12,000,000 years	2	62. Influx of strontium into ocean via rivers	19,000,000 years	18
25. Influx of sediment to the ocean via rivers	30,000,000 years	3	63. Influx of bismuth into ocean via rivers	45,000 years	18
26. Erosion of sediment from continents	14,000,000 years	3	64. Influx of thorium into ocean via rivers	350 years	18
27. Decay of earth's magnetic field	10,000 years	4	65. Influx of antimony into ocean via rivers	350,000 years	18
28. Efflux of oil from traps by fluid pressure	10,000-100,000 years	5	66. Influx of tungsten into ocean via rivers	1,000 years	18
29. Formation of radiogenic lead by neutron capture	too small to measure	5	67. Influx of barium into ocean via rivers	84,000 years	18
30. Formation of radiogenic strontium by neutron capture	too small to measure	5	68. Influx of molybdenum into ocean via rivers	500,000 years	18
31. Decay of natural remanent paleomagnetism	100,000 years	5	69. Influx of bicarbonate into ocean via rivers	700,000 years	19
32. Decay of C-14 in pre-Cambrian wood	4,000 years	5	70. Escape of high-velocity stars from globular clusters	40,000 years	20
33. Decay of uranium with initial lead	too small to measure	6	71. Rotation of spiral galaxies	200,000,000 years	20
34. Decay of potassium with entrapped argon	too small to measure	6	72. Accumulation of peat in peat bogs	8,000 years	21
35. Influx of juvenile water to oceans	340,000,000 years	7	73. Accumulation of sediments for sedimentary rocks	20,000 years	21
36. Influx of magma from mantle to form crust	500,000,000 years	7	74. Lithification of sediments to form sedimentary rocks	20,000 years	21
37. Growth of active coral reefs	10,000 years	7			
38. Growth of oldest living part of biosphere	5,000 years	7			

little of it was formed thus. Similarly, the quarter-billion year age for the ocean determined by sodium influx neglects the certain fact (from both geological and paleontological evidence) that the ocean has been composed of salt water from the beginning. Most of the other figures in the table are also clearly much too large.

On the other hand, some of the figures are clearly too small. The age of the ocean as based on the influx of lead and aluminum is considerably less than man's own recorded history of the ocean. It must be that the rates of influx of those metals were much lower in the past, or else that they are continually being removed from solution in some way.

Conclusions

Nevertheless, all things considered, it seems that the lower ages are likely, on the whole, to be more accurate than the higher ones. This conclusion follows from the obvious facts that: (1) they are less

likely to have been affected by initial concentrations or positions other than "zero"; (2) the assumption that the system was a "closed system" is more likely to be valid for a short time than for a long time; and (3) the assumption that the process rate was constant is also more likely to be valid for a short time than for a long time.

Thus, it is concluded that the weight of all the scientific evidence favors the view that the earth is quite young, far too young for life and man to have arisen by any evolutionary process. The origin of all things by special creation—already necessitated by many other scientific considerations—is therefore also indicated by chronometric data.

Finally, the reader should note that these conclusions were reached with no reference at all to the testimony of the Bible relative to chronology. It is, therefore, all the more significant that these results correspond closely to the brief chronology of terrestrial and human history given long ago by divine revelation in the Holy Scriptures.

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CREATION CONVENTION, AUGUST 17-19, 1975

"Space and Astronomy" will be the main topic of the Creation Convention scheduled for Seattle Pacific College, Seattle, Washington, August 17-19, 1975, under joint sponsorship of the Bible-Science Association (Seattle Branch) and Campus Crusade for Christ, International. Featured speaker at the final session, the Tuesday night banquet, will be Col. James Irwin, astronaut, who will tell the story of the scientific voyage of Apollo 15 to the moon, his own Christian experience, and how science and belief in God are compatible.

Speaker for the opening session on Sunday evening will be Harold Slusher, M.S., staff member at the Institute for Creation Research and Chairman of the Curriculum in Planetary Science at Christian Heritage College in San Diego. In his presentation he will show why a young earth is scientifically feasible.

Donald Chittick, Ph.D., Professor of Chemistry at George Fox College in Newberg, Oregon, will show how the creation model for the origin of space is the better model.

The relation of the earth to the sun is the topic of an essay by James Hanson, who is Professor of Computer and Information Science at Cleveland State University, specializing in space science.

George Mulfinger, M.S., physicist and astronomer, will demonstrate that there is little evidence for the various theories proposed for the origin of the universe, except for the record in Scripture. Prof. Mulfinger is on the faculty of Bob Jones University in Greenville, S.C., and is co-author of the just-published *Physical Science Textbook* for junior high school students.

John Read, who is an aerospace engineer with Hughes Aircraft, will discuss the question of whether or not there is life in space. He will also discuss UFOs.

Robert Whitelaw, M.S., who is Professor of Mechanical and Nuclear Engineering at Virginia Polytechnic Institute and State University, will stop at the convention on his way home after spending a year teaching at the Chung Yuan Christian College of Science and Engineering in Taiwan. His presentation will deal with harmony and discord in the solar system, and he will also discuss the spacing of orbits.

Rev. Walter Lang, executive director of Bible-Science Association, will show the relationship of Scripture to space studies. He will show that when the importance of planet Earth in the universe is recognized, then space research is more productive.

Registration information may be obtained by writing to Bible-Science '75 Convention, P. O. Box 66507, Seattle, Washington 98166, or calling 206-623-3913 or 206-242-3074.

METEORITIC EVIDENCE FOR A YOUNG EARTH

PETER A. STEVESON*

It is shown that meteorites, or things connected with them, provide three distinct kinds of evidence for a young Earth. First, no great amount of meteoritic dust, or nickel, is found in the Earth's crust. Secondly, meteorites are not found buried in the rocks which are alleged to be old by the uniformitarian theorists. Moreover, all the meteoritic craters, found here and there on the Earth, seem to be quite young.

Introduction

Most persons have had their view of the night sky momentarily interrupted by the brief flare-up of a meteor as it passed through the earth's atmosphere. Others have been able to examine in a more leisurely manner a meteorite which has survived passage through the atmosphere, and has impacted on the earth. Whatever the case, these phenomena are a part of what constitutes an important bit of evidence in the determination of the age of the earth.

Because of their extra-terrestrial origin, meteors and meteorites were long associated with mythology and paganism. They have been called "passages of souls to heaven; leprechauns on their way from one bit of mischief to the next; or angels on errands of mercy."¹ In Biblical times, the base of the image of Diana, located in the temple at Ephesus, is thought to have been a meteorite (cf. Acts 19:35). Only in comparatively recent times have meteors and meteorites been accepted for what they are.

Based on the evidence, meteors are different from meteorites, both in nature and, probably, in origin. A typical meteor flares up only briefly. The limited number of meteor spectra which are available show the presence of oxygen and nitrogen (due to the heating of earth's atmosphere), along with the presence of hydrogen, sodium, magnesium, silicon, aluminum, iron, nickel, calcium, manganese, chromium, and silicon.² Astronomers generally agree that these spectra suggest that most meteors are comet-like in nature, i.e., ices mixed with dust of a rock-like composition.³

Meteorites, on the other hand, are higher-density chunks of rocks and iron of still debated origin. Most of the stony meteorites and the iron meteorites show ablation from the intense heating produced while passing through the atmosphere. Most meteors are associated in some way with the paths of a comet, but no meteorite has ever been so connected.⁴

There have been two major falls of meteorites in this century. On June 30, 1908, a large meteorite fell in an uninhabited section of Siberia, in Russia. It was witnessed by passengers on the Trans-Siberian Railroad and detected by several seismographs around the world. An area about the size of the state of Delaware was affected. Trees were blown down in a pattern which radiated outward from the point of impact.⁵ This fall is known as the Tunguska Crater, so named from a near-by river.

The second fall occurred in the Sichote-Alin mountains of eastern Siberia on February 13, 1947. More than 100 craters have been found in this region, scattered over an area of three square miles. Again, trees

have been blown down and scorched from the heat.⁶ The total mass of the meteorites has been estimated to exceed 100 tons.⁷

The largest meteorite known is located in Grootfontein, Southwest Africa. It is about nine feet by nine feet by three feet high. It is 16 percent nickel and is estimated to weigh about 60 tons. The second largest meteorite was found by Admiral Robert Peary in Greenland. It was moved to the Hayden Planetarium, in New York, where it was found to weigh over 36 tons. In 1902 the largest meteorite ever found in the United States was identified near Williamette, Oregon. Original weight was estimated at 25 tons, but this has been reduced by erosion to a little over 15 tons. It also is now located at the Hayden Planetarium.⁸

Meteoritic Dust

In several ways, meteorites may be used to argue strongly for a young age of the earth and the solar system. In the first place, estimates of the frequency of meteor impact upon the earth's atmosphere indicate that from 2-15 million tons of meteoritic dust settle out upon the surface of the earth each year. Taking the minimum of two million tons/year, an average density of 3.5 g/cc, and assuming a uniform rate of settling over five billion years estimated by evolutionists, a meteoritic dust layer almost 16 feet in thickness should have accumulated over all the surface of the earth, and at the bottom of the seas.

The fact that this layer does not exist cannot be accounted for by assuming that the meteoric dust has mixed with the existing crust of the earth. Meteoritic dust contains about 2.5% nickel while the earth's crust contains only about 0.008% nickel. In other words, meteoritic dust contains about 312 times as much nickel per unit volume as does the earth's crust.

In order to disperse this amount of meteoritic nickel, it would need to mix with at least $(312)(16') =$ almost 5,000 feet of the earth's crust to give the present composition of nickel in the earth's crust. This computation involves the assumption, of course, that the earth's crust contained no nickel at one time. Similar computations could be made for cobalt and for other metals present in meteoritic dust.⁹

The facts are that no such layer of meteoritic dust exists on the earth. And, if it does not exist, then a five billion year age of the earth may be questioned.

Absence from "Old Rock Strata"

A second consideration which meteorites suggest is based on the question, "Why haven't meteorites been found in so-called 'old' layers of the earth?" This question is admitted widely by astronomers writing

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on meteorites.^{10, 11, 12} Heide points out that though "Some fifty to fifty-five billion tons of coal have been mined, all of which have passed through the hands of people with a professional familiarity with stones, it is certainly remarkable that ancient meteoritic material has never been found or described up to now."¹³ This fact has led some astronomers to postulate that meteorites did not fall in the early days of the earth's existence.

Most astronomers, however, have tried to explain this absence by appealing to one of several reasons. Nininger cited the lack of experience of geologists in identifying "meteorites, particularly the *weathered* variety." He also mentioned the lack of "persistent searches for evidence of the existence of meteorites in older geologic formations,"¹⁴ and asserted that the weathering of meteorites over thousands of years makes it unlikely that they would still be recognizable.¹⁵ Heide sought refuge in the fact that "only about one-hundredth of the earth's surface is under observation, while the accessible portion of the former surface exposed during past geologic periods is several orders of magnitude smaller still."¹⁶

Some astronomers have attempted to give examples of meteorites which have been found in "old" rock formations. The examples, however, are not always clear; many seem somewhat confused. Mason has cited a report of an iron meteorite recovered from a depth of 1525 feet during an oil well drilling in Texas, in 1930. He commented,

. . . the evidence for the identification as an iron meteorite (iron content, Widmanstätten structure) is good, but unfortunately no material from it has been preserved.¹⁷

To further complicate the matter, Heide mentioned the same meteorite except that he locates its source at 165 meters.¹⁸

On the basis of authenticated meteorites, none have been found in "older" rock strata. This can be used to argue strongly that the earth is young and that meteorites are found near or on the surface of the earth because the time since Creation is on the order of a few thousand years.

It should be noted that the author does not insist that meteorites will never be found in "older" strata. The points raised by Nininger, etc., are valid to a degree. Recognizing that a time period of around 2,000 years elapsed between Creation and the Flood, meteorites may yet be found which fell during that time period, and which were buried by cataclysmic actions of the Flood. However, since the major portion of earth's history has transpired since the Flood, it is reasonable to expect that the greater number of meteorites will be found on or near the upper levels of the earth.

Crater Ages

Thirdly, identified meteorite craters are all of a relatively young age. Krinov listed 14 craters which have been proved to be meteoritic in origin by the "discovery of iron meteorite fragments in the locale of these craters."¹⁹ Not all of these craters have been studied thoroughly and age estimates are not available

for all. However, those estimates that are available are all "young" by comparison with that which normally is connected with uniformitarian geology.

The well known Canyon Diablo (Meteor Crater, Arizona), for instance, is dated c 3000 B.C. from the degree of weathering on the canyon walls. Also, Indians living in the area have legends concerning the creation of the canyon, and it is thought likely that the fall of the meteorite may have been observed by Indians living in the area at that time.²⁰ The Kaaliyarv craters, in Russia, were dated about 4,000-5,000 years old by the study of mollusks in the small craters.²¹ The Odessa, Texas crater has been dated, on the basis of Ar-39 and C-14 content of meteorite fragments, at 1400-2900 years old.²²

Three craters in Australia have been dated. Carbon-14 tests indicate that the Henbury Craters are only a few thousand years old. As with the Canyon Diablo crater, natives in the area avoid this vicinity. Their name for the crater is "chindu chinna waru chingi yabu" which may be translated roughly as "sun-trail-fire-devil-stone." This would seem to indicate that the meteorite fell within the history of these aborigines.²³

The Wolf Creek crater is the second largest of those meteoritic craters which have been definitely identified. From the fact that the weathering of the crater is only minimal, it is estimated to be of recent age, perhaps only a thousand years old.²⁴ A small crater located on the Dalgara sheep station in Western Australia is estimated, from the degree of weathering, to be 20-25 thousand years old.²⁵

In addition to the craters listed by Krinov, other scientists have listed a large number of possible craters. Many of these, e.g., the craters of the Sall Estate on Oesel Island in the Gulf of Riga (estimated to be 5,000 years old²⁶), are certainly meteoritic in nature. Others, e.g., the circular structures located near Brent and Holleford in Canada ("no meteoritic material has been found associated with any of these craters so far."²⁷) are of debatable origin.

The important point to note, however, is that dating of these craters is measured only in a few thousands of years. Anders, for instance, listed the dates of fall for 25 iron fragments and nine chondrites, as calculated from the Ar-39 and C-14 content of meteoritic fragments in the craters. Twenty-four of the iron fragments and six of the chondrites are dated at less than 7,000 years old. The greatest age given is for the Potter chondrite, 20,000 years.²⁸ Once again, then, meteoritic evidence may be used to support the idea of a young earth.

Conclusion

These three areas seem to be an excellent base for arguing strongly for a young age, on the order of a few thousand years, for both the earth and the solar system. Because of the absence of a significant layer of meteoritic dust, the absence of meteorites in the "old" strata of the earth, and the dating of existing meteorite craters at only a few thousand years in age, the creationist model of origins is superior to the evolutionary model.

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ON THE INTERPRETATION OF POTHOLES

DOUGLAS E. COX*

Since potholes are generally considered to have been formed by erosion over long ages of time, the rocks in which they occur would also seem to be of great age. Some geologic interpretations account for these topmost rocks as deposits formed during the Biblical flood. The presence of potholes poses a problem for these interpretations. The details of the uniformitarian theory of the formation of potholes are examined, and contrasted with the well-known characteristics of potholes. It is evident that the uniformitarian theory of pothole erosion falls short of accounting for the phenomenon of potholes in many ways. Potholes therefore cannot be regarded as evidence for a great age of the rocks in which they occur.

Introduction

A factor that strongly influences any interpretation of the age of a rock formation is the degree of erosion detected. Potholes are usually regarded as one of the erosional features that may influence age estimates of rocks in which they occur. The traditional interpretation is in terms of the process of abrasion of the bedrock by rotary currents inside the potholes, and vibration of pebbles and stones by the water, that gradually wore the holes deeper and deeper into the bedrock.

The immense size of some examples, upwards of 40 feet and 50 feet in depth, and similar diameters,¹ might be supposed to be indicative of long ages of abrasion by powerful currents. This would lead one to conclude that the topmost rocks of the earth's surface, in which such large potholes occur, are really very old; and must antedate the flood of Noah's time, that cannot have been more than a few thousand years ago.

Potholes pose an important question for flood geologists. Do they indicate the rocks in which they occur are really of great age? Certainly, if they have been formed by gradual abrasion of their walls by currents, they would. This would have to be a very slow process, considering the hardness of some of the

rocks in which they occur. They are common in sandstone, dolomite, and granite.²

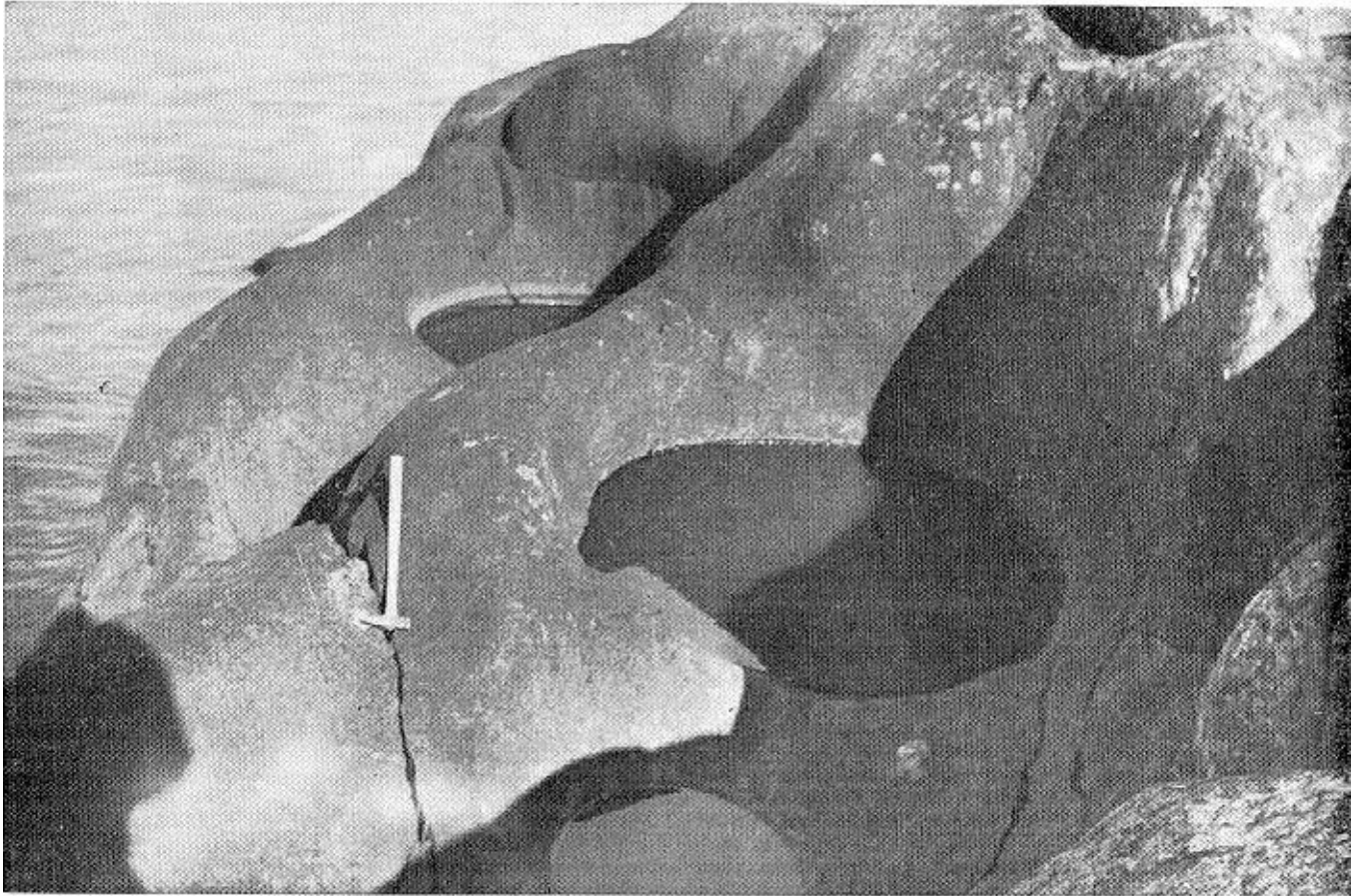
In the sandstones of Wisconsin Dells, Wisconsin, potholes abound. Along the top of the Niagara Escarpment, in Southern Ontario, many examples of potholes in hard dolomite and limestone may be found. Potholes also occur along the North Shore of Lake Superior. At Interstate Park, Taylor's Falls, Minnesota, a group of potholes occur in basalt.³ Most potholes occur in sedimentary rocks, that cover most of the continents.

Usual Uniformitarian Interpretation

In the usual interpretation presented by uniformitarian theorists, potholes are considered to be the effects of erosion by streams and rivers over very long periods of time. The actual work of abrasion is considered to have been done either by hard grains of sand held in suspension by the rapidly flowing water; or by large boulders, called "grinders," in the bottom of the pothole, that were agitated constantly by the currents swirling around inside. The tiny grains in the rapid currents are thought to have gradually worn down the rock into a depression, that was deepened by the motion of the grinders.

Considering the remarkable depths of potholes, this process would seem to require great ages of time. Alexander⁴ noted one example of 12 feet in diameter and 60 feet deep at Taylor Falls. Uniformitarian

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This picture shows potholes formed in quartzite, in the Outpost Islands, District of MacKenzie, North West Territory, Canada. This is Print Number 81755, by the Geological Survey of Canada, Ottawa, Ontario, Canada, and is used by arrangement.

geologists would have no trouble accommodating long time, but some flood geologic interpretation would have to be conceived so that this kind of effect would be possible within just a few thousand years, in the time elapsed since the Biblical flood.⁵

The slowness of the process of abrasion by which the potholes are supposed to have been formed seems to indicate the holes would be long ages in formation, but this problem is further compounded by the fact that the vast majority of all potholes are not in the process of formation at the present time. They are frequently far from the courses of streams or rivers, and many are filled up with stones and sand or other debris.

If they have been formed by erosion, the process has long since ended. The time since they were completed, together with the period of time they were in the process of formation, seems to add up to a considerable age for the latest sedimentary rocks of the earth in which they occur. Certainly this is a problem for flood geologists. How is it to be resolved?

Potholes that occur far from streams and valleys, sometimes high up on hillsides and mountains, have been explained by uniformitarian geologists as the effects of the great ice ages of the Quaternary. Supposedly, during this time, there were potholes formed when the ice melted, as rivers flowed underneath the ice and on its surface. Sometimes these surface rivers

plunged down a crevasse, and eroded the bedrock beneath, forming potholes on the most unlikely places, the glacial theorists claim.

The ice ages of the Quaternary are considered to have lasted from about two million years ago until about 10,000 years ago. In all those areas that have been glaciated, there has been sufficient time for a cover of vegetation to develop, after the ice melted. All this goes to show that potholes on hilltops and mountain sides, as they are presently understood, tend to increase estimates of the age of the earth,

Yet systems of geologic interpretations involving the flood often place the ice ages after the deluge.⁶ This means that all potholes, that are presently explained as the effects of glacial "moulin," formed while ice was spread thickly over the continents, while most of the ice melted, and subsequently trees grew, etc.—all this happened, according to these interpretations, since the flood.

Potholes: Problem for Flood Geologists

Potholes present a significant problem for flood geologists, since they occur in the topmost "solid" sedimentary strata, as well as in the older granites. These rocks are sometimes identified with deposits of the flood. Yet the presence of potholes in them indicates apparently they are in fact very old.

Can the potholes be explained apart from the assumption of a great age of the earth? Could there be

another explanation of their origin, apart from the one that is generally accepted today? Most geologists assume that potholes have been carved by streams and rivers, by abrasion of grains of sand and pebbles against the bedrock. Let us look into this interpretation of origin, and see whether it is possible to really account for the phenomena.

Certainly potholes often do occur in the beds of streams and rivers. Yet they are not confined to the courses of present day streams, by any means. They also occur on the sea shore, on hill tops, and steeply sloping rocks where it is difficult to imagine any former stream. Alexander noted:

They are generally found in the beds of streams or in abandoned stream channels. Many are found, however, where the presence of a stream at any time in the past appears difficult to demonstrate. In Norway many appear along the coast near sea level and close to the water edge.⁷

Potholes are not limited to stream beds. Those in the Taylor's Falls area in Minnesota are not in the course of the river, but many are on top of cliffs high above the river bed. Some were discovered only after a covering of gravel had been removed. Upham wrote,

The greater number were originally empty, or with only a partial filling of rounded grinding stones, silt, mud, or peat, differing much in their contents. Others, mostly of small size, were found completely filled, and some were covered and hidden by a hard deposit of glacial drift, almost typical till.⁸

Near Elk City, Idaho, gold miners had scraped off a layer of gravel from the bedrock, revealing several potholes. Of course it was supposed that a river had formerly flowed there. Professor George H. Stone described it:

On the hills between Red Horse and American rivers the miners have washed away the overlying gravel. The rock beneath the gravel is very much smoothed and polished, but is very uneven, containing many rounded depressions, bowls, and potholes up to 5 feet in depth. Evidently here was a broad river that flowed up and over hills and valleys.⁹

Upham also reported that the "giants' kettles" at Christiania, Norway (now Oslo), when first discovered, were found buried under a layer of gravel. This gravel was very carefully removed, and a record kept of the depth and positions of the boulders, etc., that were found. Upham wrote,

Taking up the question of the probable epoch or stage of the Ice Age in which the Christiania giants' kettles were eroded, we are confronted by the occurrence of marine shorelines and shells in deposits overlying the glacial drift, which demonstrate that during the time of the glacial recession there the land was depressed about 600 feet below its present height. It is impossible to ascribe the moulins and potholes to torrential agency so far beneath the sea level, and consequently they must belong at Christiania to the earlier time of high land elevation and snow and ice accumulation.¹⁰

So, at the famous Christiania (Oslo) site, the pot-

holes were found buried under a layer of gravel. This is typical of many pothole findings. Only recently, one was discovered during excavations under a house in Buffalo, N.Y. A similar find led to the development of Glacier Gardens, in Lucerne, Switzerland. Alexander wrote,

The great potholes of the Glacier Garden at Lucerne, Switzerland, have excited the wonder of two generations of travellers. At that place a group of potholes was discovered in 1872 during the process of excavating for a basement in the glacial drift. Later the drift was removed uncovering over 30 holes irregularly grouped in waterworn and striated bedrock.¹¹

It is natural to suppose, when potholes are discovered under a layer of gravel and sand, that there was a former river in the area. But, since many potholes are discovered far from river courses, and deeply buried, would it not be equally reasonable to suppose, since these potholes were found apart from the course of any stream, that their formation therefore has nothing to do with currents and stream erosion? Certainly this would be logical.

And furthermore, those that occur in the courses of streams today might not have been carved by the present stream, but merely exposed when the currents washed out the loose sand. The same process, of washing the bedrock clean of layers of gravel, would explain the presence of the potholes at the sea shore. They were already there, buried under a layer of sand and gravel, until the waves washed the bedrock clean of its cover, and the potholes were exposed.

For if the sea had been pounding the shores where the bedrock was covered with a thin layer of gravel, the sand would be washed away soon and the features underneath exposed, including potholes. The water would not have carved them, but merely exposed them. And the same applies to rivers.

Usual Cause: Water Erosion?

It is interesting that in the geologic literature on potholes there is hardly a reference to them that does not associate them with currents, and erosion. That potholes are formed by abrasion, in streams, is a deeply ingrained axiom. However unlikely it may seem, it is taken for granted that wherever potholes are found, a river must have eroded them. Even where they occur right on the very tops of hills.

A particularly remarkable example of this occurs near Archbald, Pennsylvania, where, in 1884 and 1885, two large potholes were discovered in coal mining. Below about 15 feet of drift, the first hole discovered was excavated, and found to be 38 feet deep, with a diameter of about 15 feet at the bottom, increasing to a maximum of 42 feet, and a width of 24 feet across the top. The second pothole extended a depth of 50 feet in the bedrock.¹² Another remarkable example of potholes on high hills was mentioned by Alexander:

For such potholes as those on the high quartzite bluff east of Devil's Lake, Wisconsin, it must be assumed either that this bluff was glaciated—which it evidently was not—or that some ancient river flowing hundreds of feet above the present

lake level across the then-buried quartzite ridge eroded the holes in rapids coursing down its southern slope.¹³

No matter how improbable it may seem, the majority of geologists take for granted that potholes have always been formed by rivers. Yet it is quite logical to reason, since potholes occur in areas that are unlikely to have ever been the site of a river, that their formation is not related to river action.

However, uniformitarian geologists seem to always interpret the significance of potholes the other way round. Of course, as many recent philosophers of science have said, "there are no uninterpreted facts."¹⁴ Observations, such as those just quoted, are expressed in terms of certain conceptual formulations. All "data," Hanson¹⁵ says, is "theory laden." This situation must be realized when it comes to interpretative thinking about potholes.

Instead of assuming that potholes must have been carved by erosion in streams, let us try to be objective, and determine whether the facts confirm this assumption. As has been shown, patterns of distribution of potholes do not confirm it. They occur in areas where it seems most unlikely that a stream could have existed.

Initiation of Erosion Process

Another important problem is, how is the process of their erosion in streams initiated? What causes the formation of a cylindrical depression in level bedrock? Alexander described¹⁶ potholes at Taylor's Falls, Minnesota, as small as three inches in diameter and 12 inches deep. Do these represent the initial stages of pothole erosion?

Also the writer has seen several examples of potholes two or three inches in diameter, along the top of the Niagara Escarpment in Ontario. The time involved in the erosion of such narrow holes, if they were formed by erosion, would seem comparable to the age of even the largest variety. At Taylor's Falls these tiny holes are associated with giant potholes up to 60 feet deep. Over a hundred potholes occur in that vicinity.

The initiation of the pothole boring process, according to the uniformitarian approach, is described by von Engeln:

Where the rocks of a stream bed are non-uniform in texture, or are frequently intersected by joints, or have any kind of localized weakness, a small pit may be dug by differential erosion, or a hollow may result from the breaking out of a large fragment. Once a depression is formed in the bed of a stream it can become the lodging place of sand grains or pebbles slightly too coarse for the current to move across the low spot. The sand and pebbles do not, however, remain at rest. They are, more or less continuously, given a circular motion around the bottom of the hollow. By such grinding the depression is enlarged and deepened. In consequence more pebbles and more of the current are involved. Thus a pothole, progressively deepened and widened at the bottom, comes into being.¹⁷

The difficulty with this proposal is that once a depression is formed in the bed of a stream, it tends

to get filled up, not excavated deeper. The added sand and pebbles would tend to protect the particles in contact with the walls of the depression from vibrations caused by the current. This can be demonstrated easily. For a stream to behave in the manner described above, that is progressively widening and deepening holes, rather than filling them up with sediment, would be quite exceptional. It is not at all characteristic of present day streams.

This can be verified even in the examination of potholes in the courses of streams today. Where a stream passes over a pothole, the hole usually goes much lower than the bed of the stream, but it is filled up with sand and stones. There is **no abrasion** occurring below the level of the stream where the pothole walls are protected by all the material contained in the potholes. Of course, some potholes happen to reach a depth equal to the present level of the stream, and it is these that seem to demonstrate the process of their erosion.

When potholes occur in areas where bedrock is flat, it is unlikely that there would be much of a current that could initiate the pothole boring process. An initial depression of a few inches in the bedrock hardly seems likely to set up eddies in the stream flowing over it that could wear the depression into a hole several feet deep. Where the bedrock is inclined, the problem of the means of initiation of a vertical pothole is compounded. Why would the current bore a hole *into* the rock, rather than just flow across it?

A famous example of a pothole in a steeply sloping schist with a striated surface has puzzled generations of students at Inwood Park, New York City.¹⁸ The difficulty is not only that the surface of the rock is slanting, but it is striated, and according to the glacial theorists, such marks have been caused by the movement of the ice of the glacial period over the surface of the rock.

The problem is, if the glacier was moving, how could it have been the cause of the pothole? The crevasse, or "moulin," a waterfall in the former ice cap, must have moved along too. The water could not have fallen down on the rock below at the site of the pothole long enough to have eroded it.

This paradox, and the fact that potholes contain horizontal flutings and ridges on the inside walls, have led to a considerable amount of skepticism about the glacial "moulin" concept of the formation of potholes. Higgins and Alexander have argued against the interpretation that waterfalls could have caused potholes in the glacial age. Alexander noted:

The main objection to the hypothesis lies in the difficulty of conceiving the moulin as existing long enough in the necessary definite form at the same spot, or as reforming in the same manner and at the same spot often enough to account for the work accomplished. Where the ice passed over knobs or ridges, crevasses may be supposed to have formed repeatedly, but to assume that in each succeeding crevasse the moulin formed over the same identical spot and in the same manner so as to continue the work of its predecessors rather strains the theory of

probability. There are no apparent reasons for its so forming.¹⁹

Higgins has written:

There is no *direct* evidence that moulin waterfalls form potholes. Neither is there, as noted above, any *indirect* evidence that they might have done so. Furthermore, there are grave mechanical difficulties in the moulin hypothesis.²⁰

Experiments on Pothole Dynamics

Mechanical difficulties involved in accounting for the formation of potholes by a vertical flow of water in a waterfall or "moulin" led Alexander and Higgins to abandon completely the possibility of a moulin origin for potholes. They found the mechanical difficulties insurmountable.

Alexander actually conducted experiments with a specially designed apparatus to determine the effects of introducing jets of water into a container, shaped like a pothole, from different directions. The flow produced when the jet was vertical was radial rather than rotary, and he concluded that that type of current would tend to produce a shallow, flaring plunge-pool depression.

He found that a rotary motion in the water within a pothole would be produced only when the water jet entered the pothole obliquely at a low angle, and the current flowed in a spiral motion down the walls, rotating at the bottom, and flowing up again in the center. Alexander found that *only very fine* particles were lifted by this upward current. He reported:

In the 8-inch glass cylinder used for the observations of these currents, with a vortex velocity as high as 80-100 revolutions per minute, very fine sand was lifted only a few inches from the bottom. It would thus seem that in eddy holes, after depth exceeds diameter to any extent, only matter of exceeding fineness would be removed.²¹

The full extent of the difficulty this observation makes for the idea of pothole formation by erosion does not seem to have been appreciated by Alexander. He was, in fact, proving its impossibility by his experiments. In the long time that potholes are supposed to have been eroded, swift streams would no doubt carry a considerable amount of sediment. Much of this would find its way into potholes. Any large particles that fell into them would remain, settling down, and protecting the surfaces from any further abrasion by currents. Only the very finest material could escape, as he noted, in an upward current in the center of a spiralling, downwards swirling current.

A major difficulty with the assumption that running water could have carved the potholes lies in the characteristic forms of the potholes. Often they are surprisingly deep and narrow. Many of them widen with increasing depth.

Alexander²² described one at Taylor's Falls, called the "hourglass," that contracts from three feet in diameter at the top to about 18 inches, and then expands again to three feet below the narrow section. The 60 foot hole is 12 feet in diameter at the top, 15 feet in diameter at a depth of 40 feet, and three feet at the bottom.

It is difficult to see how a current or eddy in a

river flowing above such holes could have increased in power with increasing depth. Alexander found, in his experiments, that the power of a jet at the surface decreased with increasing depth.²³

Problem of Ridges, Flutings

A significant proof that the potholes are not in the process of formation at the present time, and that they are not worn by the abrasion of streams, is due to the presence on the walls of typical examples of little ridges, or flutings. These are often inclined at an angle to the horizontal.

Where potholes are being washed by streams today, these flutings can often be seen above the level of the water, but in the vicinity of the water they are *gradually being worn away*. They are **not** formed by the action of the water, or by pebbles and sand abrading the walls of the hole. Actually such flutings are destroyed by these agents.

When one uncovers potholes below stream beds, which penetrate deep below the water level, and are filled up with sand and stones, one finds that their surfaces down under the stream contain these tiny ridges and flutings, while the walls being abraded by the water do not. The water action tends to make the walls of the potholes smooth, not abrade them in such a way that flutings are produced.

Since the water does not form ridges and flutings on the walls of potholes today, neither could it have done so in the past. These flutings therefore could not have originated by an abrasion process.

Potholes sometimes occur in a series, forming a canyon, with a stream flowing along the bottom. In the uniformitarian interpretation, the stream that flows along such a canyon was supposedly the agent that eroded the potholes. In such a canyon, the potholes would either have formed one at a time, consecutively, or concurrently, all at the same time. In either case, the difficulties with erosion as the causal agent seem to be substantial. A description of the process, as it has been explained as due to erosion, has been given by von Engeln.²⁴

Once begun, the pothole persists, as such, deep below the vertical penetration of the rock inequality by which it was initiated. Meanwhile the grooving scour of the stream lowers the general level of the bed. Upstream or downstream, another pothole site is brought into the zone of the stream action, and another pothole is initiated. In time the whole stream bed may become a succession of potholes. Most of these will have been descended or inherited from rock conditions that are no longer in evidence. By lateral enlargement adjoining potholes intersect at the bottom from time to time. The miniature natural bridge that then separates the upper portions is broken down at the next period of flood flow. Shortly the complete length of a gorge-cutting stream becomes a succession of independent and intersecting potholes. The whole current of the stream must, in consequence, move in a series of gyratory swirls passing from one pothole to the next. The downcutting erosion of the gorge thus becomes chiefly a business of pothole grinding.

When the significance of the linked potholes so regularly observed on gorge floors is appreciated, it becomes clear how generally the pothole process of downcutting is operative and effective.²⁴

In pothole canyons such as that of Watkins Glen, New York, there are many examples of potholes intersecting. Many others are evident in Mohawk River Gorge at Little Falls, New York. Along the walls of this canyon, the sides of a whole series of intersecting holes can be seen. But an explanation is not quite as simple as the foregoing quotation might indicate. Consider a hypothetical example of the formation of just two potholes, formed in the manner outlined, that intersect for part of their length:

Hypothetical Example of Pothole Formation

As a hypothetical example, let us call the one pothole "A" and the other "B"; and let us suppose that "A" began to erode first, a little downstream from "B", but close to it. After "A" has got a good start, let us say eddies in the stream cause pebbles and sand to begin wearing the depression where "B" is eventually supposed to form.

By then "A" would be down a few feet in the rock. All goes fine until one day "B" begins to enlarge in diameter, near the bottom. Actually there is a hole worn in the side. Presumably the two potholes have begun to join. What happens?

Since the walls of "B" are not completely round where the two potholes intersect, the currents in "B" would not circulate. They would have no boundary on one side. So the process of boring in "B" would cease. And in "A", likewise, a hole would have appeared in the wall, and the swirling around of currents would cease below the hole, because the energy imparted to the water by the current entering at the mouth of the hole would be lost into "B" at the point of contact.

There would be no further swirling action of the current below the hole. There is no possible erosion of the two holes past the point of intersection, since each hole has a portion of wall missing. Currents do not keep following a curve unless bounded completely by something solid. The water would no longer "swirl" where there was an intersection of two holes.

So based on this hypothetical example, one would expect that whenever two holes intersect, they would not be eroded any deeper, since the current flow that supposedly caused their abrasion inside would no longer exist. Is this what is actually found?

Wherever canyons have been formed by intersecting potholes, the intersection extends for a considerable vertical distance. There is no evidence that development has been limited below the point of intersection of two or more holes. In the walls of such canyons, arcing grooves are evident that represent parts of the walls of former potholes, intersecting with a whole series of other potholes.

According to the concept of pothole erosion by flowing water, the motion of water inside the potholes would have to be rotary. This would be possible only if all the walls of the potholes were intact.

A series of potholes in a canyon is made up of intersecting holes; and, if they were formed successively, each new hole that intersected a previous one would have to have been formed with one side missing. The water eroding it would have to rotate without any enclosing wall on one side of the pothole. Clearly this goes beyond the bounds of common sense.

In the case of a series of potholes that intersect being eroded simultaneously, at the same level, the difficulty with the assumption of carving by currents is that there would be no means for water to carve the walls into arcs, since the direction of flow of the currents, when not bounded by the walls of the pothole, would tend to be in a tangent rather than to continue in a curve. There would be no means for water to form rounded, symmetrical holes at all.

The shape of the walls of the canyon on one side could not control the shape of the walls of the other side. Also the pattern of turbulence of a river eroding its bed for successive ages, would not cause vertical, cylindrical holes to form. Could eddies form in the same part of the stream, year after year, age after age, and make the wall of a canyon arc in just the same way, down through time?

Conclusions

Potholes, properly considered, and without the prejudice of a uniformitarian axiom that they have been caused by the erosion of currents, do not prove a great age of the earth. It will be found that they penetrate far below their present depths. The stream was only an agent of exposing them.

Potholes occur wherever the bedrock is covered by a thin cover of gravel and sand, which when uncovered by natural or human agents exposes them. The difficulty of the interpretation of potholes does not lie in the phenomena, but in the assumptions of uniformitarian geologists: that they are caused by erosion over long ages of time.

When creationists propose a new framework, such as the Biblical flood, it is necessary to explain many familiar phenomena in a completely different way. Potholes are an example.

According to the principle of uniformity, geological processes as causes are limited to those processes that can be shown to be in operation at the present time. However, if there was a worldwide flood in the past, that covered all the continents of the earth, and even the mountains, conditions would have been completely different than they are today.

For instance, the effects of high pressure would have to be taken into consideration. Perhaps some effects of high pressure would not be easy to discern today, especially those that might have involved the effects of a release of pressure on rocks.

It is hoped in a later article, to investigate some possible effects of the hydraulic pressure to which rocks and sediments were undoubtedly subjected during the Biblical flood.

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SELECTION MEANS CHOICE

It seems certain that some kind of "natural selection" is needed for evolution to occur. For otherwise, even though there might be variations, the creatures concerned would soon revert to type, as can be observed actually. Yet what is meant by "natural selection" is rarely investigated. In fact, it is not "nature" which does the selecting, unless by a metaphor; it is the creatures concerned.

Remember, "selection" is the same as "choice." Consider Darwin's alleged (proto-) giraffes with necks a little longer than their fellows'. "Nature" did not choose that they eat from treetops, and thus survive hard times. The giraffes chose it presumably; they could have ignored the treetops, and starved. Or the alleged fish, on the way to becoming an amphibian, chose to go up onto the shore, and breathe a little air directly. "Nature" did not command the fish to do so. (These common allegations are used only for the sake of illustration.)

Now such a thing might work, with living things of some complexity if they were already established. But however useful this doctrine of "selection" might be in explaining the diversity of life, it is obviously useless in explaining origin of diversity of life.

So those who try to apply this to the origin of life, who talk of "natural selection at the molecular level" or something of the sort, are talking nonsense. Molecules do not choose to do this or to do that. Anybody would agree that, if a thing chooses, then it should be called alive. Thus "selection," i.e. choice, can never explain the origin of life, for it presupposes life.

Clearly, then, all attempts to reason that life arose "naturally" somehow are doomed as failures. So the only plausible conclusion is that life came by some intervention from "outside"; i.e., by the Creator.

As was remarked, it is perhaps somewhat easier to think of "selection" when considering living beings already established. But, in fact, there are grave difficulties there, as has often been noted in this and in other publications. Since it is necessary to admit creation to explain the origin of life, why not apply Ockham's razor and grant that creation is also the most satisfactory explanation of the diversity of life?

—Contributed by Harold Armstrong

THE THEOLOGICAL NECESSITY OF A YOUNG UNIVERSE

T. ROBERT INGRAM*

It is shown that sound Christian theology requires belief in a young universe. For, to suppose a Creation untold ages ago is really to dismiss the notion of Creation, as a serious matter; and to do that, in turn, is to play down, and eventually ignore or deny, the difference between the Creator and His Creation. Thus doctrines which, for euphemism, may be called progressive creation, for instance, but which, in everything which matters, are really a form of evolution, are almost certain to lead into some vague deism, and thence into either agnosticism or pantheism.

Introduction

What bearing does it have on theology that the universe is young?

There are many who would be quick to reply, none at all.

Such persons have found no difficulty in supposing that all the general speculation about gradual evolutionary progress and improvement is not contrary to acceptance of God as Creator of heaven and earth. That God was Creator of heaven and earth, and all that is therein, is the basic and controlling premise of all theology. Again, God is He who made everything that was made.

In other words, some people would say that the work of Creation might have been done, every bit as well, by an enormously long process of gradualism as by a sudden, instantaneous command.

Aside from the fact that such radically diverse ways of God's working must postulate radically different notions of the existence and attributes of God (for God is known by His works, and his ways were made known unto Moses), talk about gradualism merely deflects attention from the real matter. Any discussion of gradualism avoids the question of how, and more to the point here, when material existence came into being in the first place.

Theology, Young Universe, Special Creation

Traditionally attention is kept focused on the true meaning of Creation by insisting that it speaks of creation *ex nihilo*, out of nothing. The reshaping and rearranging of preexistent form and matter is plainly something else again from giving existence where there was none. When gradualism is presupposed, the question of creation *ex nihilo* is never faced.

Another point to make is that there can be such a thing as creation *ex nihilo* only once. Once there is something, there can never again be nothing. True, it has been allowed that God's power would enable Him to reduce back to nothing all that He had made; yet such an act would be contrary to Himself, it would be repugnant to the meaning of His work, and so is one of those things that God cannot do. Therefore it would seem necessary that the act of creating *ex nihilo* cannot have been anything other than instantaneous. There can have been no gradualism between nothing and something. All in a flash, there was the beginning.

I suppose one cannot dismiss out of hand the notion that God might from time to time call into

being that which was unseen, and so add to the stock of the universe continually. In fact the six days of God's creative work seem to involve, for some persons, something very like that in regard to that first glorious week. Yet this notion, beyond the first week, so flies in the face of universal human experience and reason, as well as of the plain statement in Genesis that God ceased from his work of creating after six days, as to be out of the question.

But, someone will object, what does gradualism have to do with the age of the universe?

Everything!

If the universe is less than 10,000 years old (or 50,000 years for that matter), things cannot have come to be what they are by gradual processes in time. There just isn't enough time for it all to have happened, and I think there is no opposition to this statement.

Theology, Young Universe, Time

To postulate a young universe, then, rules out both evolution and progressive creation as a possibility: neither could have occurred in the time allowed. Inversely this requires acceptance of the traditional doctrine that all things were made; and that, therefore, there is the Maker who is Himself unmade and eternal, and that all things were made by divine fiat to which response was instantaneous. This is the beginning of theology.

Next, both in reason and in importance, the fact of a young universe draws the distinction between time and eternity as cannot be done on the assumption of billions of years. Any concept of time implies limits, since time is forever coming and passing away. Augustine speaks directly to the point:

If the idea of so short a time upsets them, and the years since man's creation, as recorded in our authorities, seem so few, they should consider that nothing which has a limit is of enormous duration. (City of God, Bk XII, Chapter 13)

Contrariwise it may be said that all that is conceived of as having enormous duration (in terms of millions of years, to say nothing of billions) is really thought of as having no limit.

As important to theology as the identification of God as the Creator is the distinction between time and eternity: God, being uncreated being, and therefore without beginning or limit, is also of necessity unchanging; all else, having a beginning and therefore changing at least from nothing into something, is subject to time and change. The distinction is fundamental and has governed Christian thought always. Again to quote Augustine:

If we are right in finding the distinction be-

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tween eternity and time in the fact that without motion and change there is no time, while in eternity there is no change, who can fail to see that there would have been no time, if there had been no creation to bring in movement and change, and that time depends upon motion and change, and is measured by the longer or shorter intervals by which things that cannot happen simultaneously succeed one another?

God: NO Beginning, NO Change

It may be observed here that men grow in the knowledge of eternity by the process of coming to an understanding of time. It is axiomatic that most of what men can say about God (Theology) is in the negative—that is, it is to say what God is not. Finite and created minds are reduced to knowing about God by understanding wherein He is unlike what He has made. For example, I have said of God chiefly that He is NOT created, that He has NO beginning, that He does NOT change.

It is not beside the point here to emphasize that modern scholarship, of which Oscar Cullman may fairly be said to be one of the more capable representatives, having tacitly accepted evolutionary postulates about enormous stretches of time, and being concerned to develop a theology which is silent about special Creation, has also advocated the proposition that in Biblical thought there is no room for any idea of eternity, and that where the Bible seems to speak of eternity it means time without end.

Were this true, then the Biblical doctrine of God as Creator must dissolve. In Cullman's view, God must BE time, for there is no eternity outside time; therefore God himself is dissolved in the mist of endless stretches of that which by definition is always passing. God cannot be the sum of all time, for time without limit cannot be summed.

The modern total disregard for time as the ruling factor under God in what we call the natural order has brought us perilously near to intellectual bankruptcy.

"A second of time in the motion of the vault of heaven corresponds to a definite length on earth," is a truth, the realization of which has led to the astonishing and richly productive work of several modern scholars!

There is reason to believe that the path to the knowledge of God (Theology) is through a thorough understanding of time, the governor of things temporal.

"If I have told you earthly things, and ye believe not, how shall ye believe, if I tell you of heavenly things?" asked Jesus.

If we learn about God chiefly by understanding what He is not, then our learning must be guided by a precise knowledge of time and things temporal which embrace what God is not.

Suffice it to say that although time is measured by the movement of the heavens, that measurement must be made and recorded by human beings. That is, there is no record of time, no possible record of time, apart from a recorder and there is no recorder in time apart from mankind.

It is no mere happenstance that religious learning among all men in all ages is dominated and characterized by an obsession with precise measurements of time.¹ Christianity is no exception.

Theology, Young Universe, Evidence

This touches upon a third important connection between theology and a young universe, which is indirect but no less important. That is an understanding of the nature of evidence.

"At the mouth of two or three witnesses shall the matter be established," said Moses; and the rule applies to this day.

The much touted "scientific method" rests upon total dependence upon this principle—personal observation alone can furnish data.

This rule banishes "vain speculations" deplored in the New Testament, and anchors theology in history—in observed and recorded data.

God is notoriously known by His works; and His works are known to man only by the mouth of two or three witnesses, written for our learning. More and more scholarly disciplines are closing in on an outside limit for the possibility of human observation, especially any that has been recorded for our learning, and that limit is uniformly under 4,000 B.C. A most astonishing conclusion of the authors of *Hamlet's Mill* is that "time Zero" (whatever the full implications of that term) is precisely 4,000 B.C., remarkably close to Archbishop Ussher's much maligned scheme.²

At any rate, any talk about time before that date must be relegated to the realm of "vain speculations" and the only conclusion we may draw from *bona fide* evidence is that of a young universe, probably now 6,000 to 7,000 years old. Conversely the postulation of a young universe coincides very well with all acceptable evidence, and ratifies the rules of evidence by which God is known by man.

I conclude, then, that theology and a young universe go hand in hand in that (1) a young universe demands special creation by fiat; (2) a young universe accords reasonably with the nature of time as having limits and so gives the clue to the knowledge of earthly things necessary before the understanding of heavenly; and (3) a young universe accords with the rules of evidence which govern all disciplines including theology.

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A DECADE OF CREATIONIST RESEARCH

DUANE T. GISH*

The primary purpose of the Creation Research Society is to carry out, or to encourage, Creationist research in the natural sciences, and to publish the results of such research. By Creationist research is meant research which proceeds from a belief in, and attempts to correlate with, special Creation.

It is shown that, in about the last ten years, a significant amount of research has been accomplished. It has been done, moreover, at very little expense, and, as far as is known, with no expenditure whatever of public money.

While reference is made especially to the Creation Research Society, it is known that good work has been done outside the Society. No claim is made that this list of research is complete. It is probably impossible to list everything which has been done; and some work is not included mainly because it was difficult to fit it under any particular heading.

It is clear, from what is reported here, that Creationist research is a worthwhile activity. There is, of course, much more to be done; and it is hoped that many more people who are able to do research will come forward.

Introduction

Evolution is the dogma of the scientific and educational establishments. Many millions of dollars from government sources are spent each year on research that is oriented and correlated within the framework of evolution theory. On the other hand, as far as I know, not a single tax dollar has been available, or is available, for research by scientists who openly attempt to correlate their results within the concept of special creation. Perhaps this virtual "shut-out" is due in part to lack of ingenuity and aggressiveness on the part of creationists, but there is little doubt that the most ingenious and sustained action of creationists would do little to weaken the stranglehold evolutionists have on public funds.

In spite of this fact, a significant and growing research effort by creationists has been sustained during the past decade. Although a limited amount of research had been conducted prior to, and since its founding, independently of, the Creation Research Society, the establishment in 1963 of this creationist organization of Christian men and women of science, has provided the inspiration for, and, to a considerable degree, the funds necessary for this research.

This Society was established primarily for research in all fields of science designed to demonstrate that the scientific evidence related to origins can be correlated and explained much more satisfactorily by the concepts of special creation and a universal catastrophic flood than the concepts of evolution and uniformitarian geology. Beginning in the Fall of 1964, the results of this research have been published in the *Creation Research Society Quarterly*.¹ This paper is a review of the articles published in the *Quarterly* during the first decade of publication, which constitute the results of original research.

These papers can be arranged in approximately six scientific categories: geology, genetics, natural selection, taxonomy, general biology (genetics, natural selection and taxonomy are specializations within biology, of course), and thermodynamics.

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GEOLOGY

Geological papers constitute the largest category of papers published in the *Quarterly*. This is not surprising. The research needed to demonstrate the fact that evolution could not occur and, in fact, has not occurred, has already been performed. These research results provide strong support, on the other hand, for a special, supernatural, direct creation.

Yet, considerable research needs to be done to support the *specific Biblical creation model* and to re-establish Flood geology as an alternative to evolutionary geology. Thus, most of the research performed by creationist geologists has been directed at the goal of interpretation of geological data within the concept of catastrophism in contrast to the actualism of evolutionary geologists.

Overthrust. Evolutionary geologists assume that sedimentary strata have been laid down over vast stretches of time, and have arranged these strata in a supposed time-sequence, particularly the fossil-bearing strata, based on assumed evolutionary transformations. The strata are identified by fossils that are characteristic of each strata, usually marine invertebrates.

It is believed, for example, that the Cambrian strata, identified by the particular types of trilobites found within them, were laid down over a period of about 80 million years beginning approximately 600 million years ago. Evolutionary geologists thus believe that these sedimentary deposits were laid down during what is called the Cambrian Period.

In addition to trilobites, these rocks contain fossils of every one of the major invertebrate types, including jellyfish, sponges, brachiopods, worms, crustaceans, and corals (evolutionary ancestors for which have never been found, the so-called Precambrian rocks being devoid of multicellular fossils).

The Cambrian Period was supposedly followed by geological periods of successively younger age, such as the Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, etc. Fishes are not found in Cambrian rocks, but appear in the Ordovician. Amphibians are not found in Cambrian, Ordovician or Silurian rocks, but are found in Devonian and "younger" strata. Reptiles appear in yet "later" strata, then birds, mammals, etc.

The various strata have thus been arranged in an assumed time-sequence according to a supposed evo-

lutionary development of invertebrate to fish to amphibia to reptiles to mammals to primates to man. The arrangement of the various strata in this assumed time-sequence is known as the geological column.

If this assumed time-sequence is correct, and was actually created by the slow deposition of one set of strata on top of another through vast stretches of time, then "younger" strata should always rest on top of "older" strata. On the other hand, if, as Flood geologists maintain, most of these sedimentary deposits were laid down at the time of the Flood, and the particular sequence usually observed was determined by a combination of factors, including ecological zones, hydrodynamic sorting, attempts to reach safety at higher altitudes, etc., then breaks in the sequence and even occasional reversals of the usual sequence of fossils would be expected under the catastrophic conditions of the Flood.

Many inversions of the strata scattered throughout the world actually exist, "older" strata lying on top of "younger." In places this upside-down arrangement of the strata is hundreds and even thousands of square miles in extent. To explain the manner in which older strata became superimposed upon younger strata, evolutionary geologists are forced to postulate vast "thrust-faults."

Supposedly huge blocks of the crust were uplifted and then somehow thrust over the adjoining area. The upper layers of the "thrust block" were then eroded away, leaving the lower, or older, strata of the thrust block lying on the younger strata underneath. This sequence of events thus supposedly accounts for the many cases where the older fossils of more "primitive" creatures lie on top of younger fossils of more "advanced" evolutionary development.

Creationist geologists have attacked this postulate on the basis of both the physics involved and the lack of field evidence required to substantiate these supposed overthrusts. While pointing out that there is evidence of local folding and overthrusting on a small scale, creationists maintain that physical evidence along the contact line, such as brecciation, gouge, and slickensides, does not exist for the supposed large thrust-faults. A number of field expeditions have been undertaken to search for evidence, or lack of it, for overthrusting.

Harold Slusher, then assistant professor of physics at the University of Texas, El Paso, (now Research Associate at the Institute for Creation Research and Professor of Physics, Christian Heritage College, San Diego) examined a supposed overthrust in the Franklin Mountains near El Paso.² In that area a massive structure of Upper Ordovician limestone (supposedly about 450 million years old) lies on top of strata identified as Lower Cretaceous (supposedly about 130 million years old). Neither Professor Slusher nor the geologist accompanying him could find any physical evidence of overthrusting.

In 1956 and 1957, Walter Lammerts visited the site of the so-called Lewis "overthrust" in Glacier National Park. Dr. Lammerts' doctorate is in genetics, but he has had university courses in geology and has maintained a keen interest in this field. The Lewis "overthrust" extends laterally from 15-30 miles. It is postu-

lated that a huge block of Precambrian limestone, thousands of feet thick and almost 10,000 square miles in area, was thrust eastward over soft Cretaceous shale, resulting in a formation supposedly older than 600 million years resting on top of a formation about 100 million years old.

Dr. Lammerts studied the contact line exposed at Chief Mountain, one of the most imposing sights in the Park. He reported that all the evidence he could discover indicated that the contact was sedimentary rather than a thrust-fault.³

Clifford L. Burdick, a professional geologist, carried out an extensive survey of the contact line of the Lewis "overthrust" at several places in the U.S. and Canada. The report of this research⁴ includes an excellent review of the overthrust concept and of the standard interpretation of the so-called Lewis overthrust.

The contact line at Wynn Mountain, Chief Mountain, and Roes Creek in the U.S., and at Crowsnest Pass, and near Mt. Eisenhower in Canada was studied. Evidence for thrust-faulting along the contact line, Burdick reported, such as gouge (rock powder), mylonite (coarsely ground rock), tectonic breccia (conglomerate including rock fragments set in a matrix), and slickensides (striations on rock surfaces) was absent.

At Mt. Ishbel, near Mt. Eisenhower, Burdick reported that the strata were sharply upturned, and he found great piles of rock rubble along the pass between the two mountains. He concluded that if there had been local lateral pressure in the area, the rock was so incompetent it would have broken up rather than moving laterally, and that the upturned strata of Mt. Ishbel had been caused by a granitoid intrusion from underneath.

If, as Burdick and Lammerts have concluded, the Lewis contact line is sedimentary and not a thrust-fault contact line, then the entire concept of the geological column as an evolutionary succession of geological ages is highly questionable, to say the least.

Burdick and Slusher studied an alleged overthrust in the Empire Mountains in Pine County, Arizona.⁵ They first examined known thrust-faults in other areas to confirm the type of evidence to be found where actual thrust-faulting has occurred. In one case, for example, a block of limestone about one-half mile long had been thrust about one-half mile. A gouge layer about three feet thick composed of ground-up rock powder gave evidence that thrust-faulting had occurred. At another site of a small thrust-fault, a 15-20 foot thick layer of tectonic breccia (crushed and ground pieces of rock fragments) and slickensides gave evidence that overthrusting had occurred.

Examination of the alleged contact line of the Empire Mountain "overthrust" gave no such evidence. The overlying Permian rock (greater than 200 million years in age, allegedly) fit into deep grooves eroded in the underlying Cretaceous (about 100 million years old, supposedly) like a glove on a hand, or like material poured into a mold. If the Permian cap rock had been thrust over the Cretaceous (as evolutionary geologists contend), why, Burdick and Slusher ask, were not all of these sharp projections planed off? Why is there no evidence, such as brecciation, gouge,

and slickensides, for thrust-faulting? They concluded that the evidence indicates that the contact is depositional and not a thrust-fault contact.

Lammerts studied the classical Lochseite of the Glarus "overthrust" near Schwanden, Switzerland.⁶ Here a huge block of Jurassic limestone (about 180 million years) rests on top of a Eocene formation (about 60 million years). The overlying rock of over a mile in thickness supposedly was thrust almost 21 miles over the underlying Eocene. Lammerts' analysis of the evidence failed to support the latest evolutionary uniformitarian concepts on the Glarus overthrust (reviewed in his paper). Lammerts presented an alternative proposal, based on Flood geology, which explained how these deposits may have been laid down in the present order.

Fossil Anomalies. When fossils are found in strata which would be impossible according to standard evolutionary interpretations, these are labeled fossil anomalies. Usually such reports are ignored by evolutionary geologists, since they assume that an error has been made or an obvious explanation must exist. Several such fossil anomalies have been reported in the *CRS Quarterly*.

Professor Wilbert Rusch has studied the subject of fossil human footprints, personally examining some found in Kentucky.⁷ This study has become even more interesting in the light of the reported finds of human footprints along with dinosaur footprints in Cretaceous limestone of the Paluxy River area near Glen Rose, Texas. This latter report has been extensively documented by Stanley Taylor in the film, "Footprints in Stone."⁸ Rusch indicates that some of the footprints he researched (not in the Glen Rose area) were carvings, but others appeared to be genuine. He also recounted the report of an iron pot found in coal.

William Meister, while searching in the trilobite beds of Antelope Springs near Delta, Utah, split open a slab of rock to expose what appeared to be a human sandal print in which was imbedded three fossil trilobites.⁹ If true, this means that this footprint was made when trilobites were still in existence, but trilobites supposedly became extinct many scores of millions of years before man had evolved! Evolutionary paleontologists and anthropologists merely shrugged off this find as not genuine, but an anomaly due to some natural cause.

Clifford Burdick has reported on his investigation of the find of two modern human skeletons in the Dakota Formation of the Cretaceous (supposedly about 100 million years old) near Moab, Utah.¹⁰ During a mining operation for hydrothermally deposited copper, a hillside had been bulldozed away. The hill was composed of Dakota sandstone. On the floor of the excavated site, Lin Ottinger, a rockshop owner and guide of Moab, discovered two human skeletons. The blade of the bulldozer had sliced through the skeletons, leaving most of the remains exposed at the surface.

Burdick concluded that the bones were definitely in place, with no evidence that the surrounding rock had been disturbed. He believes that the location of the find deep within the hillside indicates that these

individuals were buried at the time the Dakota sandstone was deposited.

Prof. Wilbert Rusch and I carried out an investigation of this find shortly after Burdick's visit. We also visited the University of Utah to examine the bones, which were in custody of the Anthropology Department. There was no doubt that these skeletons were buried deep within the hillside, and as Burdick reported, there was no evidence the surrounding rock was disturbed.

We felt, however, that since all of the overlying material had been removed, the evidence required to positively eliminate the possibility that these individuals had reached the site via a fissure or cave was not available. Thus, while all the evidence that did exist indicated that these individuals were part of the original deposit, the possibility that they had entered the site at a later date could not be excluded with all certainty. Other reports of the finds of modern human remains in sediments supposedly many millions of years old have been summarized by Cousins.¹¹

Palynology. Palynology is the study of fossil pollen and spores. Burdick has reported on his palynological studies of formations in the Grand Canyon.^{12, 13} The striking fact about his results was the presence of fossil pollen grains of plants in sedimentary deposits that were allegedly laid down several hundred million years before the plants are believed to have evolved. He reported, for example, the discovery of fossil pollen of gymnosperms, many of them conifers (pine trees), and of angiosperms (flowering plants) in Cambrian and Precambrian formations.

The gymnosperms, or seed-bearing plants, supposedly did not evolve until long after the Cambrian rocks had been laid down, and the angiosperms are supposed to have evolved even later. The Cambrian Period is believed by evolutionists to be a time when no land plants or animals were in existence, in fact, a time when only marine and fresh water invertebrates existed.

A report by Rusch in the *Quarterly*¹⁴ related the fact that there have been numerous reports in recent years of the finds of fossil pollen of woody plants, including conifers, in Cambrian rocks by evolutionary geologists. Even fragments of woody plants have been found in Cambrian rocks.

These finds decisively contradict the supposed time and order of so-called plant evolution given in almost all books on geology, paleobotany, and evolution. These facts are not even known to the vast majority of geologists and biologists. For example, when I brought these facts to the attention of the audience during a debate with the world-famous botanist and evolutionist, Dr. G. Ledyard Stebbins, he was astounded, and demanded documentation. His astonishment was compounded when the documentation I readily provided included a report by one of his colleagues at the University of California at Davis and a close friend, geologist Dr. Daniel Axelrod!

GENERAL GEOLOGICAL REPORTS

Geology of Mount Ararat. Burdick has reported on the expedition that visited Mount Ararat in 1966. Mount Ararat lies in the northeast corner of Turkey

near the Russian and Iranian borders. It is believed to be the Biblical Ararat where the Ark came to rest. The expedition, one of several in recent years, including the 1972 Institute for Creation Research expedition led by John Morris, was undertaken primarily to search for the remains of the Ark. Numerous alleged sightings of the Ark have been reported in ancient times and in relatively recent times.

While in the Ararat area, Burdick undertook a study of the geology of this area.¹⁵ He postulated that the Paleozoic and Mesozoic limestone that covers eastern Turkey was laid down at the time of the Flood. During the Flood, Burdick reports, basaltic and andesitic lava burst up through the limestone beds to form a peak nearly 20,000 feet high. Much of the basalt and andesite composing upper Ararat is often found in rounded blocks called pillow lava, which is the hard, micro-crystalline form taken by lava when it is extruded under water. Erosion has reduced the mountain to its present 17,000-foot height.

Research on the Joggins Petrified Trees. Harold Coffin has re-investigated the Carboniferous section of Joggins, Nova Scotia¹⁶ (the Carboniferous includes the Mississippian and Pennsylvanian Periods, which are believed by evolutionists to have been laid down over a period of about 50 million years beginning about 300 million years ago). The prevailing idea of evolutionary geologists is that the petrified trees and numerous coal seams in the Joggins area are *in situ*, that is, in their original position of growth. It is postulated that there were numerous long periods of growth of bogs which slowly formed coal at lower depths. Repeated transgressions of the sea, it is believed, buried these coal seams and engulfed the trees.

Dr. Coffin's study did not support this concept. His research, on the other hand, produced numerous lines of evidence that the trees, along with masses of plant material, had been transported by water to the site where they are now found, and were then buried under conditions of rapid sedimentation. Petrification and carbonization followed. The evidence for this hypothesis included absence of soil zones, unusual plant fossils within hollow stumps, remarkable preservation of delicate fossils, diagonal trees, abundant presence of the marine tubeworm *Spirobia* (the attachment of this marine, or salt water, organism, to vegetal matter in the coal contradicts the bog environment hypothesis), and polystrate trees (trees extending through two or more strata, each of which, according to evolutionary interpretations, was deposited slowly over a long period of time).

The evidence developed by Coffin supports the hypothesis that the coal was formed by the tremendous quantities of trees and vegetal matter that was uprooted, transported and buried by alternating tidal waves and other catastrophic effects of the Flood. I have briefly reviewed laboratory experiments that produced petroleum in 20 minutes and coal in a few hours from cellulosic material (garbage and manure, for example, demonstrating that the formation of coal and oil would not require vast stretches of time).¹⁷

Coffin has recently given an excellent report of his studies of the petrified forests in the Yellowstone Park area.¹⁸ These studies have led him to believe that

these trees also had been transported and buried at their present site by water action.

The Sisquoc Diatomite Fossil Beds. Bernard Northrop researched the diatomaceous earth beds near Lompoc in Santa Barbara County, California.¹⁹ Evolutionary geologists have maintained that these beds formed gradually over vast periods of time, but Northrop's studies provided striking evidence of the rapid and catastrophic deposition of these beds.

In the Sisquoc area, countless billions of the delicately sculptured siliceous cell walls of diatoms (microscopic organisms) have been deposited in such a way that fish were entombed with bones and even body organs intact. Some fossil fish were trapped so that they lie parallel to the bedding plane of the diatom matrix, but many other fish fossils extend across the bedding plane. The latter fossils (standing partly on end) must have been buried quickly, or else the part not buried at first would have been devoured by scavengers, or would have decayed long before it could have been buried by a diatom "rain." Fossils of various fish, sea birds, and whales also indicate that the diatom material was deposited rapidly and catastrophically rather than by gradual and uniform activity.

Northrop postulated that the original diatom supply was first formed in cool waters after the Flood and was redeposited at the Lompoc site during a post-Flood catastrophe.

Cyclical Black Shales of West Central Illinois. Walter Peters has applied photomicrographic techniques to the study of black shales of the Pennsylvania system of west central Illinois.²⁰ The evolutionary uniformitarian interpretation of a slow, undisturbed sedimentation and mineralization of these shales over vast periods of time could not be true, according to Peters.

Study methods included gross and macrophotography, microscopic examination of thin shale chips, and photomicrographic inspection of X-rays of shale samples. Cyclical deposition was indicated by the structural details of the shale as well as by the virtually mutually exclusive occurrence of foraminifera and conodonts in successively alternating bedding planes and black shale matrix. Rapid transport and burial was implied from several observations including *Orbiculoidea* shells packed into lenses up to one inch thick; microlaminations apparently interrupted by small coal balls; and the distorted bedding, both at the bottom and the top of the shale member.

Peters concluded that all of his observations can be used to support strongly the Biblical tidal interpretation of fossil deposition and burial.

The Capitan Fossil "Reef." The occurrence of alleged fossil "reefs" in various portions of the geologic column has been recognized by many observers to be a very difficult problem to reconcile with Biblical chronology. If accumulated at approximately the same rate as modern reefs allegedly form, a single fossil "reef" would take many thousands of years to form, and therefore would jeopardize the implication from Genesis of a young earth and would also question the role of the Flood in earth history.

The famous Capitan Limestone in the Guadalupe Mountains of southeastern New Mexico and western Texas is alleged by many geologists to be a classic example of a fossilized "barrier reef." Stuart Nevins conducted a study of this alleged fossil reef to see if the actual field evidence supports this concept.²¹

Nevins reported that his study cast doubt on the various depositional and ecologic environments alleged to be associated with the "Capitan Reef." The so-called "backreef lagoon" and "forereef talus" deposits were not contemporaneous with "reef" accumulation. In addition, the Capitan lacks large, *in situ*, organically-bound frameworks and deposits of broken debris which can be shown to be derived from an organic framework.

Nevin's research indicated that the Capitan is composed primarily of broken fossil fragments in a fine-grained matrix of lime, silt, and sand which were not wave-resistant when deposited. The fossil flora and fauna of "Capitan Reef," he reported, represent a shallow water assemblage which was not especially adapted to a wave or strong current environment. Reef-forming organisms which could bind sediments and build frameworks are either altogether absent or largely inconspicuous.

Nevins concluded that the available data certainly do not require many thousands of years for the Capitan to have accumulated, and therefore seem to present no problem for Biblical chronology. Instead, the lack of large organically-bound structures, which would have required thousands of years for growth, suggests that deposition was very rapid. Nevins proposed that the Capitan Limestone accumulated rapidly either during the last stages of the Flood or shortly thereafter.

Geologic Study of the John Day Country. Recently Nevins reported on his study of the strata of the John Day Country in the Blue Mountain region of north-eastern Oregon, which reveals abundant testimony of volcanic catastrophism.²² The strata, which show a cumulative thickness of over 7,000 feet, consist primarily of numerous terrestrial lava flows, gigantic ash-flow tuff beds (each extruded in a single explosive event as a huge cloud of incandescent ash), boulder breccia layers (presumably deposited from enormous mud flows), tuff-breccia beds (representing very explosive stages in volcanism), and volcanic siltstone and sandstone (deposited as each explosive episode subsided). The area covers about 5,000 square miles and lies southwest of the Columbia Plateau, which consists of a basaltic lava flow covering 100,000 square miles and as much as a mile in thickness.

Nevins pointed out that fossils of large mammals and tropical and subtropical plants occur in particular horizons, which suggests that only on rare occasions of quiescence between volcanic eruptions was life re-established in this region. Nevins maintained that the supposed evolutionary fossil series leading to the modern horse is artificial and thus false. Further, he maintained that there is little evidence suggesting 60 million years of history for this area as assumed by evolutionary geologists.

Nevins suggested that since good evidences of the Flood are not found in the John Day Country strata

he studied, the Flood must have preceded the formation of these strata. He thus concluded that an interval of many hundreds of years intervened between the close of the Flood and initiation of the recent glacial period. The vast volcanism of the John Day Country and the glacial ice sheet which covered the northern areas of North America and Europe are thus attributed to catastrophic events which occurred during the period of readjustment following the stupendous catastrophism of the Flood.

The Magnetic Moment and Age of the Earth. Thomas Barnes has carried out a fascinating study of the decay of the earth's magnetic moment and the implication this has regarding the age of the earth. His results are contained in an article in this issue and in a series of papers in the *CRS Quarterly*,²³⁻²⁵ and in a monograph published by the Institute for Creation Research.²⁶

The earth's main magnetic field has been shown to be due to a magnetic dipole, the strength of which is called its magnetic moment. The magnetic field is due to circulating electric currents. These currents probably reside in the core of the earth. The core is believed to consist of hot liquid metal, composed mainly of iron. There is no mechanism to sustain these currents, so these currents and the resultant magnetic field are decreasing in strength, that is, decaying. These currents and the accompanying magnetic field thus have every appearance of having been "wound-up" at some time in the past, with uninterrupted decay to the present.

Measurements of the earth's magnetic moment have been made since 1835. Using these measurements, Dr. Barnes has calculated that the earth's magnetic moment is decaying exponentially with a half-life of 1400 years. The magnetic moment is decreasing because the circulating electric currents which generate the earth's main magnetic field are decreasing in strength. Part of the energy of these currents is continually being lost as heat energy, with resultant decrease in the strength of the currents and the magnetic field they generate.

Extrapolating the strength of the earth's magnetic moment back into the past, based on the exponential decay curve, the value of the magnetic moment at any time in the past can be calculated (the magnetic moment would double for every 1400 years). The heat that would be generated by the current necessary for such a magnetic moment can also be calculated. Beyond about 10,000 years, the magnetic moment would exceed a reasonable estimate for any planet the nature of the earth, and by one million years the current required to generate the magnetic moment predicted on the basis of the decay curve would liberate enough heat to vaporize the earth. Barnes thus maintained that these data, which are especially reliable because they are based on measurements over 130 years, indicate that the earth cannot be much older than 10,000 years.

In an attempt to get around this barrier to a long age for the earth, evolutionists must postulate that some sort of a self-generating dynamo causes the liquid in the core to circulate, generating the magnetic field, rather than an electrical current circulating in a quiet

liquid core as postulated by Barnes. Barnes pointed out that there is no physical evidence for motion within the core, and, in addition, a self-generating dynamo within the core would require motions of an extremely complex and unreasonable nature. He concluded that no acceptable dynamo theory to sustain or oscillate the earth's magnetic field has ever been conceived nor is one very likely. Dr. Barnes strongly affirms that the data on the earth's magnetic field demand a young age for the earth, an age that probably could not have much exceeded 10,000 years.²⁶

GENETICS

Mutations and Evolution. In a series of papers in the *Quarterly*,²⁷⁻²⁹ Walter Lammerts presented data which are very damaging to the idea that mutations could have supplied the means of change that would have allowed evolution to occur.

Genes are the units of heredity which when replicated by an organism and passed on to offspring during reproduction cause the characteristic traits of a species of organisms to be reproduced. These genes are composed of a type of chemical structure called deoxyribonucleic acid (DNA). Each gene, or DNA unit, is made up of hundreds or thousands of sub-units arranged in sequence in a long chain. The genetic message encoded in each gene is determined by the specific sequence or arrangement of the sub-units in the DNA chain, analogous to the way the message in this sentence was composed by arranging the letters of the alphabet in a unique sequence.

Mutations are random changes in the chemical structure of DNA. That is, mutations cause one sub-unit to be randomly exchanged for another, or sub-units may be randomly excised or inserted. Analogously, letters in this sentence might be blindly removed and replaced with others. Blindly or randomly exchanging letters in the sentences on this page would rapidly generate spelling errors and, very shortly, complete nonsense. Similarly, the effect of mutations in living organisms is harmful and often lethal.

While evolutionists readily admit that the vast majority of mutations are harmful, they are forced to postulate that a small percentage, perhaps one in ten thousand, must be beneficial. In the final analysis, the only source of variability required for evolution must come from mutations of one kind or another, and beneficial changes must occur if evolution theory is true. Thus, evolutionists insist that beneficial mutations do occur.

Creationists maintain that it is extremely doubtful if a truly beneficial mutation ever occurs. A random change in a highly complex and intricately coordinated machine could produce only disorder and loss of function. Even if a beneficial mutation could occur, a mutation could only bring about a change in an existing characteristic and thus could not create any new trait or generate increasing complexity.

Dr. Lammerts studied the effect of neutron radiation of Queen Elizabeth rose buds in producing mutant varieties.²⁷ He found that such radiation was successful in inducing a wide range of variations in rose plants grown from such buds. His results showed that biologically, all of the mutations were defective varia-

tions from the pattern of development characteristic of the variety radiated.

His studies further indicated that mutations can only alter various phases of the basic varietal pattern expression, but the basic pattern itself remains unchanged. He concluded that truly unique and outstanding varieties of roses such as Peace, Charlotte Armstrong or Queen Elizabeth would never result from the accumulation of mutations.

In two excellent articles,^{28,29} Lammerts has reviewed the effects of mutations and other chromosomal changes on various organisms, both plants and animals. This review of the data indicates that neither mutations nor chromosomal changes, such as translocations, inversions and polyploidy, provide a mechanism for bringing about the changes demanded by evolution theory. Lammerts concluded that the incredibly complex and amazingly integrated genetic system could only be the product of a remarkably intelligent Creator.

Effect of Genetic Aberration in a Tomato Plant. William Tinkle studied the characteristics of a tomato plant which had three cotyledons instead of the normal two.³⁰ The first lateral structures formed on a seedling plant differ from true leaves and are called cotyledons. Some plants are monocotyledenous while others are dicotyledenous. Occasionally a genetic aberration of some sort will cause a plant to have one or two extra cotyledons. Thus, plants that ordinarily have two cotyledons may produce, on rare occasions, varieties with three or even four cotyledons.

Dr. Tinkle found a tomato plant that had three cotyledons instead of the two that is normal for this plant. He collected seeds from this plant and studied the progeny produced from these seeds. From 100 seeds that he planted, 69 plants developed. Three of the plants had three cotyledons and 66 had normal two cotyledons. Planting seeds from the three tricotyledenous mutants produced seven plants with three cotyledons and 30 with two cotyledons.

Dr. Tinkle studied the normal and mutant varieties with respect to fertility, vigor and resistance to frost. Although one might expect that a plant with an extra cotyledon, because of the extra surface exposed to light, might have an advantage, the plants with the extra cotyledon were found to be inferior to the normal plant in germination, rate of growth, and resistance to frost.

Even some of the plants produced from the seeds of the mutant tricotyledon plant which bore the normal number of cotyledons (two) showed growth abnormalities. The mutant gene for the tricotyledenous condition is apparently recessive. That is, its effect is more weakly expressed than the normal gene for two cotyledons, which is dominant. Though the plants just mentioned were heterozygous, bearing the dominant normal gene as well as the recessive mutant gene and thus having two cotyledons, even the presence of the mutant gene in the heterozygous state weakened the plant.

This example of a mutation which causes the abnormal presence of three cotyledons in a seedling tomato plant rather than the normal two and which results in the production of an inferior plant is addi-

tional evidence that mutations, being random changes in an incredibly complex and intricately coordinated genetic system, are inevitably harmful.

New Guinea Communities and the Migration-Dispersion Model. The origin of the peoples of New Guinea is a subject of dispute among anthropologists. Regardless of their origin, New Guineans in the past have tended to isolate themselves in small groups which have become diversified both linguistically and genetically. R. Daniel Shaw compiled data on the ABO, MNS and Rh blood groups for natives of New Guinea in 37 areas spread over the entire island in an attempt to discover any relationships that might aid in correlating these genetic data,³¹ and which might provide some basis for postulating how these diverse groups arose.

Although the data are insufficient to validate any theory, Shaw maintained that his data supported a Migration-Dispersion model for the origin of these New Guinea population groups. According to this model, as individuals migrate in small numbers from a common gene pool, the new group becomes more distinct than the source group. This is so because new generations come from only a limited gene pool and are isolated from the normalizing effect of interbreeding within a large gene pool where all genetic factors are available. Genetic traits peculiar to the group are thus rapidly and strongly expressed because of a high degree of inbreeding.

It is postulated that "Papua-Melanesians" migrated to New Guinea in relatively large numbers. After settling on the coasts of what was probably an uninhabited island, population growth forced these people to migrate up river valleys and into the highlands. These groups became reproductively isolated from one another due to geographic, linguistic and cultural barriers. This gave rise to populations that were genetically diverse from one another, since each migratory group had carried with it only a fraction of the total gene pool.

While evolutionists generally propose that the origin of races required gradual processes over a vast length of time, creationists postulate that a process similar to the one above could have caused the origin of races in a short period of time. The rapid dispersion that took place following the confusion of tongues at Babel³² would have resulted in the isolation of relatively small groups. Furthermore, the manner in which God bestowed various languages among this previously monolingual human population may have been so directed as to isolate genetically similar individuals in the same language group.

Thus, those individuals having a higher proportion of genes for Negroid features, or for Caucasian features, etc., may have been given a common language. Once the race itself was established through isolation and inbreeding, further migrations and other isolating mechanisms, such as those described above, could account for the diversity within each major racial group.

Pine Cone Spirals and the Fibonacci Series. A curious, but seldom observed, pattern runs through much of nature.^{33, 34} The reproduction of male bees, the

number of spiral floret formations visible in many sunflowers, spiraled scales on pine cones and pine-apples, the arrangement of leaves on twigs, and many other structures fit the Fibonacci series. This series, developed by the Italian mathematician Leonardo of Pisa, also known as Fibonacci (1170-1230), is 0, 1, 1, 2, 3, 5, 8, 13, 21, . . . , with each number the sum of the two previous numbers. Harry Wiant's study of the cones of the major southern pines confirmed that, almost without fail, the number of spirals around the cones at a selected point, to the right and left, were adjacent numbers in the Fibonacci series.³⁴

Some exhibited counts of 5 and 8, others of 3 and 5. Preliminary studies indicated that approximately 50% of the cones give the maximum count to the right and 50% show the maximum to the left. Wiant suggested that these patterns in nature, in both the plant and animal world, rather than reflecting a random evolutionary process, are indicative of the design of a Creator-God.

Stability of Bacterial Populations. Basic to the orthodox evolutionary model is the belief that the population of an organism is constantly undergoing change due to mutations and pressures brought on by changes in the environment. Jerry Moore studied a pure culture of *Proteus mirabilis*, a bacterial species belonging to the Enterobacteriaceae family of the Eubacteriales order, which he had isolated from a clinical source, in order to determine its stability or variability over a period of time under markedly different conditions.³⁵

The organism was serially transferred onto 10 randomly-selected laboratory media and the cultures were held at temperatures ranging from 20-37° C. for a period of three months. The conditions of culture and incubation were thus quite varied, yet remaining favorable enough at times for hundreds of bacterial generations to occur. After 62 serial transfers, 30 biochemical and anti-biotic sensitivity characteristics had not changed from those initially observed, except for a minimal and variable response to Penicillin G. The variable response to the latter may have been due to cell wall damage from exposure of the bacteria to noxious components in the culture media rather than to exposure to Penicillin G.

Moore's experiment, although admittedly limited in scope and duration, does support a natural biologic stability. In his paper, Moore reviewed some examples in the scientific literature of tremendous biologic stability, including a study which indicated that a bacterium had retained its rigid biological characterization during the 150 years it has been subject to investigation.

NATURAL SELECTION

As mentioned earlier in this article, fundamental to evolutionary thinking is the concept that new varieties within each species are constantly arising via mutations or other genetic variations. The genetic variants that arise by these processes, due to differences in viability, fertility, etc., contribute, via reproduction, differentially to the gene pool of subsequent generations, some leaving more offspring than others.

Those that reproduce a larger proportion of offspring which, in turn live to reproduce in larger numbers, are said to be the most fit. They are said to have been selected by nature, and the evolutionary process is thus a process of mutation with natural selection.

Another concept that is fundamental to evolutionists is the belief that these minor changes, or micromutations, accumulate in such a way that one basic kind of an organism can change into a basically different kind of an organism, and simple organisms will change or evolve into more complex organisms.

Creationists recognize that all organisms have an ability to vary, but they insist that all empirical evidence indicates that this ability is restricted within relatively narrow limits, and that there is no evidence that one kind of an organism has ever arisen from a basically different kind of an organism. They further believe that this ability to produce normal variants (distinguished from pathological variants) was built into each kind by the Creator to enable each kind to survive under a great variety of conditions, and thus to be perpetuated even though conditions may change. Creationists are interpreting biological data according to this concept rather than within evolutionary concepts.

Galapagos Island Finches. Darwin and other evolutionists have supposed that the varieties of finches now living in the Galapagos Islands, a group of islands lying 600 miles and more west of South America, have arisen from migrants from South America. The original migrants, it is believed, were more or less uniform, but mutation with natural selection has given rise over a long period of time to finches that now inhabit the various islands and which possess differences (mainly in size and shape of the bill) in response to variations in the type of food supply found on the several islands.

Creationists interpret these data in much the same way, with some important exceptions. They point out, first of all, that the variation that has apparently occurred among these finches is very limited, for these finches are not only still birds, but they are still finches. Neither the molecule-to-man idea of evolution, nor the idea that basically different kinds of birds, such as ducks, humming birds, and vultures, have arisen from a common ancestor is supported by such evidence.

Secondly, creationists believe that the genetic potential, or gene pool, carried to the Galapagos Islands by the migrant finches from South America was sufficient to permit the variation that has occurred. This variability did not arise via mutations, but the potential was already present in the original migrants, which diverged into various forms as a result of the chance arrangement of their original variability potential (the fact that this variability potential existed was not by chance!).

Finally, as the study of these finches by Walter Lammerts³⁶ showed, the actual divergence that has occurred among these finches is considerably more limited than represented in much of evolutionary literature. Dr. Lammerts studied the large collection of Galapagos Island finches (sometimes called "Darwin's finches") at the California Academy of Science. He particularly noted: 1) the length of each bird

from tip of bill to end of tail, 2) the height from belly to top of back, 3) total length of bill, and 4) width of the ventral side of the lower mandible of the bill.

These finches have been classified into four genera, *Geospiza*, *Camarhynchus*, *Cactospiza*, and *Certhidea*. Those studied by Lammerts bore 17 different species labels. While Lammerts held that the *Certhidea*, or Warbler finches, are distinctive from the other genera, he stated that the four species within this genera are hardly more than color variations, and should be placed in a single group with species rank rather than genus rank. Lammerts further observed that if all the species labels were removed from the remainder of the Galapagos Island finches and they were arranged according to body and bill size, complete integration would be found. The same is true of bill length and width and plumage coloration.

Lammerts noted that the range in variation among these finches, although they are classified into several genera and many species, is exactly comparable to the variation found within a single species of song sparrow, *Melospiza melodia*. He further pointed out that these finch "genera" are in no way comparable in distinction to the genera *Rosa* (roses), *Frageria* (strawberries), and *Pyrus* (pears), members of the family Rosaceae.

Lammerts considered that it would be much more realistic to classify these finches into a single species. He also emphatically rejected the idea that the variations in size of bill are "adaptive divergences" resulting from natural selection. Present feeding habits, Lammerts emphasized, are the *result* of the particular types of bills which happened to occur among these birds, rather than the bills developing slowly as an adaptation to differences in the types of food available.

Crowding and Reproductive Rates in Planaria. E. N. Smith has reported on his study of the effect of crowding on asexual reproduction of the planaria *Dugesia dorotocephala*.³⁷

As Smith pointed out, there are two possible mechanisms for regulating population densities. Individuals within a population might reproduce maximally near their physiological limit, with the population density being regulated by negative outside forces (predation, disease, starvation, etc.). Those individuals which are better able to compete against these outside forces and reproduce more offspring are said to be more fit and thus to be selected. Alternately, the individuals within a population might possess some internal regulating force which in some way regulates population density and maintains a form of density homeostasis.

Evolutionists generally prefer the former view. Natural selection is said to favor the individuals that can leave the most reproducing offspring. On the other hand, if the alternate view is correct, there would be no real competition between populations and no selection. The postulated cause of the evolutionary process would fail.

The freshwater planaria, *Dugesia dorotocephala*, reproduce asexually by fissioning. Smith maintained the planaria in identical containers, and conditions in each experiment were the same in each container, except the population density was maintained at

different levels. Smith found that crowding clearly reduced the fissioning rate of the planaria. This reduction did not appear to be due to slime, oxygen depletion or carbon dioxide build-up, but appeared to be due to some water-soluble inhibitor produced by the planaria.

The planaria thus appeared to have a built-in density-dependent reproduction regulatory mechanism. Smith postulated that these creatures (and other animals) regulate their own numbers without the necessity of outside forces such as predation, starvation, and disease. He pointed out that built-in density dependent reproduction rates were mandatory after creation and before the fall, and that it is quite conceivable that living organisms had a mechanism for regulating their numbers without intervention of external conditions such as predation, starvation and disease.

Plant Succession Studies. Walter Lammerts and George Howe used plant succession studies to observe the effect of natural selection under widely divergent conditions.³⁸ Repeated field analyses were made of variation in five plant species populations including the California poppy, lupine, thistle sage, owl's clover, and a yellow pansy, representing five different plant families. Observations were made over a period of five growing seasons at staked localities in the vicinities of Newhall and Corralitos, California.

Despite great variation in annual precipitation during the study, no gradual shifts or evolutionary trends were evident. The natural selection observed actually restricted the amount of variation, bringing populations back to a typical or normal form during years of moisture stress. Lammerts and Howe concluded that these studies indicated no evidence for natural selection of the type required by evolution theory.

Origin of the great range in variation found in many species of plants were discussed. It was the conclusion of one of the authors, namely Dr. Lammerts, that plant variations were supernaturally derived from the originally small populations of plants of the various kinds which survived the Flood. The alternative possibility exists, however, that a sufficiently diverse gene pool within each plant family survived the Flood to give rise to the many plant varieties existing today. The experiments by Howe discussed in the next article have shed some light on this question.

GENERAL BIOLOGY

Seed Germination and Plant Survival Following Submersion in Salt and Fresh Water. George Howe undertook a study of the effect of prolonged submersion of seeds of flowering plants in sea and fresh water as an aid in understanding how plants were able to survive the Flood.³⁹ Seeds from the fruits of five different species and families of flowering plants were tested for germination after soaking in sea water, fresh tap water, and an equal mixture of sea and tap water.

Soaking was continued for a maximum of 140 days, which corresponds roughly to the 150 days during which water prevailed upon the earth during the Flood. At intervals of 4, 8, 12, 16, and 20 weeks after initiation of soaking, seeds of each plant species were

removed from the various treatments and placed under favorable germination conditions.

Ability to survive the soaking varied among the plant species tested, but even after a soaking period of 140 days in each of the solutions mentioned above, seeds from three out of the five species tested germinated and grew.

The first suggestion that Howe made in answer to the question of plant survival during the Flood was that many plants did not survive! He pointed out that much destruction of plant life would be expected during a prolonged global flood and that extinction of many species would thus be a predictive consequence of such a flood. Paleobotanical studies have revealed that numerous kinds of plants are found as fossils but which are not found living today.

Howe reviewed several other mechanisms for plant survival during the Flood in addition to resistance to soaking by seeds. Vegetation, including trees, have been known to have been torn away by storms and carried out to sea still embedded in soil masses. Survival during prolonged periods of such a process would be possible.

Plant material has been known to have been transported while embedded in icebergs. Seeds that were contained in the carcasses of dead birds floating in sea water have been known to germinate and grow. No doubt many seeds would have been carried on the ark, as well.

From his data and that of others, Howe concluded that a variety of mechanisms were available to account for the survival of plants during the Flood.

Flora and Fauna of the Galapagos Islands. John Klotz visited the Galapagos Islands, made famous by Darwin, and has published an extremely interesting review of the plants and animals which now inhabit these islands, particular attention being given to finches, tortoises, cacti, and iguanas.⁴⁰

About a half dozen of these islands measure 10 to 20 miles across, and one, Albemarle, is 80 miles along. Mountains on these islands rise 2,000 to 3,000 feet above sea level, the highest point being 4,000 feet on Albemarle. Generally the islands are arid and the landscape harsh. Inland and at higher altitudes, there is humid forest with rich black soil and tall trees covered with ferns, orchids, lichens, and mosses. In the very highest areas there is open country with grass, ferns, mosses, and occasional thickets.

Floral and faunal types are relatively few in number. The fauna include only six passerine forms of birds and one species of cuckoo; two types of land mammals (a bat and a rat); and five types of land reptiles, which include a giant tortoise, a lizard, a gecko, a snake, a land iguana, and a marine iguana. There are no amphibians. Domesticated animals have been introduced by settlers.

Klotz devoted a large section of his paper to the finches. He stated that there seems to be no reason to question their origin from a common ancestor. As Klotz noted, evolutionists have generally assumed the origin of all the finch species from a single gravid female, a single pair, or at most a very small number reaching the islands together. Klotz discussed the suggestion of Lammerts (1966), mentioned earlier in this

paper, that migration of finches to the Galapagos Islands might have included many pairs, although he did not seem to favor that view.

Klotz, in contrast to Lammerts, maintained that most of the Galapagos Island finch species are actual species rather than mere varieties. There seems to be good evidence on each side, although Lammerts presented some especially convincing evidence. Klotz believes there is no reason to doubt that new species arise or that new species of finches actually did arise on the Galapagos Islands.

Klotz emphasized that origin of species is comparatively only a minor problem for evolutionists. Finches are still finches and there is no evidence of the changes in magnitude required for macroevolution, that is, increase in complexity with origin of one basic kind from another. He thus asserted that the evidence presented by the fauna and flora of the Galapagos Islands did not constitute any real support for amoeba-to-man evolution.

TAXONOMY

Molecular Approaches to Taxonomy. Taxonomy is the science of classification of plants and animals. It is obvious that there are recognizable groups of organisms in the present world which have many similar characteristics. Such groups have always existed as evidenced both by the fossil record and the Genesis reference to "kinds." The father of taxonomy, Carolus Linnaeus, was a strong believer in creation, and believed, as do modern creationists, that similarities among organisms exist not because of their origin from a common ancestor but because God based His creation on a complex of plans with an underlying thread of unity.

Wayne Frair's approach to taxonomic studies avoids evolutionary presuppositions, his assumption being that the world of life is to be viewed as having risen from certain stem organisms which constitute the original "kinds" mentioned in Genesis. He views the problem of grouping organisms within the kinds and of establishing relationships among the kinds to be the proper function of taxonomists.

Frair's interests as a biologist have included serology and herpetology. He combined elements of both in his taxonomic studies, utilizing antibodies to the serum of turtles as an aid in establishing the taxonomic relationship of these turtles.⁴¹ He injected the blood sera of the turtles into rabbits or chickens in order to establish antibodies to the serum proteins. The antibody-containing serum, or antiserum, was obtained from the rabbits or chickens and mixed with serial dilutions of the serum from the various turtles. The sera from closely related turtles would be expected to give a strong cross-reaction, while sera from distantly related turtles would cross-react weakly or not at all (a cross-reaction is said to be obtained if antiserum generated by injection of serum of species A also reacts, or gives a precipitate, with serum from species B).

Frair's studies did not support the widely held view that snapping turtles belong to a separate family related to the Kinosternidae, but rather should be placed within the Emydid family group. Such a switch is probably minor enough to pose no problem for the

evolutionary biologists. Creationists maintain, of course, that taxonomic classification should be established without reference to a supposed evolutionary origin or phylogeny, but should be based strictly on degree of similarity.

THERMODYNAMICS

Many papers have been published in the *CRS Quarterly* which were concerned with the relationship of the laws of thermodynamics to the creation-evolution problem. Emmett Williams, in his most recent paper on this subject, presented an excellent review of the papers on this subject.⁴² To review these papers here, or even to review in detail Dr. Williams' outstanding series of papers on this subject⁴³⁻⁴⁶ would exceed the scope of this paper. To omit any mention of this work from the present paper, however, even though such work did not involve collection of any new and original data as such, would be a serious omission. I will, therefore, briefly review Williams' series of papers.

Those who hold to the general evolution model postulate that the present universe and all that it contains began in some primordial disordered state. Evolutionary forces have been at work throughout the billions of years since that state existed, it is believed, and have acted in such a way that the highly structured universe and a vast array of incredibly complex organisms have arisen here on the earth. Thus, there has occurred, according to this thinking, at least in the observable part of our universe and particularly on the earth, an immense increase in order and complexity. This supposedly has taken place solely according to mechanistic, naturalistic processes which can be attributed to properties inherent in matter.

If the above were true, then matter obviously must have possessed an inherent ability for organization into higher and higher levels of order and complexity. Scientists should have been able to recognize this universal inherent property of matter and to construct natural laws which describe it. As a matter of fact, scientists have **not** been able to recognize any such property of matter.

However, scientists have recognized just the opposite tendency in matter. The more probable state of matter is always the more random state. Every change in nature that takes place *spontaneously* always results in a *loss* of order. Natural processes always occur in such a way that the complex tend to become less complex, ordered states tend to become disordered. Therefore, this universe is constantly becoming more disordered.

This tendency is so universal and so unfailing it can be expressed as a law—the Second Law of Thermodynamics. The operation of the natural forces which has resulted in man's description of these forces in the form of the Second Law of Thermodynamics has a number of consequences, and thus the Second Law may be defined in several ways. These consequences include the loss of usable energy, the loss of order, and the loss of information. The Second Law may thus be defined in several ways so as to emphasize these several consequences. In discussions of this Law and its relationship to the creation-evolution problem, the

loss of order and information consequences are usually emphasized.

In Williams' first paper on this subject,⁴³ he discussed the operation of the Second Law from the viewpoint of classical thermodynamics (loss of usable energy) and the viewpoint of statistical mechanics (loss of order). Entropy is a thermodynamic quantity which can be defined, in a non-technical sense, as a measure of the randomness of a system—the greater the randomness or disorder within a system the greater the entropy.

An increase in order requires a decrease in entropy, while the reverse is true. The Second Law of Thermodynamics is thus sometimes referred to as the law of increasing entropy. In his first paper, which was the more technical of the series, Williams discussed entropy and the solid state.

Following an excellent introduction, including a thorough definition of terms and of the Second Law in thermodynamic and statistical terms, Williams discussed the effect of entropy on the solid state. Contrary to what is commonly believed, crystalline solids are not structurally ordered. There are many imperfections in the lattice structures of such solids, and these imperfections are thermodynamically stable because the entropy of the solid is increased by their presence. Williams emphasized that the principle of increasing entropy is opposed to evolution and to certain aspects of ruin-reconstruction interpretations of Genesis 1.

A simplified explanation of the First and Second Laws of Thermodynamics was given in non-mathematical language in Williams' second paper.⁴⁴ That the total amount of energy in the universe is a constant is expressed in the First Law. Since matter and energy are interchangeable, and therefore equivalent, everything in the physical universe is a form of energy and neither increases nor decreases, in perfect agreement with the Biblical pronouncement of a finished creation. Williams explained that evolution could not have occurred unless both the First and Second Laws of Thermodynamics were violated many times. He shows that the three arguments which are usually offered by evolutionists to circumvent the laws of thermodynamics are invalidated by the evidence.

In his third paper⁴⁵ Williams asked the question, "Is the universe a thermodynamic system?" One would have to know the answer to that question before one could assert with authority that the laws of thermodynamics apply to the entire universe in addition to our readily observable portion of the universe, where these laws have been tested. Williams asserted that there is no way scientifically to determine the extent of the universe or its thermodynamic character at the present time.

He pointed out, however, that statements in Scripture support the fact that the laws of thermodynamics do apply to the entire universe. The applicability of the First Law is asserted in Genesis 2:1-3 and in II Peter 3:7, and the applicability of the Second Law is made plain in Psalms 102:25, 26, and Romans 8:20-22. Since the universe is subject to these laws of thermodynamics, and no matter or energy exchange

can be observed, it is *assumed* that the universe is an isolated thermodynamic system.

But whether the universe is open, closed or isolated, it is definitely degenerating. No matter what type of a thermodynamic system is chosen, the entropy of the system always increases with the occurrence of an irreversible process. Williams therefore asserted that evolutionists, who demand a decrease in entropy, are in an indefensible position in the face of the Second Law of Thermodynamics.

In his fourth paper,⁴⁶ Dr. Williams offered an extremely interesting and thorough consideration of the applicability of the laws of thermodynamics to living systems. There is a rather general impression, often stated by evolutionists, that living systems somehow circumvent the Second Law, since the development of a seed or fertilized egg into the adult organism seems to result in an increase in complexity.

As Williams pointed out, this increase in complexity is only apparent and not real. The fertilized egg is as complex, or more so, than any cell in the growing or adult organism. All of the information needed for the production of the adult is present in the egg. No new information is needed or added. As a matter of fact, almost from the moment of conception, loss of information and order via mutations, injuries, and disease begins. This loss of order, or the rate of increase in entropy, slows during development, but never ceases.

The rate of entropy increase accelerates during the aging process and finally results in death, whereupon the organism reaches its maximum entropy state—a pile of dust. If living things circumvented the Second Law of Thermodynamics, they would live forever.

As indicated early in this section, Williams' most recent paper (1973) on thermodynamics in the *CRS Quarterly* was a review of creationist literature on the relationship of the laws of thermodynamics to the subject of creation and evolution. Publications by Henry M. Morris, R. E. D. Clark, D. Penny, T. G. Barnes, George Mulfinger, Walter Lammerts, I. McDowell, Bolton Davidheiser, G. C. Lockwood, and A. E. Wilder-Smith were cited in this respect. Dr. Williams concluded his 1973 paper with a discussion of evolution in the light of probability considerations, showing that evolution, on the basis of these probability considerations alone, can be shown to be impossible.

A RESEARCH CHALLENGE

In 1970, Larry Butler, then Chairman of the Research Committee of the Creation Research Society, issued a research challenge to creationists in the form of a list of proposed research projects.⁴⁷ These included:

(a) experimental demonstration that coal can be formed rapidly under catastrophic conditions (This has actually been demonstrated since then by a University of Utah scientist—see reference 17.);

(b) experimental formation of fossils under a variety of conditions in order to demonstrate that fossilization can take place relatively rapidly;

(c) experimental determination of optimum conditions for rapid growth of coral reefs; investigation of caves, mine shafts, and tunnels of recent origin (100-

200 years) to determine growth rates of stalactites and stalagmites;

(d) anthropological measurements of variations in thickness, shape, etc., of contemporary human skulls.

Other suggested research included:

(a) consideration of the thermodynamic effects of the Flood;

(b) surveys of geological formations from high altitude (40,000 feet) and interpretations of the broad features revealed within the context of Flood geology;

(c) continuation of Howe's investigation of the effect of soaking in sea water on the viability of seeds;

(d) a reinvestigation of alleged examples of species formation;

(e) further research to verify the claim that radioactive decay of uranium and thorium has actually produced only a minute fraction of the helium that should have been produced in 4.5 billion years.

Further projects listed were:

(a) research to determine the true origin of cultivated plants;

(b) carbon dating of samples of organic material that is supposed to be millions of years old and which should thus be devoid of radiocarbon (C-14);

(c) taxonomic studies in an attempt to determine the limits of the "kinds" described in Genesis;

(d) a formulation of a list of "living fossils," that is, a list of plants and animals once believed to have been extinct for millions of years but now known to be living;

(e) finally an investigation of settling rates to see if differential settling by water action, as proposed by Whitcomb and Morris,⁴⁸ can account for the way fossils are distributed in the geological formations.

The list of proposals by Dr. Butler is certainly not exhaustive, of course. For instance, there is the need for: (a) Dr. Barnes to continue his fascinating study of the magnetic field of the earth, (b) a continued need for the search for remains of the ark on Mount Ararat, (c) further investigations of alleged overthrusts, (d) research into the processes and procedures used in radiometric dating, etc.

Butler nevertheless posed a real challenge to creation scientists; and he gave some idea of the important need for creationist research and the possible direction of such research. As is evident from this review, creationists have not been idle during the past decade, and readers can expect that creation scientists will have gained significant insight into many of the problems posed by Dr. Butler before the end of the present decade.

References

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CREATIONISM, SCIENCE, CORRUPTION

A vision which the prophet Amos saw may have meaning for creationists. He reported: "I saw the Lord standing upon the altar, and He said, 'Smite the lintel of the door . . .'"¹ The meaning, it appears, is that there may come a time when religion will be so corrupt that God will tear it down and start over. Of course, such a thing happened once to more than just religion; it happened to the whole world at the time of the Flood.

Moreover, God might see fit to deal thus with any human activity or institution, as well as with religion. For: "... judgement must begin at the house of God: and if it first begin at us, what shall the end be of them that obey not the gospel of God?"²

That science is a human activity or institution, everyone would agree. That there are signs of corruption in it here and there, few would be able to deny. The faults mostly go back to that pride—what the Greeks called "hubris"—which hates to be subject to God. Evolutionary theorists, who try to avoid the need of a Creator, are obvious examples of this fault. (There are others; there are, for instance, certain developments which can hardly be called anything other than corruptions of medicine.)

Those, then, who are concerned for the future of science should be glad for the creationist movement. For spokesmen aim, in the last analysis, to prevent or remove some of this corruption. Just as Christianity

is to be the salt of the earth³—and one job of salt is to prevent corruption—so creationism could be the "salt" of science.

All this, of course, will mean nothing to those who do not believe the Gospel at all. But there are many who consider themselves to be Christians (and in this I do not argue with them; it is not for me to judge someone else as servant⁴), and who are interested in science, but who seem to have little use for creationism.

Such people, especially, might do well to consider the points which have just been made. There may be some things which they do not like about the way in which creation is sometimes presented. Just so, there were those who objected, about 200 years ago, to the way in which the Wesleys and their associates presented their message. Yet many believe that it was the Wesleys' work, more than any other human action, which saved England from disaster at that time.

Let it be considered, then, whether creationism may be what is needed to save science from disaster.

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—Contributed by Harold Armstrong

LEAFLET ON PILTDOWN MAN HOAX

It is reported, in *Nature*, Volume 247 (5437):130, that the British Museum, London, England, has published a leaflet, "The Piltdown Man Hoax." This is Palaeontology Leaflet 1, No. 2, has six pages, and costs seven pence, about seventeen cents.

CONDUCTING VESSELS IN PLANTS: PROBLEMS FOR EVOLUTIONISTS AND CREATIONISTS

GEORGE F. HOWE*

Most land plants have, as one complex feature among others, a conducting system. It would be inappropriate to call such a system a circulatory system, in analogy to that of many animals; for one reason, plants do not have circulation, but transportation one way. The conducting system in plants consists of tubes in the xylem and phloem which are formed during growth by special development of certain cells. All attempts to explain how such features could have "evolved" have been unsuccessful; it is much more reasonable to believe that the various kinds of plants were created as functioning entities, with many special features.

Introduction

Most land plants have conducting systems and by this trait differ substantially from the algae. Food molecules move through a complex land plant tissue known as phloem, whereas water conduction occurs largely in the xylem. Plants with phloem and xylem are called "vascular plants."

The conducting portions of xylem and phloem develop through definite patterns of cell differentiation. Immature phloem cells stacked one above another at first resemble other cells in the young plant quite closely; but, as phloem cells mature, they undergo elongation, formation of holes in the end walls, and loss of cell nuclei; so that, when mature, a phloem "sieve tube" is formed. A sieve tube is thus composed of several cells called sieve tube elements, one atop another, that form a cytoplasmic channel allowing conduction of materials such as sucrose and amino acids from one cell to the next. Likewise xylem cells undergo various patterns of differentiation which transform them into conducting tubes.

Rhynia—A Phloem Link?

Rhynia, an extinct fossil vascular plant from the Devonian chert beds of Scotland, had no leaves but possessed systems of upright, dichotomously forked, branches sometimes called "telomes" which arose from an underground stem in a manner not unlike the relationship between underground and aboveground stems in the horsetail plant (*Equisetum* sp.) of today. Because of small size, dichotomous branch pattern, leafless condition, and apparent lack of phloem, *Rhynia* was suggested as a prototype for the "evolutionary" origin of other land vascular plants.

Evolutionists have proposed a scheme in which the forked branches of *Rhynia*, or some such ancestral plant type, are supposed to have undergone fusion and modification to yield leaves and other plant organs through "evolution." However, as pointed out several years ago in this *Quarterly*,¹ the telome scheme is of little help in explaining the origin of vascular plants because:

1. *Rhynia* was a complex vascular plant, having guard cells, terrestrial spores, and xylem conducting structures easily visible under the microscope.

2. Leaves were already present in the fossil data as deep (Devonian), or even deeper than the *Rhynia*, which is supposed to be ancestral to leaf development.

But still evolutionists have argued that *Rhynia* was "ancestral," or at least "primitive," because phloem tissue was not found in the fossils. In 1971, however, Donna Satterthwait and J. W. Schopf published a study of *Rhynia* fossils under the revealing title, "Structurally preserved phloem in plant axes of Rhynie chert."²

Satterthwait and Schopf found, in well-preserved condition, the perforated walls of what they believed to be phloem sieve tube elements. "Their occurrence seems to indicate that Rhynie axes contained true phloem, functionally and anatomically similar to that of modern plants."³ Thus another blow was struck at the idea that *Rhynia*, or something like it, served as ancestor to the vascular plants. Since 1971 it has been recognized that *Rhynia* had typical phloem tissues and was by no means a "link" between plants with phloem and those without.

Vessel Origin Unclear

Xylem conducting elements include both the "tracheids" and the "xylem vessels." During differentiation certain cells in the xylem area form pores through the side walls and end walls, lose protoplasm, and become spindle shaped units known as tracheids through which water may move. In some plants, other xylem cells stacked on top of each other elongate, also lose protoplasm and end walls.

In this manner a tube or xylem vessel forms much as a series of stacked oil barrels would yield an upright oil pipe, if some one knocked out the end walls separating the barrels. During such differentiation of vessels and tracheids, the cell walls thicken in one of several characteristic patterns: scalariform, pitted, spiral, ring, etc. The finished tracheid is a long, single-celled conducting channel, while the xylem vessel is a multicellular tube through which water or solutions may move.

Certain evolutionists have maintained that vessels evolved from tracheids because most of the gymnosperms (plants which bear seeds nakedly, usually in some type of cone) have only tracheids and no vessels in their xylem. Therefore the most "primitive" vessels are thought to be those in which the individual vessel elements are long and thin like tracheids.

For this reason, members of the Ranales (buttercup order of flowering plants) have been designated as "primitive." However, Eames and MacDaniels in their text on plant anatomy have pointed out that vessels "... are present in some species of *Selaginella*; among the ferns, in two species of *Pteridium*; among the gymnosperms, in the Gnetales."⁴

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Selaginella (moss fern plant) is a very simple, non-seed bearing type which differs at many points from the true ferns and the gymnosperms. Thus it is clear that vessels are widely distributed in many very diverse types of terrestrial plants and there is not even a hint of an "ancestral tree" that might be devised. Eames and MacDaniels concluded, "In each of these groups the vessel has clearly arisen independently, in the angiosperms probably more than once."⁵

Two other plant anatomists, A. S. Foster and E. M. Gifford, confirm the facts of Eames and MacDaniels as they discussed the anatomy of *Selaginella*:

Several years ago (Duerden, 1934) certain species were shown to possess vessels, a feature considered formerly to be one of the distinctive characteristics of angiosperms. Not only do certain species of *Selaginella* have vessels, but this type of tracheary structure is found at least in one genus of the ferns and in certain gymnospermous genera (for example, *Ephedra*, *Gnetum*).⁶

Eames and MacDaniels concluded that vessel "evolution" must have taken place independently in several widely distinct lines—most fern versus flowering plant, for example. But Armen Takhtajan, who is also a non-creationist and Chief of the Department of Higher Plants, Komarov Botanical Institute of the Academy of Sciences, U. S. S. R., concluded that although various forms of angiosperms may differ considerably from one type to another, they must all be considered as branches of one family tree.

This is because the odds are very much against two or more lines of evolutionary descent independently producing plants with several characteristics in common, such as stigmas in the female flowers, double fertilization in the embryo sac, endosperm formation, and sieve tubes in the phloem of angiosperms. For this parallelism to occur in several otherwise independent lines, Takhtajan concluded, would be:

... comparable to the so-called "dactylographic miracle" whereby given enough time, a work of literature, such as a Shakespearean sonnet, would be produced by chance alone.⁷

And with this same argument in mind, it is surprising that Eames and MacDaniels would grant polyphylogeny of vessels in many separate groups—even several separate times among the angiosperms. It would seem unlikely enough to ask that vessels arise only once by chance through "evolution," but to require that this happened independently by chance in several separate lines simply compounds the improbabilities involved.

Since creationists assert that God gave the various plant forms parallel systems for physiological, ecological, or other functional purposes, it would be commendable to devise experiments to test such proposals. For example, one might search for a reasonable or possible purpose for the fact that gymnosperms (e.g., pine or hemlock) have stems that are devoid of xylem vessels, but possess tracheids only. For what physiological reasons might elms, maples, and oaks (angiosperms) have such vessels as well as tracheids in their xylem? Are there functional relationships behind the fact that the lowly *Selaginella* plant has vessels as well

as tracheids? Answers to questions like these would not only supply support for creationistic scientific theories, but might also further man's comprehension of plant physiology beyond its present status.

Monophylogeny, Polyphylogeny, or Kind Creationism?

Takhtajan proposed a monophylogenetic scheme because of the significant similarities between diverse life forms. Yet Eames and MacDaniels were led with equal vigor to a polyphylogeny because of the numerous differences which the same assorted groups manifest. In the creationist view such unnecessary monophylogenies and dubious polyphylogenies disappear because each plant kind is seen as a unique genotype, created separately, with genetic structure and ecologic niche adaptations intact from the time of its formation with a minor, but significant variability potential incorporated at the time of creation.

Criteria for recognizing the boundaries or limits of these created kinds or "baramin," as they have been called by Dr. Frank L. Marsh, have been proposed,⁸ but very little research has been directed toward applying such criteria to the various types of living and fossil creatures. It is simplistic to assume that boundaries of the baramin will lie consistently at the species level, because "splitting" has been altogether too common among taxonomists. Criteria for erecting species groups have varied widely between individual specialists and also between workers in various branches of biology—botany versus zoology or microbiology.

The actual work of revising taxa along creationistic lines, to the best of my knowledge, has not been done for any single group, although steps in that direction were taken among animal taxa by Arthur Jones⁹ and the late J. J. D. De Wit.¹⁰ Until cytogenetic and taxonomic analyses are undertaken along creationist lines, the baramin concept will remain somewhat vacuous as regards all creatures except man.

Problem of Angiosperm Evolution

Although a devout evolutionist, Takhtajan made several very frank admissions of weaknesses in his scheme:

The origin and dispersal of the flowering plants is one of the most troublesome and complex questions of biological history, touching as it does upon many of the general problems of organic evolution. Much is uncertain and much is in dispute. There are so many different hypotheses of the origin of flowering plants, and so many different attempts at morphological interpretation of the flower, that even a brief resume of them, let alone a critical review, would require a whole volume.¹¹

Angiosperms are supposed to have evolved from the gymnosperms because only a few gymnosperms have vessels, while most angiosperms do. However, Takhtajan pointed out that the vessels of the primitive angiosperms are more primitive than those vessels found in certain gymnosperms because they have a type of wall thickening (scalariform pattern), which was considered most primitive by Dr. Bailey.¹²

At the beginning of his third chapter entitled, "Ancestors Unknown," Takhtajan included these uncertain remarks:

The identity of the ancestors of the flowering plants is a most difficult problem which is as yet far from being solved. It would be hard to find a group of plants that has not at some time been postulated as ancestral to the flowering plants; not only the various gymnosperm groups, such as the pteridosperms (including the Caytoniales), cycads, Bennettitales, Cordiales, conifers, *Gnetum*, and *Ephedra*, but even ferns, equisetophytes, lycopodiophytes, rhyniophytes ("psilophytes") and algae have been considered as possible precursors (see Tikhomiriv, 1965). Yet these very diverse hypotheses have on the whole been given little justification by their authors; indeed, some have not even bothered to accord their views any factual basis whatsoever. Most have not withstood the test of time and have been discarded, but some do continue to command support. Can we find which in fact comes closest to the truth?¹³

Monocot and Dicot Dilemmas

This basic problem concerning angiosperm origins is made more vexing by virtue of the fact that two very different groups of flower-bearing plants exist—monocots and dicots. The monocots have flower parts in sets of three or multiples thereof, veins parallel to the main leaf vein, and stem vascular bundles in a scattered pattern (see Figure 1). The dicot flowering plants have flower parts in fours, fives, or multiples of these numbers, veins of the leaf not parallel but branched in a network, and the stem vascular bundles arranged in a neat peripheral ring (see Figure 2).

Many evolutionists have attempted to explain the origin and integration of monocots and dicots via some "evolution" scheme; and, recently, a significant review paper was produced by Hatsume Kosakai, M. F. Moseley, Jr., and Vernon I. Cheadle of the University of California at Santa Barbara. Many evolutionary botanists have held that woody dicots, (such as *Magnolia*) were the ancestors of the dicot herbs such as buttercup. Furthermore, evolutionists have conjectured that somehow the dicot herbs then produced the monocot herbs and in their 1970 paper, Kosakai *et al.* have summarized the evidence and have attempted to correct inherent misunderstandings.

According to these workers, certain early evolutionists suggested that monocots came from herb members of the dicot Ranales order—buttercup, for example. Yet, they have noted, it is unlikely that monocot herbs arose from dicot herbs, because certain monocots have "less advanced" xylem elements than their supposed ancestors—the dicot herbs. To sidestep this issue, some botanists have proposed water lotus (*Nelumbo lutea*, shown in Figure 3), a dicot herb of the Nymphaeaceae family as probable ancestor for the monocots, because they thought *Nelumbo* had no xylem vessels at all:

Takhtajan (1954) considered that the Nymphaeaceae were originally vesselless. He felt that, since many other aquatics possess vessels in

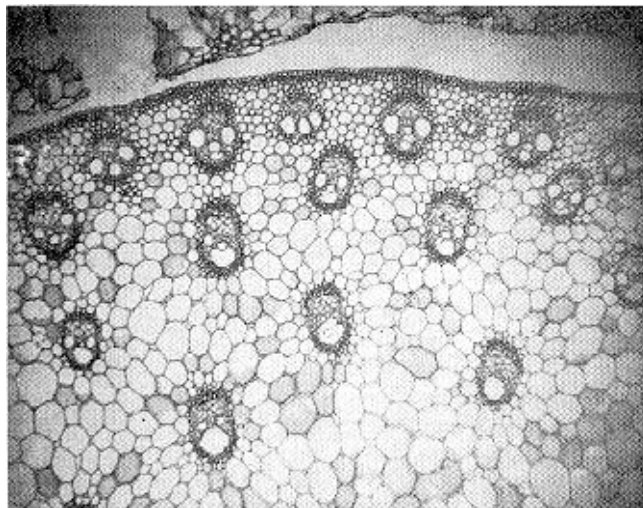


Figure 1. Photomicrograph of corn (monocot) stem cross section. Note that vascular bundles are not present in one peripheral ring, but are scattered throughout the stem cross section. While some evolutionists have held that monocots "evolved" from dicots, no evidence exists to support such an idea. Magnification is approximately 40X. (Photo by George Howe.)

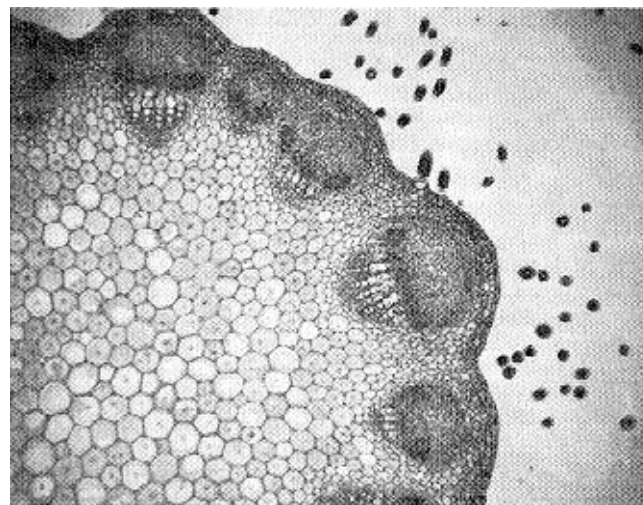


Figure 2. Photomicrograph of clover (dicot) stem cross section. Note that vascular bundles of this typical herbaceous dicot are arranged in a peripheral ring. Although dicots are supposed to be the ancestors of the monocots in "evolutionary history," dicots have separate specializations and appear to be composed of many separate kinds created as distinct entities. (Photo by George Howe.)

their roots, Nymphaeaceae would probably have them now if they had had them previously. Later, Takhtajan (1959) stated that it was more likely that the Nymphaeaceae were primitively vesselless because they still have only long, scalariform tracheids, a primitive character.¹⁴

But in the Kosakai paper, the authors demonstrated that *Nelumbo* has xylem vessels, and is not a likely ancestor for the monocots. According to Takhtajan's scheme of monocot "evolution," aquatic families of the monocots "evolved" from a *Nelumbo* prototype of dicots and, subsequently, these aquatic monocot fami-

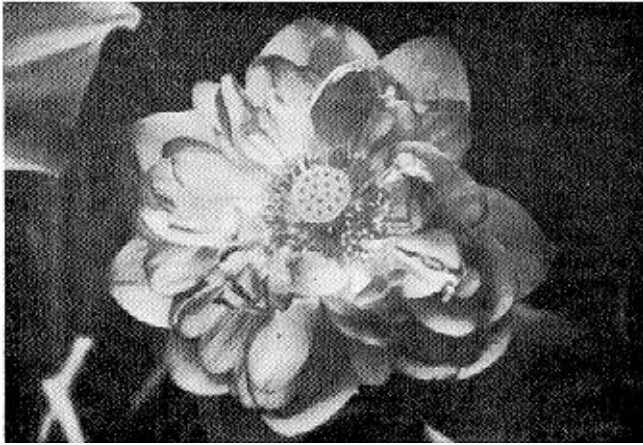


Figure 3. Flower and portion of leaf of *Nelumbo lutea*, the water lotus. Evolutionists once believed that this beautiful aquatic dicot angiosperm was the link between dicots and monocots because they believed that *Nelumbo* had no xylem vessels. According to recent findings by a University of California (Santa Barbara) research team, however, *Nelumbo* does have xylem vessels and is by no means a valid evolutionary link. *Nelumbo* is also important as a plant involved in certain aquatic ecological successions evident in the midwestern United States and elsewhere. (Photo by George Howe.)

lies then yielded all other monocots through “evolution.” But Kosakai *et al.* have shown that although the aquatic monocot families do show striking flower similarities to aquatic dicot herbs, the aquatic monocots could hardly have produced the terrestrial monocots.

This is because the supposed aquatic monocot “ancestors” have more highly “advanced” or “specialized” xylem than their terrestrial monocot descendants, which have only very “primitive” vessels in the xylem of their roots. Likewise, they maintained that the *Nelumbo* group of dicots is an unlikely ancestral type for monocots, because the *Nelumbo* plants already have “specialized features,” such as elongated scalariform pits in the vessel walls (see their Figures 3 and 16).

Kosakai *et al.* then discussed possible trends of evolution within the monocot group. Some of the monocot families are herbs, as in the case of the grass family; and some are predominantly arborescent, like palms. Certain evolutionists hold that monocot herbs were the ancestors of the tree families, while other evolutionists assert with equal vigor that the arborescent forms produced the herbs.

It is clear, from the authors’ detailed treatment, that any or all of these “evolutionary” ideas could be defended (or rejected?) on the basis of existing fossil evidence, since the “earliest” layer that contains monocots has both the woody and herbaceous members present—e.g. palms and lilies. Because of this fact, Kosakai *et al.* stated:

We agree, consequently, with Delevoryas (1968) and Emberger (1968) in concluding that the fossil record has not yielded significant evidence concerning the origin of monocots.¹⁵

Takhtajan likewise mentioned the amazing explosion of angiosperm life that appears in the Cretaceous strata:

At the close of the Albanian, i.e. towards the middle of the Cretaceous period, one of the most sudden and fundamental transformations of terrestrial plant life occurred, and in the course of a few million years—a very short interval of geological time—the angiosperms came to be widely distributed throughout the world, quickly reaching the Arctic and Antarctic regions. They appear in great diversity of form and quickly become dominant. Most of these Cretaceous angiosperms belong to extant genera, and there are representatives both of more or less primitive forms (Magnoliaceae, Lauraceae and related families, the genus *Nelumbo*, etc.) and of highly evolved ones (Fagaceae, Moraceae, Euphorbiaceae, Salicaceae, Juglandaceae, etc.). It is obvious that the angiosperms had previously undergone a protracted period of development during which they had been able to differentiate into many distinct families.¹⁶

This last assertion of Takhtajan’s, of course, is not obvious to anyone except committed evolutionists, since the complexity and diversity of flowering plants in the Cretaceous fossils would otherwise fit better with the idea expressed in Genesis, that God created plants after their kinds, with the seeds inside.

There are no experimental data to show the origin of angiosperms from gymnosperms, or any other plant type, despite recent claims by Vesta Meyer¹⁷ to the contrary. As a result of certain hybridization experiments involving cotton, plants resulted which produced ovules on the petal margins (“carpeloid petal” plants). Meyer maintained that such carpeloid petal forms are “. . . strikingly similar to fossil megasporophylls described by Mamy. . . .”¹⁸, and also asserted that “. . . their very existence in a living plant population demonstrates the possibility that something similar could have happened before.”¹⁹ Thus she intimated that the carpeloid petal may have been the route by which angiosperms arose from ancestral gymnosperms.

In discussing the significance of carpeloid petal cotton, it should be pointed out that in addition to ovules borne on petals, the flower in question also had a typical ovary with enclosed ovules, as Meyer reported. Furthermore, she wrote, “Few of the abnormal flowers produce seed, and no exposed ovules have ever developed into seeds.”²⁰ Thus Meyer has simply shown that under intensive hybridization of cotton, various chimeras appear in which petals may produce sterile ovules. While this is informative and a significant finding in itself, it is surely no evidence favoring origin of angiosperms from gymnosperms.

No more phylogenetic significance should be attached to carpeloid petals than is given to any other chimeras, such as stem fasciation, sectoral chlorosis in plant organs, etc. Such reasoning on the part of Meyer is reminiscent of the logic by which zoological evolutionists rejoiced over the “tail,” which is evident infrequently on a human baby, but ignored at the same time possibly embarrassing phylogenetic significance of other birth abnormalities, such as cleft palates, hare lips, or flipper limbs.

Conclusions

The Kosakai *et al.* paper is an excellent review. The authors have frankly stated "evolutionary" problems, and have supplied a comprehensive survey of the attendant literature—75 sources are mentioned. A catalogue of problems like this is of value to both evolutionists and creationists.

Apparently some creationists have also come to the place where they are willing to face controversial matters. In recent *C. R. S. Quarterlies*, for example, there have been fruitful exchanges regarding the nature of entropy before the Fall, and the problem of how the "races" and "varieties" may have arisen since the Flood.

There are still other problems that deserve critical discussion, such as (a) the supposed vapor canopy,

(b) possible role of continental drift in Biblical history, (c) limits of the actual plant and animal baramin, and (d) biogeographic problems, which have been largely untouched by those who hold the creationist view.

Viewed from the creationist context, Kosakai and coworkers have shown that all "evolutionary" attempts to explain the development of flower plants have thus far failed. Their presentation of data fits better with the position that God formed many "kinds" of monocot and dicot plants, distinct from each other, and yet with "parallel" patterns or systems as required for proper function. The Kosakai paper, although written undoubtedly for evolutionists as a critique of schemes of plant "evolution," will be of great value to any student of the subject who wants to get beyond superficial discussion.

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WHAT CAN AND CANNOT BE DESCRIBED

Most people who have taken a course in physics or general science will recall Young's experiment. Two narrow parallel slits, a short distance apart, are made in an opaque screen. Light is directed through the slits, and onto a suitable surface. On the surface are seen alternate bright and dark regions; for at the dark regions the light from one slit is "interfering" with that from the other. For a long time this interference was considered to be conclusive evidence that light consists of waves in something.

About the turn of the century Planck and others introduced the notion of "photons." Instead of a sequence of waves, one might think of a stream of photons. But then there are difficulties. How can a photon which came through one slit interfere with one which came through the other? Worse still, if the light should be so weak that only one photon at a

time is involved, how can the photon interfere with itself?

Authors of many treatises admit frankly that such questions should not be asked; rather men should give up trying to say what happens between the source of light and the surface on which it eventually falls.

Sometimes, when creation is discussed, the objection is made that no one can say in great detail what happened during the actual Creation, because it was unique and not repeatable, by scientists. But if it is acceptable—and, in fact, good science—to forego trying to describe what happens to light at the slits of Young's experiment (which one would expect, at first thought, to be a part of regular nature, and hence a fit subject for science), how much more is it legitimate to forego trying to get a detailed description of Creation (which is outside the regular course of nature)!

—Contributed by Harold Armstrong

FURTHER RESEARCH ON REDUCED VIABILITY OF MUTANT PLANTS

WILLIAM J. TINKLE*

On Pleiotropy in Tomatoes

Some time ago personal observations on pleiotropy (extra cotyledons) in tomato were reported.¹ Since that time more tests have been made on tomato, and also on campion.

In the original report mention was made of the mutant type of tomato plant with three cotyledons, which appears to have an advantage in that it has more leaf surface when young compared to the normal plant. Actually, though, on the basis of growth records, the mutant is deficient in vigor.

Seeds of both the mutant and normal types were planted in a cool, fairly light basement. After two months, 20 per cent of the plants of the 3-cotyledon type were living; while 37 percent of the normal 2-cotyledon type were living.

The mutant type is a late fruit-bearer and also is feebly resistant to cold. After a light frost, 76 per cent of the leaves were damaged on a plant of the 3-cotyledon type, and 54 per cent on a 2-cotyledon plant.

Another observation that can be reported for the first time: the average total weight of fruit on 3-cotyledon plants was 92.0 ounces, whereas the average total weight of fruit was 119.3 ounces from the normal 2-cotyledon type. Care was taken to provide equal room and soil for all the plants.

On Pleiotropy in Campion

Pleiotropy appeared unexpectedly in another genus this year. Seeds of sweet pepper were planted in a

flower pot, but several plants of campion, *Lychnis alba*, also appeared. One of the plants, which happened to be in the center, had three well-shaped cotyledons. To increase growth space, all but four campion plants were removed, and later the remaining four plants were transplanted to outside soil.

At the time of transplant, all campion plants appeared to be of equal vigor; but the 3-cotyledon plant soon showed a lack of vigor due to the shock of transplanting. Two days later, the 3-cotyledon plant had lost two leaves entirely, and half of the area was lost from four leaves. Now let us look at the three normal campion plants: Plant No. 1 lost no leaves after transplanting, plant No. 2 lost one, and plant No. 3 lost one.

It is evident that a change in gene structure which makes even a small change in morphology, deranges also physiological functioning. The result is a loss of vigor. Just as in tomato mutants, the lack of vigor may be overlooked; but exact observation, especially in a harsh environment, shows the loss to be significant.

Many mutations have been reported, but few have been studied carefully enough or long enough to show the extent of the loss of vigor. Since it is agreed that mutation is the source of lasting variation, the only method by which evolutionists imagine *Amoeba* could have developed into *Homo*, mutations are certainly worth studying. If it is established that all mutations cause a loss of vigor and loss of reproductive ability, it becomes incredible to believe that *Amoeba* changed into *Homo*.

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MORE ON A WATER CANOPY

Some creationists make much of a canopy of water in some dispersed form, which they believe formerly existed high above the earth. Others doubt whether such a thing was either necessary or possible.

Whatever may be the eventual resolution of this matter, it is of interest to consider the history of the notion. One early proponent of the canopy was Isaac N. Vail, who was active in the last century.

Vail's article, "Waters Above the Firmament," originally published in 1874, has been reprinted in *The Stonehenge Viewpoint*, Volume 7, Number 2, second quarter 1974 (published by Annular Publications, 25 West Anapamu Street, Santa Barbara, California 93101) on pages 6 to 9.

Vail's notion seems to have been that the earth formerly had a ring, like that now seen around Saturn, composed of particles of ice. However, Vail did not think that the ring form was permanent, but held that in time the ring spread out somehow, thus contributing to a greenhouse effect. Eventually it fell, and contributed to the Flood.

—Contributed by Harold Armstrong

A COMPARISON OF THE ARK WITH MODERN SHIPS

RALPH GIANNONE*

Not long ago, during a consulting assignment with Sea-Land Service, Inc., Elizabeth, N. J., the author had occasion to travel aboard the S. S. Portland to San Juan. The S. S. Portland carried 360 truck trailers, which was a sizeable cargo. (But Sea-Land currently operates other ships (SL7) which transport 1096 trailers. And that at 33 knots!)

Since Noah's shipbuilding accomplishment is often mocked, it might be instructive to review some of the technical data for the Sea-Land container ships, as shown in Table 1:

Table 1

	VESSEL	
	SL7	S.S. Portland
Length Overall	946.6 ft.	522.9 ft.
Length between Perpendiculars (LBP)	880.5 ft.	496.0 ft.
Breadth	105.5 ft.	71.5 ft.
Depth	64.0 ft.	43.5 ft.

NOTE: These are certain dimensions of some modern ships. The Length Between Perpendiculars is the length between the forward and after perpendiculars, i.e., the length between the forward side of the stem at the designed waterline and after side of the rudder post, or centerline of the rudder stock, depending on the design of the ship. (See Robert H. Macy. Vessel Damage Control. Vol. I. Naval Architecture, p. 159. Sea-Land Service, Inc., 1970.

Now let us examine Noah's vessel so that a comparative analysis might be made. It is described as follows: "The length of the ark three hundred cubits, the breadth of it fifty cubits, and the height of it thirty cubits."¹

If a cubit is understood to be 18 inches, which seems to be at least approximately correct, then Noah's Ark was 450 feet long, 75 feet wide, and 45 feet high. Assuming the length overall and the length between perpendiculars (LBP) of the Ark to be identical, it is possible to compare the ratios of dimensions of the Ark to those of modern vessels, as is shown in Table 2:

Table 2

	VESSEL		
	SL7	S.S. Portland	Noah's Ark
LPB/Breadth	8.346	6.937	6.000
LPB/Depth	13.758	11.402	10.000
Breadth/Depth	1.648	1.644	1.667

NOTE: Here some significant ratios of dimensions for modern ships and for the Ark are compared. Note that the breadth and the beam are about the same dimension; hence the ratios of breadth to depth and of beam to depth will be about the same.

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In order to get a professional evaluation of these data, the author consulted with John W. Boylston, Naval Architect at Sea-Land. He supplied the following information:

... the Length (again LBP) to Breadth ratio and the Breadth to Draft (the draft, of course, is a function of height) ratio are significant from a hydrodynamic or speed standpoint. Taking the strength ratios and the hydrodynamic ratios forces most ships into a rather narrow category so that all proportions are relatively equal. There are certainly exceptions such as very wide and shallow-draft barges for shallow rivers, and short, deep vessels which must traverse some geographical restriction such as a canal lock.

Thus the beam² to depth ratio is not normally used in design but is fairly consistent (much more so than one would expect) due to the consistency of the other ratios.

As one naval architect stated: "It is somewhat depressing to me to think that we've been working all these years, but we really haven't made much progress!" (This refers, of course, to the all-over shape of a ship. Certainly great things have been done in such things as the power plant and aids to navigation. But—the Ark did not need such refinements.)

Certainly the Master Architect knew precisely what He was doing when He gave explicit instructions to Noah, the world's first shipbuilder.

Incidentally, both those who believe that Moses wrote or edited Genesis, and those who do not, would agree that the author or editor (humanly speaking) was not personally familiar with the construction of large ocean-going ships. Yet the design recorded in Genesis is a practical one.

The Babylonian flood account, on the other hand, seems to have a quite impractical cubical structure. And even the Greeks, one of the great sea-faring peoples of antiquity, seem to have had only the vaguest notion of the means by which Deucalion was saved. Surely here is evidence for the inspiration of the account in Genesis.

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¹Genesis 6:15.

²The word "beam" is used here to mean the extreme breadth of a ship. It means also an athwartships or longitudinal structural member supporting and stiffening deck plating. (See page 144 of the reference given with Table 1.)

BODY TEMPERATURE REGULATION IN REPTILES, BIRDS, AND MAMMALS

E. NORBERT SMITH*

Homeothermic birds and mammals maintain a constant body temperature by behavioral and physiological adjustments. The latter includes changes in heat production, blood flow, and evaporative water loss. Poikilothermic reptiles also maintain a stable body temperature (often higher than that of mammals) when environmental conditions allow, by using behavioral and physiological mechanisms. Both modes of life have advantages and disadvantages. Neither poikilothermism nor homeothermism is unquestionably advantageous under all conditions; therefore, neither group of animals is indisputably better suited for survival than the other. God created all animals equally fit to live in their respective niches.

Introduction

Evolution is thought to be a continual process of improvement. It supposedly is powered by the ever present over production of offspring and a subsequent harvesting of the less fit by natural selection. Each species is thought to be in a race for perfection.

The rates of supposed advancement, however, vary greatly from species to species, certain groups changing little throughout geologic time while others make great "progress." (It always has seemed paradoxical to the author that any "primitive" form could compete for long periods of geologic time with more "advanced" contemporaries, but this is not the issue here.) This "advancement" in contrast to "primitiveness" is a nebulous concept but seems to involve specialization, diversity, and increased complexity in form and function.

Classic examples of so-called advanced phyla are the arthropods and chordates. Protozoa and Porifera would be placed at the opposite extreme in the animal kingdom. Even within a more restricted group—the vertebrates—considerable variation is said to exist, with certain fish cited as "primitive" examples and birds and mammals representing the most "advanced" forms known.

If some organisms have "evolved" toward a higher state of perfection, while others remained at some "primitive" level, degrees of perfection should be observed in nature. That is, assuming the rates of evolutionary change are different from group to group, then certain "advanced" groups should be unequivocally and irrefutably better suited for survival than other less advanced groups in a particular environment. Let us compare in some detail certain aspects of differences found between "primitive" reptiles and "advanced" birds and mammals.

One of the most striking differences between these groups is maintenance of body temperature. Birds and mammals generally are classified as being "warm blooded" or more descriptively, homeothermic, while the reptiles are "cold blooded" or poikilothermic. Homeothermism of birds and mammals is considered to be one of the most significant "advances" made from presumed reptilian ancestry. Let us look closely at this so-called advancement and see if it is unequivocally and irrefutably an improvement over poikilothermism.

Homeothermic Temperature Regulation Mechanisms

Birds and mammals generally are able to main-

tain a constant body temperature in spite of wide fluctuations in their environmental temperatures (see Figure 1). Most birds and mammals are covered with insulating feathers or hair. Although insulation aids in the conservation of body heat, the major difference between homeothermic and poikilothermic animals is at the tissue level, homeotherms consuming up to 10 times the energy per gram of tissue that a poikilotherm consumes.

This increased metabolism (even at identical temperatures) provides the source of heat for regulation of body temperature. The terms endotherm and ectotherm also are used. Endotherms or homeotherms have the source of heat within; conversely ectotherms or poikilotherms rely on external heat. Actually, neither of these terms is fully adequate.

Regulation implies control, and several mechanisms of control have been elucidated. The mechanisms may be placed under two headings: control of heat production and control of heat loss.

Control of Heat Production

Rates of biochemical reactions, like other chemical reactions, are temperature sensitive. Higher temperatures result in faster reactions. Many biochemical reactions are approximated by the familiar van't Hoff generalization: that increasing the temperature by 10°C doubles the reaction rates.

Rates of biochemical reactions inside poikilothermic animals appear to be passively controlled by the prevailing body temperature. When the energy consumed is compared as a function of temperature for both homeothermic and poikilothermic animals, strikingly different results occur as are illustrated diagrammatically in Figure 2.

As expected for poikilotherms, increased temperature results in increased energy consumption. In the homeothermic animal however, the opposite effect results. Referring to Figure 2, if the temperature is decreased below point A, energy consumption increases.

In most biochemical transformations for example: $A \rightarrow B$ energy is lost as heat. This "loss" of energy is the source of heat for homeothermic animals and is called non-shivering thermogenesis. Apparently in non-shivering thermogenesis metabolic pathways are shifted to "less efficient" pathways increasing the energy "lost" to heat and thereby maintaining thermal homeostasis. Brown fat is especially important in the production of metabolic heat and is utilized extensively in the arousal of small mammals from hibernation.

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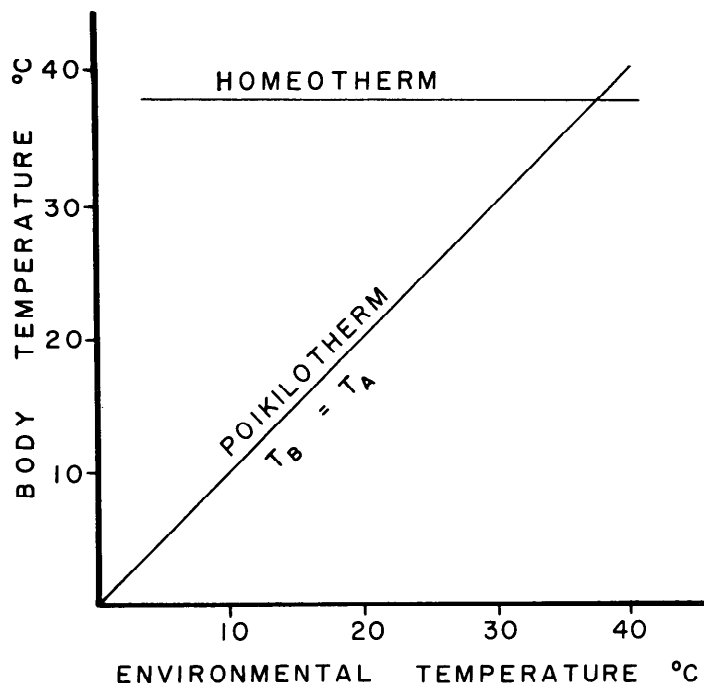


Figure 1. Relationship of the body temperature of homeotherms ("warm blooded") and poikilotherms ("Cold blooded") to environmental temperatures. This is a generalized diagram showing trends. Evaporative cooling and/or endogenous heat production would slightly alter the poikilotherm's body temperature and of course the homeothermic animal's body temperature is not completely independent of environmental temperature.

Besides, non-shivering thermogenesis, chilling temperature also induces shivering. This involuntary flexing of skeletal muscles results in great amounts of metabolic heat, and helps to explain both increased heat production and increased energy consumption with decreasing temperature.

The heat production that enables such a high level of environmental independence of homeotherms is not free. Approximately 90% of the food required by homeotherms goes to the maintenance of body temperature. Homeotherms living in cold regions must never be far from food.

Referring again to Figure 2, it is apparent that the energy consumption is constant for a portion of the range of changing environmental temperatures from A to B. This thermal neutral zone implies that some mode of control other than changing the rate of energy consumption must be working to maintain thermal stability.

Changes in Insulation

For animals with hair or feathers the effective insulation can be changed considerably by varying the thickness or degree of erection of the pelage or feathers. A bird with its feathers fluffed out has considerably more insulating trapped air than does the same bird with its feathers drawn tightly against its body. A similar situation exists for most mammals with hair erect.

In addition to changes in insulative quality caused by position of hair or feathers, changes in blood flow

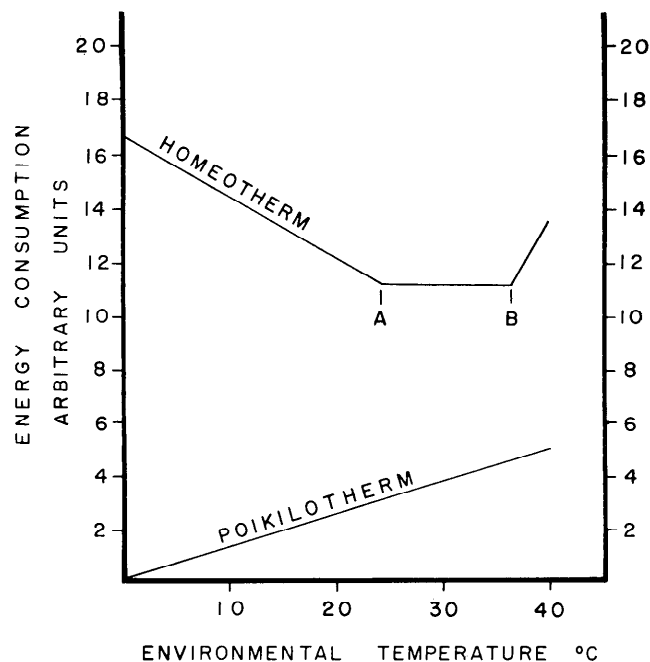


Figure 2. Relationship of energy consumption of homeotherms and poikilotherms to environmental temperature. Again this is only a first approximation. The slopes are not constant but increase sharply at warmer temperatures.

can cause great changes in the amount of heat flow from or into an animal. A hot animal flushes blood to the surface resulting in rapid heat loss to the outside. A cool animal reduces peripheral blood flow and shunts the blood deep inside its body thus minimizing heat loss.

Finally, many homeotherms can pant, lick themselves, or sweat thus aiding maintenance of their body temperature below that of the environment. Water secretion is metabolically expensive and energy consumption rises sharply as seen in Figure 2 beyond point B.

Mammals and birds, then, have the ability physiologically to regulate their body temperatures by varying heat production by changing their effective insulation, by adjusting blood circulation, and by evaporating water.

Behavioral Mechanisms

In addition, mammals and birds behaviorally select protected nest sites and more hospitable microhabitats in the environment. Grazing animals feed with their backs to the wind on cold windy days. Most animals seek shade when hot.

Some animals, when hot, dig to expose cool moist soil on which to lie. Many smaller animals seek shelter from both heat and cold by going underground. Some mammals escape cold weather by hibernation, and many birds and some mammals migrate to milder wintering quarters.

Reptilian Thermoregulation

Biologists long have known that, when a fish, frog, or snake is placed into a cold environment, the body temperature soon approximates that of the new en-

vironment (Again see Figure 1). In contrast the body temperature of a bird or mammal varies little even when exposed to rapid and extreme environmental temperature changes. The body temperature of poikilotherms was thought always to approximate that of the environment.

The early work of Cowles and Bogert¹ on temperature regulation in reptiles began to change the picture. Certain small diurnal lizards were found to regulate body temperature simply by moving about in the natural environment. When cool, lizards crawl into the sunlight; when warm, they seek shade. By behavioral thermoregulation some desert lizards have been found to regulate their body temperature to $\pm 3^{\circ}\text{C}$ during the day.

In the intervening years many investigators have continued to study reptilian thermoregulation. All reptiles studied have been found to possess thermoregulatory behavior and are able to minimize fluctuations in body temperature. Several excellent reviews of the literature are available²⁻⁵ and none is intended here.

Much of the early work with reptilian thermoregulation dealt largely with thermoregulatory behavior. Lizards were found not only to seek the sun when cool, but also to align themselves in such a way that the sun fell on the larger surface area of the animal, and the animal usually aligned itself perpendicular to the rays of the sun. Furthermore, in order to gain heat from a warm substrate, reptiles would lie flattened out and increase conductive heat gain. Conversely, heat conduction could be minimized by standing high above the substrate.

By simple exposure to the sun's warming rays, lizards can elevate their body temperature considerably. Certain small lizards living at high altitudes have been found to maintain body temperature as much as 30°C higher than the surrounding air.^{6,7} These measurements demonstrate the utility of basking. Many reptiles gain the advantages of high temperatures without high energy consumption.

Not only can the body temperature of terrestrial poikilotherms be higher than the air, but also there are examples of lizards having temperatures higher than the body temperatures of some mammals.⁸ Monotremes, for example, lose the ability to thermoregulate at 32.5°C ; 35°C is lethal for the platypus and 37°C kills echidna.

In contrast the preferred body temperature of most species of *Sceloporus*, the spiny lizards, is between 34 and 36°C . Many *Cnemidophorus*, whip-tailed lizards, are active with a body temperature of 35 - 44°C . Certain lizards can operate at temperatures harmful or even lethal to some mammals. Obviously the term "warm blooded" and "cold blooded" are inappropriate, and should be discontinued.

While thermoregulatory behavior no doubt plays an important part in reptilian thermoregulation, recent studies indicate that many of the physiological thermoregulatory mechanisms used in the "advanced" birds and mammals are used by the "primitive" reptiles.

Endogenous heat production is significant in the thermoregulation of the lace monitor^{9,10} and even for the more aquatic alligator.¹¹ Frair observed that body temperature of a large marine turtle was 18°C higher

than the water from which it was taken.¹² Just as mammals and birds regulate body temperatures by changes in blood flow so do many reptiles.^{13,17}

Not only has total blood flow been found important for the regulation of body temperature of reptiles, but also local cutaneous vasomotor responses to temperature variations were found to play a part in the thermal stability of the Galapagos marine iguana¹⁸ and spiny-tailed iguana.¹⁹ That reptiles can cool by evaporation has been well established.²⁰

It appears, then, that birds, mammals and reptiles, while active, all utilize both behavioral and physiological mechanisms to maintain a relatively stable and often high body temperature.

What are the advantages of a high body temperature? Higher temperatures cause increased rates of chemical reactions. An increase in temperature causes food to digest and to be assimilated more rapidly. Higher temperatures increase the speed of nervous impulse transmission and the rate of muscular activity resulting in greatly improved coordination, speed of movement, and consequently the ability to elude a predator or to capture prey.

While assets of a high body temperature are many, there also are liabilities. Increased metabolic rates mean the fuel that enables such luxurious living quickly is consumed and must be replaced or starvation results. This is especially true for smaller organisms. How is the high rate of metabolism to be maintained during periods of food shortage?

In many cases it is not. Many homeotherms hibernate, with the onset of colder weather; and, in so doing, drop their body temperature, thereby reducing their food requirements. Many tiny humming birds, with usually high body temperature and extremely high rate of metabolism, avoid nightly starvation by turning down their thermostat and letting their body temperature drop to near that of the environment.

Temperature Regulation and Creation

Using the above brief introduction to temperature regulation let us return again to the question of homeothermy and survival suitability. Is homeothermy, as seen in birds and mammals, an "advance" in suitability for survival? Are these animals uniquely and irrefutably better suited for their environment than their more "primitive" peers? Obviously it depends on circumstances.

As temperatures fall, reptiles require less food and homeotherms require more. If food is a limiting factor the homeotherms are at a marked disadvantage. Yet a sluggish, cold reptile is easy prey for the ever alert homeotherm. Neither is irrefutably and unequivocally better suited for its environment.

Instead of viewing homeothermism as a step "upward" in complexity and fitness it is more logical to view the two modes (and all intermediate steps) as equally useful methods of exploiting particular niches. In some ways the hibernating mammal and lizard that become active on warm days are exploiting a habitat more efficiently than can the homeotherm that must eat, starve or hibernate during less hospitable days.

Instead of viewing partial homeothermism in reptiles as developing nascent homeothermism on the way

to becoming full-fledged homeothermism, it is more logical and consistent with nature to view partial homeothermism as a special (and fully developed) method of exploiting a particular niche.

Similarly, hibernation should not be viewed as a "return to reptilian poikilothermy," but as a highly refined mechanism enabling its user to exploit the advantages of both poikilothermism and homeothermism.

Let us look briefly at an example of a "primitive" poikilothermic animal and see how it is suited for survival and how it competes with (more "advanced") homeotherms.

American Alligator: Specific Example

The American Alligator, *Alligator mississippiensis*, was once the dominant vertebrate in the Southeastern United States. It inhabited every available river, lake and marsh. Old hunters compared the number of alligator eyes seen reflecting automobile lights to the stars overhead.²¹ It has been said that if the alligators in the Mississippi River would hold still, a man easily could have stepped from head to head across the river without wetting a shoe.

The abundant alligator was to Southeastern Indians what the buffalo was to the plains Indians. It provided food, clothing and tools. With the opening up of the wet lands to hunters and trappers during the first part of this century the numbers of alligators began to decline. McIlhenny has estimated over three million alligator hides were sold in Louisiana alone.²² This "primitive" animal, then, was a dominant vertebrate, and obviously fared well with more "advanced" forms.

Anatomically the alligator has a four-chambered heart; but until recently it was thought that a shunt between the right and left aortic arches (*foramen Panizzae*) caused inefficient mixing of arterial and venous blood. Here again crocodilian circulation has been viewed as a kind of developing avian or mammalian circulation better than that found in "lower" reptiles, but not as good as the circulation of the homeotherms.

White²³ has recently shown that functionally there is no mixing of oxygenated and unoxygenated blood when alligators are breathing air. When submerged, however, increased pulmonary resistance induces a right to left shunt.

Instead of being inefficient and poorly developed, this system, along with other anatomical and physiological adjustments, enables the alligator to dive for extended times. During prolonged diving it would only waste energy to profuse the lungs with blood. It is the homeotherms that would be at a distinct disadvantage with their mandatory dual circulation.

Bradycardia in response to submergence, has been shown to occur in all air-breathing vertebrates studied.²⁴ In reference to the alligator it has been called diving bradycardia and was thought to be a reflex to submergence.²⁵ However, in a recent study of free-ranging alligators, using radio telemetry, Smith and coworkers²⁶ have found instead that bradycardia is fear-evoked, and not a response to submergence.

An alligator spends a great deal of time submerged and the profound bradycardia response, if present, would undoubtedly be harmful to normal alligator

function. It does however, ably suit the animal for prolonged emergency dives. The author has timed dives exceeding one hour and fifty minutes, during which time the alligator was actively evading capture in clear water.

In terms of thermoregulation the alligator has been found to maintain a relatively stable body temperature by a combination of behavioral and physiological adjustments.²⁷ Endogenous heat production probably coupled with cardio-vascular adjustments enables the alligator to maintain a body temperature several degrees above the water even during the night time.

The alligator, thought to be a relic of the age of the dinosaur, seems optimally suited for a particular environment, and certainly competes well with more "advanced" forms. It is even considered necessary and helpful in shaping plant communities in the marshland, and important to the general ecology and maintenance of the wet land ecosystem.²⁸ In fact, it seems that a vicariate homeotherm might considerably upset the ecology in relation to migrating water fowl.

The alligator becomes less active and requires considerably less food when winter approaches. During cold weather most of the southern marshlands are teeming with migratory water fowl. A homeothermic carnivore, as abundant as the alligator once was, surely would upset the ecology as it is known today. Could it be that there actually is a purpose or plan in nature?

Snakes: Further Specific Examples

Additional evidence that another poikilothermic animal is well suited physiologically for a particular way of life comes from studies of a snake. Squamates possess a three-chambered heart with two atria and an incompletely divided ventricle. From anatomical evidence it was reasoned that the circulation was "primitive" and inefficient, involving mixing of venous and arterial blood. Physiological studies, however, revealed virtually no mixing, the pulmonary artery receiving only unoxygenated blood.²⁹

Recent studies of the carpet python, *Morelia spilotes*, have shown a significant temperature difference of blood leaving the heart.³⁰ This suggests that the heart of snakes is functionally superior to the avian or mammalian heart, for it aids in thermoregulation, sending mostly cool blood from the posterior portion of the animal to the lungs. This helps to maintain head-body temperature gradients and minimize respiratory heat loss.

Once more the placing of squamate circulation in an "evolutionary" sequence has been unfruitful. Instead of possessing an inefficient nascent homeothermic circulation, snakes appear to have a highly specialized and perfected circulatory system, attending not only to oxygen transport but also to function in thermoregulation.

Reptiles can and do compete favorably with homeotherms. In some ways they are more suited for certain environments than more "advanced" forms.

Zoogeographically homeotherms predominate in cold regions. In the tropics both groups abound. Perhaps arctic regions, as they are found today, did not originally exist and have been filled secondarily in post flood times.

Conclusions

The precept that some organisms generally are more suitable or more nearly perfect is a part of "evolutionary" thinking, and is entirely unscriptural.

According to "evolution" (in the broadest sense), the earth before life was "primitive," relatively devoid of order, and lacking complexity or perfection. As time passed (and "evolution progressed") order and complexity supposedly increased.

This is contrary to the teaching of the Bible (to say nothing of the laws of thermodynamics), however, for the writer of Genesis uses the very same phrase, "And God said that it was good," to describe the formation of the dry land³¹ that is used following the creation of birds³² and cattle.³³

In several scriptural passages various "kinds" of animals and plants are singled out, but never is it said (or implied) that some are more "advanced" than others, with the notable exception of man who was

created in the image of God. God created many "kinds" of organisms rapidly, and all equally suited for survival. A lizard is no less designed (let us be theological, Moses was) for any particular niche than is a mouse. "And God saw everything that he had made, and, behold, it was very good."³⁴

Acknowledgment

Dr. Wayne Frair critically reviewed the early manuscript and offered many helpful suggestions; however, the author is responsible for content.

☆ ☆ ☆

Added Note: It may be remarked that there are other cases of thermoregulation besides those discussed in this paper. For instance, thermoregulation is found in some insects³⁵ and recent evidence indicates thermoregulation in the plant kingdom.³⁶ Indeed, thermoregulation may prove to be the rule, rather than the exception, among living things.

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EVIDENCE OF TELEOLOGY IN BOTANY: DIFFERENTIATION IN THE VASCULAR CAMBIUM INTO XYLEM AND PHLOEM*

JOHN E. THOMPSON**

It is the purpose of this paper to examine the process by which ordinary cells differentiate from uniform cambium cells into xylem and phloem. It can be said that while the complexity of this process does not, perhaps, completely prove teleology, yet no "evolutionary" explanation is really adequate.

Introduction

It is the purpose of this paper to examine the process by which ordinary cells differentiate from uniform cambium cells into xylem and phloem. It can be said that the complexity of this process does not conclusively prove a case for teleology but, as will be shown, no "evolutionary" explanation is really adequate.

Cell differentiation is a marvelous, intricate system in vascular plants, microscopic in size. This process involves individual cells that differentiate to form functioning tissues. Katherine Esau has written:

The formation of new cells, tissues, and organs through the activity of the apical meristem involves division of cells. Certain cells of the meristems repeat divisions in such a way that one product of a division becomes a new body cell while the other remains in the meristem.¹

Out of this new tissue, lateral meristems are eventually formed called vascular cambium and cork cambium. Lateral meristems

... make their appearance, developing from procambial and pith ray parenchyma cells in the case of the vascular cambium and from cortical parenchyma or collenchyma in the case of the cork cambium. Activity of lateral meristems results in the formation of secondary tissues. The vegetative plant body of a typical woody organism is made up of both primary and secondary tissues.²

The course of differentiation, then, progresses from a point where all cells are largely simple and similar to the formation of a much more complex woody stem. One wonders how anyone could believe that such a

complicated process could take place in nature by chance.

In this paper, primary concern will be with the functioning of the lateral cambiums, and especially the vascular cambium, from which secondary xylem and secondary phloem tissue develop.

Cambial Differentiation: An Experiment

Evert, Kozlowski, and Davis performed an experiment which seemed to suggest that there are natural processes which indirectly effect cambial differentiation. In a series of experiments with sugar maple, the phloem of several different trees was isolated by girdling during successive periods of the growing season. Then the effects of phloem isolation on cell differentiation in the cambium were observed, and compared from tree to tree. Also a careful check was made of a normal sugar maple, which had no phloem blockage. The experimenters commented on the very interesting results:

Normal cambial activity in woody plants requires a continual supply during the growing season of phloem-translocated products from shoots. Thus, severing the phloem so as to prevent transports of carbohydrates and hormonal growth regulators to the lower stem greatly modifies production and maturation of xylem and phloem cells beneath the wound.⁴

If phloem isolation occurred in the dormant season, no new xylem or phloem was produced. If isolation occurred after the growing season started, then relatively undifferentiated parenchyma cells were produced. Some xylem were produced, but short in length. Phloem sieve tubes died early.

But, the later in the growing season the phloem blockage took place, the more nearly normal were the xylem and phloem cells formed. The researchers concluded:

There is considerable evidence that the abnormal cambial growth below stem girdles involves a deficiency of hormonal growth regulators and carbohydrates. The fact that cell division in some species is curtailed more rapidly than all wall thickening below stem girdles suggests that different systems may be involved in different phases of cambial activity.⁵

From this experiment, it is evident that the mechanism of cell differentiation is very complex, involving many factors—hormonal regulators, the presence of carbohydrates, the health of the extant phloem, and so forth. This is as one would expect, if the system were the result of careful design.

Before differentiation takes place, virtually identical meristematic or cambium cells exist side by side. But, after cell divisions, the inner cells become xylem

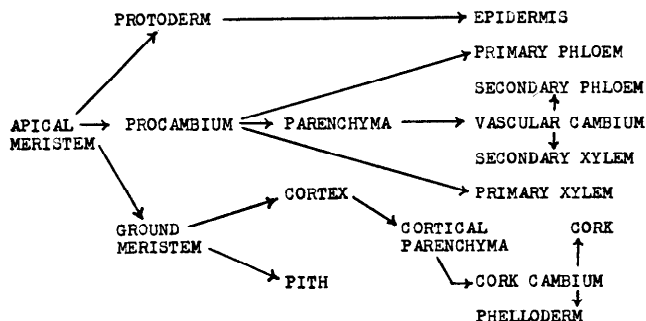


Chart of meristematic activity and the process of differentiation from the apical meristem to organized tissues.³

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and the outer cells phloem. How is it possible for cells, originating by simple mitotic division, to become so radically different in make-up?

DNA theorists face the same problem. If DNA is the sole explanation for differentiation, will scientists ever understand why one particular cell, fitting perfectly into the order of things, becomes a sieve tube while another becomes a xylem vessel? But, that is not all, because environmental factors have a role in differentiation, as has already been noted.

Cell Differentiation: Another Experiment

In another experiment, Robnett and Morey discovered that chemical factors seem to be important in differentiation. They found that water deficits are only indirectly causal to formation of spring and summer wood.⁶ They also discovered that "auxins are clearly involved in vessel member differentiation in some hard woods."⁷ Salisbury and Parke have stated:

Auxin is a chemical substance that can cause stem cells to elongate. . . . If *auxin* is applied to an intact stem at concentrations considerably above those that result in cell elongation, the stem cells begin to divide again, producing tumor-like growths called *callus*. Thus, *auxin* is capable of starting one form of meristematic activity.⁸

Robnett and Morey also discovered that certain other chemical treatments had an effect on xylogenesis. They wrote:

Although reduced in diameter, the vessels formed during 2,4-D and 2,4,5-T treatment are so numerous there is no significant difference between phenoxyacetic acid and control seedling groups with regard to total area of xylem occupied by vessels. The preferential maturation of xylem cells over parenchyma and the transformation of fusiform initials into septate parenchyma strands in phenoxyacetic acid-treated *Prosopis* resemble the structural changes reported to occur after girdling in the cambial tissue of other arborescent angiosperms. Bending experiments indicate that tension-wood fibers of *Prosopis* differentiate in response to an auxin deficiency.⁹

Further, 2,4-D increases cell proliferation and elongation but, at the same time, it unfortunately causes xylem to become very narrow with thick lignified cell walls.¹⁰

Therefore, the role of chemicals in cambium differentiation is established. Exactly how chemicals initiate and carry out specific cases of cell differentiation has not been determined yet. Still, it is known that cell division is caused by cytokinins.¹¹ But the problem remains a difficult one.

David R. Dobbins pointed out that secondary tissues are produced in an organized, predictable manner even when seeming abnormality is the result. His work with *Doxantha unguis-cati* demonstrated that cell differentiation is always an organized process. He wrote:

In this case, four normally functioning areas of vascular cambium cease or reduce xylem production while continuing to produce phloem.

The secondary xylem becomes lobed by deep furrows of phloem.¹²

To this species, an abnormal mode of differentiation is considered normal. And, even with abnormalities, it is clear that, whatever the factors that influence xylem and phloem differentiation, they would appear to operate in a similar manner in obedience to a set design in all plants containing genuine vascular systems. Regarding chemical influences on differentiation, it is well to remember Salisbury and Parke's statement:

The effect can be roughly duplicated by attaching a small source of auxin (such as an agar block containing auxin) onto a callus. Further control is gained by adding sugar (sucrose or glucose) along with auxin.

Low sugar concentrations result mostly in xylem formation, high sugar in phloem formation, and intermediate sugar levels in formation of xylem and phloem with cambium between. Sometimes nodes of vascular tissues formed in these cultures, in which case the xylem is always on the inside and the phloem on the outside as in the normal plant.¹³

Thus, auxin is not the only factor in cell differentiation. Sugars also are important, in fact they may be crucial, since it is true that

. . . the secondary phloem constitutes much less of the secondary growth in the stem than does the xylem, and as thickening proceeds the primary phloem and even in its turn the first-formed secondary phloem, may become crushed and functionless.¹⁴

It seems that one may assume there is a relatively low sugar concentration in the cambium area.

Much remains to be told; however, the complexity of mechanisms involved in xylem and phloem differentiation have been demonstrated.

Cell Differentiation: Fossil Evidence

Of further significance to the creationist, however, is the fact that there has been no known change in the basic processes of forming secondary vascular tissue since studies of the processes were begun. There is evidence that this same differentiation process was not unknown in the period of massive fossil formation.

For instance, *Sphenophyllum*, a trailing Articulate type of plant resembling the Equisetums or horsetails and found from the Devonian to the Permian periods of geologic time, had a clear xylem arrangement, even though some stems were "incompletely preserved and have a circumxylary lacuna marking the original position of the outer tissues of the stele."¹⁵

Furthermore, "there is incomplete preservation of stems to include meristematic vascular cambium."¹⁶ It is illogical to assume that there were xylem cells apart from phloem, since functions of xylem and phloem are known to be complementary. A vascular plant with no phloem is a contradiction in terms.

And there is evidence that the phloem may have been there originally. The secondary tissue in *Sphenophyllum* was created by a "bifacial vascular cambium."¹⁷ The process was the same. Based on what is known about modern vascular systems, it is

not surprising that phloem failed to survive the fossilization process, since phloem has a higher mortality rate than xylem and less of it is produced in living plants.

Rhynia, a fossil plant from the Devonian period unlike any modern species, also contains a vascular system. As in *Sphenophyllum*, the phloem was poorly preserved in the fossil specimens. Satterthwait and Schopf have reported:

Phloem tissue is so poorly preserved in most fossils that commonly, in the illustrations, the phloem is labeled as such because the position is assumed to be appropriate for the tissue.¹⁸

In this case, xylem tissue was surrounded by a narrow zone of thin-walled cells, which must have been phloem, and which would have been surrounded, in turn, by cortex. Sieve tubes have not yet been discovered in *Rhynia*. Even with the absence of sieve tubes, however, it is clear that vascular bundles have

not changed much since the chert beds were laid down.

Conclusions

Based on the above, one may conclude that differentiation is a complex, but clearly defined, process by which similar cells in a meristematic zone become unlike. The processes involved at such microscopic level are so intricate that one can argue strongly in favor of adoption of a belief in teleology with regard to botanical science.

Furthermore, the process of differentiation has not changed demonstrably since the period when the *Rhynia* were fossilized in chert beds. This, too, is evidence of teleology in nature. Taken alone, it may not be conclusive; but, combined with all the other available evidence, it falls into a familiar pattern.

The Psalmist stated that the heavens declare the glory of God, but it is likewise clear that vascular bundles, though only microscopic in size, perform the same function.

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ARCHAEOLOGISTS, INSCRIPTIONS, MEANINGS

In 1973, when new sidewalks were built in Kingston, Ontario, the contractors had forgotten apparently to change the stamp used to mark certain information in the concrete. Hence the sidewalks are dated 1972 in places. Some attempts were made to change the "2" into a "3" before the concrete had hardened, but in some places the figure is still more likely to be taken for a "2".

A somewhat similar example is provided by some commemorative china. Items appeared marked "Marriage of Queen Elizabeth II, 1948," or something to that effect. Now the wedding was in 1948; but the present Queen was not Queen then. She was then the Princess, and became Queen in 1952.

The point in mentioning these matters is that were either of these examples found by future archaeolo-

gists, they could be misled. Is it not likely, then, that some inscriptions from the past are similarly misleading? Indeed, it would seem to be most likely.

Specialists agree that literacy was not very common. It is quite likely that some stone-carvers, for instance, did not know the meaning of some of the things which they carved. So they would be less likely to catch mistakes. Is this the reason, perhaps, why the symbols in hieroglyphics are sometimes interchanged in order?

The reason for mentioning this point, of course, is to notice that inscriptions are not infallible. So if inscriptions should seem to conflict with Scripture, as some might, it is perfectly reasonable to continue to believe the Scripture.

—Contributed by Harold Armstrong

CONVERSION OF CODONS INTO ANALOGOUS CONFORMERS, AND ASSEMBLY OF CONFORMERS INTO POLYPEPTIDES

LOYD Y. QUINN*

This article is a supplement to "Evidence for the Existence of an Intelligible Genetic Code," in the previous issue of the Quarterly, as was proposed in that article. More information on the constructions mentioned in the first article are provided for those who may want to assemble the models described.

Procedure for Conversion of Codons into Analogous Conformers

In genetic translation of mRNA into corresponding polypeptides, the recognized high fidelity of the process depends on accurate recognition of mRNA codons by homologous tRNA anticodons. Recognition, in chemical terms, consists of the close fitting together of A:U and G:C homologous base pairs when the nucleotides to which they belong are in fully extended or "anti" conformation.

Not only are homologous base pairs complementary in shape at points of contingency, but they also produce strong hydrogen bonds at these apposed points, namely: N-3 and O-4 of uridine (U) bond to N-1 and N-6 of adenine (A), respectively; O-2, N-3, and N-4 of cytosine (C) hydrogen-bond to N-2, N-1, and O-6 of guanine (G), respectively. These base-pairing patterns are illustrated in Figure 1.

Usually, a codon such as GGG for Gly is recognized preferentially by the expected homologous anticodon of tRNA, namely CCC. However, on occasion, when three bases such as G,G,U are assembled into a trinucleotide such as GGU for Gly, electrical charges on the potential H-bonding sites of component bases are so altered that the expected hydrogen-bonding

patterns with the predicted anticodon, in this case ACC, cannot develop.

It has been shown that the genetic machinery anticipates this problem by first forming the expected anticodon ACC, and then directing the enzyme adenosine deaminase to convert the N-6 amino group of adenosine to an O-6 group, thereby forming inosine (I). The resulting modified anticodon ICC very effectively recognizes Gly codon GGU in the translation process.

The characteristic shape of each subspecies of isoaccepting tRNA molecule is determined by the specific patterns of base-pairings which form among the 80 or more component bases in a tRNA molecule; also, the spatial orientation of an amino acid covalently bound to its unique subspecies of isoaccepting tRNA is controlled by the pattern of hydrogen bonds formed between juxtaposed O and N groups of the amino acid and certain bases of the tRNA. This multiple-bond linkage insures that the bound amino acid will be held in a specific 3-D conformation as it is presented to the ribosome by tRNA during the translation process.

This 3-D conformation for the amino acid, the conformer, permits the establishment of the proper hydrogen bonds, hydrophobic interactions, and disulfide bridging with the existing polypeptide at the moment of peptide bond formation. The loaded tRNA needs to hold its conformer burden on the ribosome

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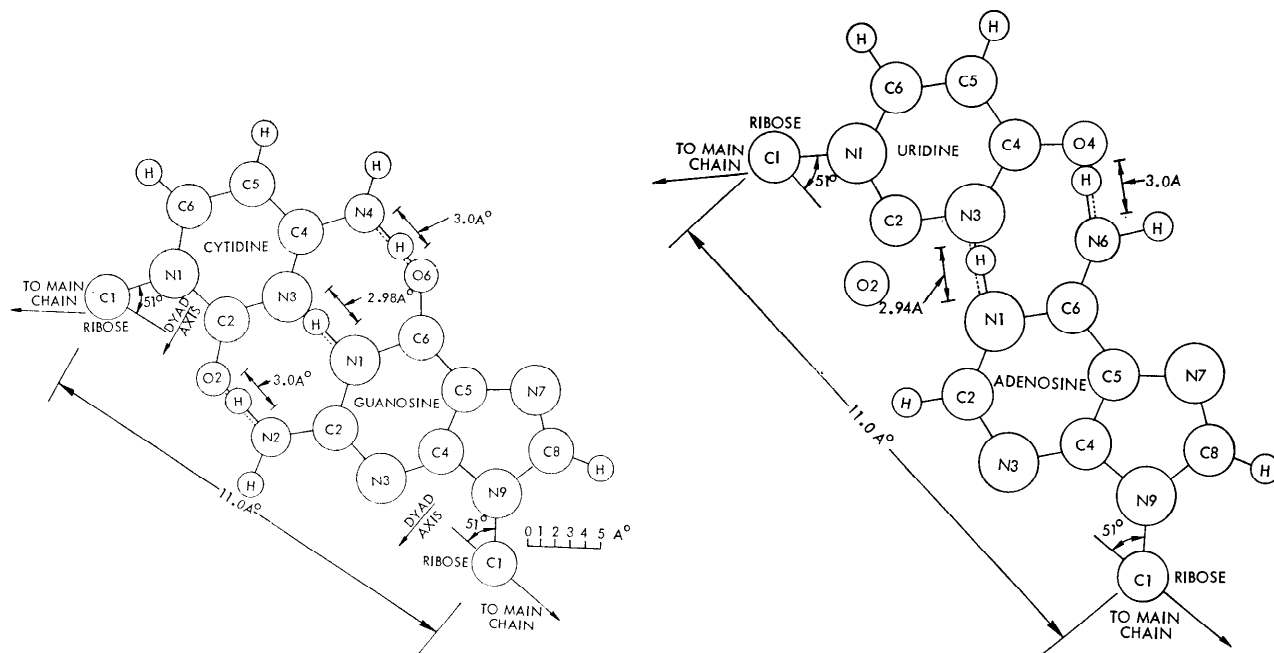


Figure 1. Watson-Crick hydrogen bond pairing of RNA bases between guanosine and cytosine (left) and between adenosine and uridine (right).

for only 1/50th second before peptide bonding is completed enzymatically, and the covalent linkage of amino acid to tRNA is broken simultaneously, also enzymatically.

In this direct control of polypeptide shape by specific mRNA codon sequences, each conformer is functioning as an analog of the corresponding codon.

The assignment of a conformer to each of the 64 mRNA codons was conducted in a somewhat arbitrary, but consistent, fashion as follows:

Step 1. As illustrated in Table 1, codons may be converted logically into analogous binary arithmetic numbers, or binary codons; in this system, the binary codon is the binary arithmetic complement of the binary anticodon, and vice versa.

Step 2. Since the hydrogen-bonding potentialities of codon and anticodon trinucleotides are determined by the relative distributions of electropositive and electronegative charges at contingent sites, a dynamic representation of the binary codon is an obvious re-

quirement for conversion of mRNA codons into conformer analogs. In other words, a method must be employed for conversion of the static "1" bits into functional representations of positive charges, and for conversion of "0" bits into functional representations of negative charges.

Since the electrostatic charges involved in H-bonding behave somewhat like small magnetic fields, it seemed feasible to represent "1" bits as N polarity, and "0" bits as S polarity of bar magnets. This conversion of binary codon to its equivalent magnetic codon is illustrated in Figure 2 which shows the spontaneous deflections of the array of magnets produced by interacting polarities.

Step 3. Since the conformer is considered to be the analog of the corresponding mRNA codon, it is logical to relate the angular deflections representing a given magnetic codon to a set of angular rotations of the corresponding amino acid that will give rise to the spatial orientation of the conformer. This conversion of rotational angles to representations of the

Table 1. Steps in conversion of codons into conformers. This same table was given in the article, "Evidence for the Existence of an Intelligible Genetic Code"; and is reproduced here for convenience.

Amino Acid Conformer	Trinucleotide Codon Acronym	Binary Codon	Magnetic Codon	Rotational Angles for Amino and Carboxyl Groups in x, y, z planes					
				0	0	0	0	0	0
Gly-1	GGG	000000	SSSSSS	300	300	300	300	300	60
Gly-2	GGA	000001	SSSSSN	0	0	0	0	270	0
Gly-3	GGU	000010	SSSSNS	340	340	340	340	70	70
Gly-4	GGC	000011	SSSSNN						

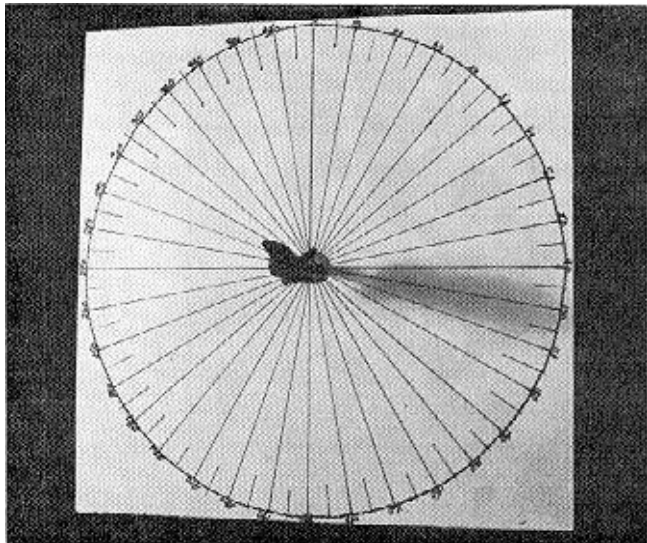


Figure 2. Device to convert binary codons to magnetic codons. A protractor is drawn on a board. At the center is an axle, on which magnets are placed so as not to prevent rotation. In the case shown here, it will be noticed that some are at 60 degrees, some at 300 degrees.

It might be remarked that the magnets, due to interaction, will move into a configuration in which their energy is a minimum, subject to the constraints. A similar principle applies to the interaction of electric charges, as is mentioned in the text. Thus the arrangement of magnets might be considered a sort of analogue computer, to investigate the interaction of the electric charges which, in turn, determine the interaction of the molecules concerned.

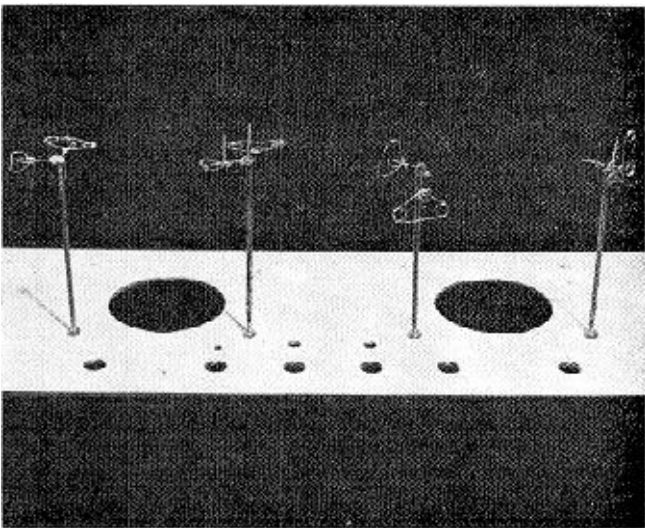


Figure 3. The four conformers of Glycine, as Kendrew Wire Scale Models, shown here in a top view. This is Figure 1 (b) of the article, "Evidence for the Existence of an Intelligible Genetic Code," reproduced here for convenience.

conformers of amino acids was carried out in the following manner:

A Kendrew wire model of the amino acid backbone (shown in Figure 3) was mounted on the stage of a Leitz-Wetzlar universal stage with the amino-terminus to the left on the east-west axis, as viewed from the normal position of a microscope operator. This amino acid conformation corresponds to the orientation of Gly-1 conformer that is shown in Figure 4.

All rotational angles were read clockwise, as viewed from above the "top-side" of the amino acid backbone. In a few cases, where the rotational angles were close to 180° , it was convenient to invert the entire instrument to facilitate setting the angles.

Reading from left to right, the six angles generated by magnetic codons were applied to the amino acid model as follows:

- Rotation of the amino group around the C^α , in the horizontal plane.
- Rotation of the amino group around the N- C^α axis in a plane that is perpendicular both to the horizontal plane and to the N- C^α axis.
- Rotation of the amino group about the C^α in a plane that is perpendicular to the other two planes.
- Rotation of the carboxyl group around the C^α in the horizontal plane.
- Rotation of the carboxyl group around the C'- C^α axis in a plane that is perpendicular both to the horizontal plane and to the C'- C^α axis.
- Rotation of the carboxyl group around the C^α in a plane that is perpendicular to the other two planes.

It will be noted that conformer Gly-1, which is the analog of the first mRNA codon for Gly, has the orientation of the reference amino acid backbone model since all angles produced by the corresponding magnetic codon, SSSSSS, are zero in magnitude. The remaining three mRNA codon synonyms for Gly, however, transform into Gly conformers with characteristic spatial orientations, as represented in Figure 4.

To facilitate orientation of scale models of amino acids into conformers, the Cartesian coordinates on X, Y, and Z axes were determined for each atomic center in each different conformer, using a scale of 1 cm per Å. As an illustration, the 3-D coordinates for the four Gly conformers are listed in Table 2.

Procedure for Assembly of Conformers into Polypeptides

Protein chemists have established a standard conformation of an amino acid as the reference position from which all angular rotations of the amino acids in a polypeptide may be measured. This standard conformation of an amino acid is that of Gly-1 conformer, as shown in Figure 4.

A second convention of protein chemistry is that in polypeptide synthesis, peptide bonds are formed to the right during genetic translation of mRNA; the C-2 group to the left links with the N-1 group of the next amino acid to be joined to the growing peptide chain.

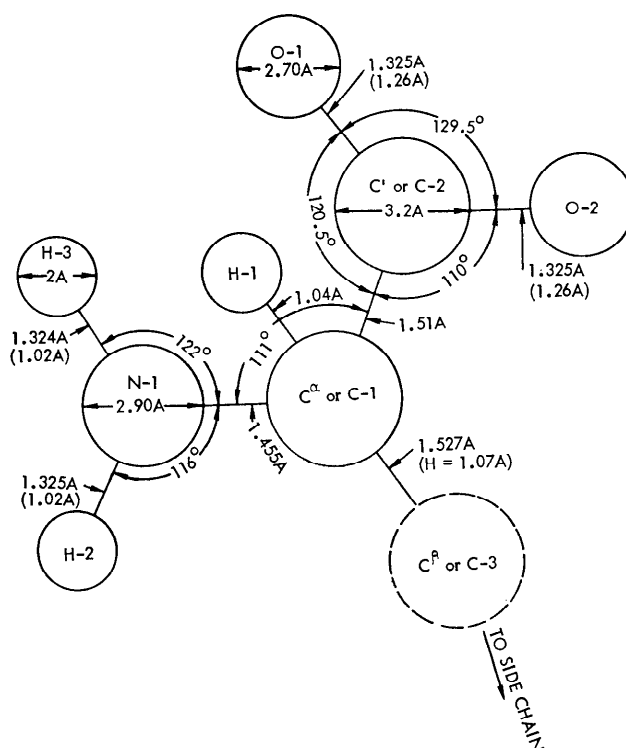


Figure 4. Amino acid backbone structure in standard reference configuration.

As mRNA translation starts, considerable freedom of choice exists for spatial orientation of amino acid residues forming the first peptide bond, for aside from avoiding steric hindrance, these amino acid residues need only abide by the restriction that their C-1 or C^α groups must lie about 3.8 Å apart. An additional restraint is introduced, however, as the second peptide bond links the third amino acid residue to the polypeptide, for now the second peptide bond must be formed in "trans" or staggered configuration with respect to the initial peptide bond.

To illustrate, if the first peptide bond involved O-1 of the first amino acid residue and H-2 of the second amino acid, the third amino acid must bond to O-2 of the second amino acid rather than to O-1; this trans pattern is continued on down the polypeptide chain of normal proteins.

As the polypeptide chain lengthens, the bulky side-chains of amino acid residues introduce additional restraints on the allowable conformations. When conformers are fitted together in peptide linkages, they must be able to anticipate not only how they should bond to their nearest neighbors, but also how they must position their sidechains to leave space for conformers yet to be added at much more distant regions of the chain.

When a specific mRNA codon sequence is translated into assembled conformers, as illustrated in Figures 2-5 of the article "Evidence for the Existence of an Intelligible Genetic Code," the individual conformers are held in their typical 3-D orientation until the peptide bond has been formed.

Table 2. Coordinates for glycine conformers.

GGG = 000000 = Gly-1

Atoms	X-axis	Y-axis	Z-axis
C.1	30.5	30.5	30.5
C.2	32.1	30.5	30.5
C.3	33.1	26.7	30.5
H.1	28.3	33.5	30.5
H.2	23.1	28.7	30.5
H.3	24.0	33.5	30.5
N.1	26.0	30.5	30.5
O.1	29.4	37.0	30.5
O.2	36.2	35.9	30.5

GGU = 000010 = Gly-3

Atoms	X-axis	Y-axis	Z-axis
C.1	30.5	30.5	30.5
C.2	31.5	30.5	25.3
C.3	31.6	30.5	34.0
H.1	28.8	30.5	27.5
H.2	23.8	30.5	33.1
H.3	23.3	30.5	27.7
N.1	25.5	30.5	29.8
O.1	28.5	30.5	22.4
O.2	36.0	30.5	25.5

C radius = 1.6A
H radius = 1.0A

O, N radii = 1.3A
C^a = C.1

GGA = 000001 = Gly-2

Atoms	X-axis	Y-axis	Z-axis
C.1	30.5	30.5	30.5
C.2	31.7	31.2	33.5
C.3	31.5	32.2	25.0
H.1	26.3	27.8	32.0
H.2	24.0	30.8	27.3
H.3	23.3	27.7	32.7
N.1	24.7	29.4	30.5
O.1	29.0	27.8	36.0
O.2	35.9	29.0	33.2

GGC = 000011 = Gly-4

Atoms	X-axis	Y-axis	Z-axis
C.1	30.5	30.5	30.5
C.2	33.1	36.0	30.5
C.3	29.0	28.3	26.4
H.1	30.8	32.7	32.5
H.2	27.3	26.0	34.5
H.3	31.3	31.2	37.1
N.1	30.5	29.5	34.0
O.1	32.7	36.5	33.2
O.2	33.5	36.2	26.0

C' = C.2
C^β = C.3

After assembly, the conformers must remain in their initial conformations to enable the normal hydrogen bonding patterns to occur. These hydrogen bonds are simulated by soldering connecting wires of 3.0 Å length between the H-bonded sites.

After the entire polypeptide chain has been pro-

duced, disulfide bonds can be inserted between the appropriate half-cysteine residues; the formation of these disulfide bridges usually requires that segments of the polypeptide chain must move with respect to the recognized "hinge" regions to permit the 3.75 Å disulfide bridge to form.

NEW CREATIONISTIC PUBLICATION

The journal *Origins* is now being published by the Geoscience Research Institute, Loma Linda University, Loma Linda, California 92354. The present intention is to publish it twice a year. Two issues appeared in 1974 and Volume 2, Number 1 was received recently.

The topics treated are of the same general nature as those in the C.R.S. *Quarterly*. Issues mentioned, for instance, have contained very good discussions of fossil trees, creation-flood model, "growth lines" in invertebrates, and C-14 age profiles for ancient sediments.

Appearance of another publication devoted to these matters is good news. The field which might be called, "Creation Science," is wide enough for many teams. And if creationists in various scientific disciplines work

faithfully, there will be results enough to fill several journals.

ANOTHER CREATIONISM PUBLICATION

The editor recently saw the publication, *Folha Criacionista*, published by the Sociedade Criacionista Brasileira, Caixa Postal, 274, 13560 Sao Carlos—S.P., Brazil. The particular issue was Volume 3, Number 6, April, 1974. It contained work by such well known authors to the Creation Research Society as William J. Tinkle and Edgar C. Powell.

An editorial mentions the distribution of literature, not only in Brazil, but also in other parts of South America. It is good to see the work of creationism being taken up in so many parts of the world.

—Contributed by Harold Armstrong

PANORAMA OF SCIENCE

Case of the Missing Tracks

Anyone who has done a course in Modern Physics knows about "tracks" in Wilson's cloud chamber, in which energetic particles, usually from radioactive material, are studied by the tracks which they leave, something like the vapor trails left by aircraft.

The tracks in vapor, of course, are ephemeral. In other experiments, tracks are left in thick photographic emulsion. These can be kept, and studied at leisure.

Tracks can be produced also in various other materials, and they may last for ages. In some studies, recently reported, it was hoped to find tracks, caused by natural radioactivity of surrounding minerals, in crystals of calcite which had formed in the marrow cavities of bones, supposed to be human or sub-human, found in South Africa.¹ The idea was that, the amount of radiation being known, the number of tracks would be proportional to the time for which the bones had been exposed. Thus it was hoped to determine the age of the bones.

In fact, though, few or no tracks were found. The explanation proposed is that the tracks have been annealed out. It is true that at high enough temperatures the tracks can disappear. However, it does not seem to have been shown that the bones had, in fact, been exposed to high enough temperatures to wipe out the tracks.

Clearly, there is an alternate solution: that the bones are not so very old after all.

Marks on Mars Not Necessarily River Beds

Some of the recent close studies of Mars seem to have revealed crooked marks, sometimes branching, on the surface. Some analysts, trying desperately to have living beings on other planets, have suggested that these marks are the beds of old rivers. They hope, of course, that if there was once more water on Mars there might have been something living there.

It has been urged lately, however, that these marks are more likely cracks, not river beds.² In the first place, careful examination shows differences between these marks and the beds of rivers on the Earth. Moreover, it is shown that cracks in various materials simulate these markings on Mars very well.

So the alleged evidence that Mars once had a climate like that on Earth seems to be very slight, if there be anything to it at all.

Incidentally, it appears that at one time there were those who held that certain marks, seen on the Moon, might have been caused by flowing water. Now that the surface of the Moon has been studied more closely, the notion that these marks are ancient river beds has been abandoned, although it is not yet certain what did cause the marks.³ Whatever the cause may turn out to be, does it not seem likely that the marks on Mars might turn out to have a similar origin?

Natural vs. Artificial Again

Recently authors of two very different sets of reports touch on the theme "natural vs. artificial."

The one has to do with the value of food.^{4,5} Ordinarily, in diets, etc., food is dealt with as if it were fuel, in terms of calories. Clearly something else is taken into account; there are doubtless a fair number of calories in sawdust, but nobody would think of putting it into a diet.

The weakness in considering only calories, it is maintained, is that the food has at least one other function besides acting as fuel. It has to provide for the construction and repair of the body. And it may be that calories alone give a rather poor indication of the suitability of some food for this job.

In the work described, rats were fed certain kinds of food, and their gain or loss of weight (if they survived at all), noted.

It was found that "... real values of food may differ greatly from what its mere analysis implies. . . ." For instance, whole milk showed about five times the food value of skim milk. There were some perhaps surprising results; eggs, for instance, from hens free on a range rated appreciably better than those laid by hens confined in batteries." There seems to be some superiority of the more natural things.

The second lot of investigations concern light. Studies at Sarasota, Florida, and elsewhere, give some evidence to show that plants, animals, and humans, may all be affected adversely if they are exposed to illumination that differs too much, in its spectrum, from sunlight.⁶ Under unsuitable illumination, it is reported, pumpkin plants may have only female blossoms, tropical fish may develop badly, and human beings may show both physiological and psychological effects. Here, too, it appears that the natural thing is best.

It may be asked, what has this to do with creationism? In the first place, if believers are commanded to do good to all, and are able to do good to people by bringing these matters to their attention, such action should be taken.

In the second place, creationists may have to meet, here, an argument which is sometimes heard in discussions about natural food. It is said that human beings (or the animals, or whatever is concerned) "evolved" to live under natural conditions, and on natural supplies.

If anyone should propose that, creationists can point out first that, just as a point of logic, the argument is faulty. Even though it be granted that if man "evolved," natural food would be most suitable, it does not follow that if natural food is better, that human beings must have "evolved."

As for those who are arguing in favor of natural food, etc., creationists can point out that it would be an even stronger argument to say that human beings were created, and the natural things were created for man's use, so of course they suit man. For any state of affairs that came about by design is better ordered than one that came about by chance, and this is no exception.

☆ ☆ ☆

Can We Believe Radiocarbon Dates?

Stanton's Cave is located in Marble Gorge at a

point 31.8 miles below Lees Ferry and 138 ft. above the present level of the Colorado River. Sedimentary deposits in this cave contain driftwood. The wood at the base of these deposits—coniferous, presumably Douglas-fir, and cottonwood—has an infinite radiocarbon age (radioactive carbon content below the level of detectability) and contains specimens with as many as 150 growth rings.⁷

At the extreme lower end of Grand Canyon, just inside the Grand Wash Cliffs, Rampart Cave is located approximately 650 ft. above the Colorado River. The base of a 137 cm deep stratified dung deposit on the floor of this cave contains bat guano and sloth dung that has an infinite radiocarbon age. Sloth dung in this deposit has a continuous sequence of radiocarbon age up to 10,000 B.P.⁸

The infinite age driftwood in Stanton's Cave could be remains of trees that were carried on the water surface throughout the Flood, or that were eroded from Flood deposits during early post-Flood time. It could also represent vegetation that grew immediately following the Flood under conditions of negligible specific C-14 level in the atmosphere. The data from Rampart Cave indicate that after the Flood bats and sloths arrived in the Grand Canyon area before the biosphere acquired a significant level of C-14.

The infinite age bat guano, sloth dung and driftwood in these caves could represent contemporaneous life in the Colorado River region during the immediate post-Flood period.

The first 37 cm of the deposit in Rampart Cave is spanned by radiocarbon ages between infinity and 40,000. The next 10 cm (between 100 cm and 90 cm depth) accumulated during the radiocarbon time period between 40,000 and 18,500. The corresponding average accumulation rate of less than five thousandths of a millimeter per radiocarbon year requires that only 840 cc (about 1¾ pints) of dung be spread throughout the cave per radiocarbon year.

An average sloth population or an average annual cave occupancy factor small enough to agree with such an accumulation rate is unreasonable. It is reasonable to presume that these dung deposits were made during a comparatively few years of real time while the C-14 activity in the biosphere was rapidly building up from a negligible (infinite age) level.

The 90 cm of dung deposit up to the present floor level of Rampart Cave was made over the radiocarbon age interval 18,500-10,500. For this interval the average increase rate is 1/9 mm of depth and about 20,000 cc (43 pints) per radiocarbon year. Since there are fresh-appearing sloth dung balls in the cave and there is no evidence of dung removal, this increase rate also suggests a dilation of radiocarbon age with respect to real time. According to this suggestion the specific C-14 activity level in the biosphere increased less rapidly between 16,000 and 10,000 radiocarbon years B.P. than it did prior to 16,000.

The data from Rampart Cave further indicate that the sloth population in the surrounding area was abruptly killed off after man arrived around 11,000 radiocarbon years before the present. Since radiocarbon years and real time have been adequately demonstrated to correlate within a few hundred years

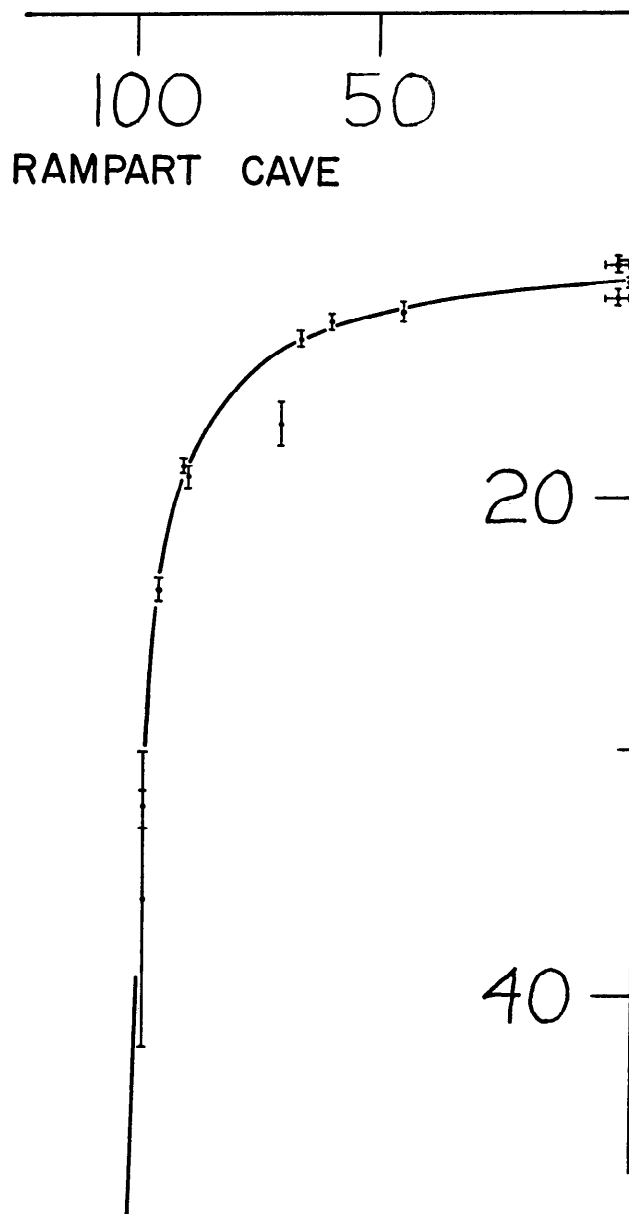


Figure 1. This shows the age, indicated by carbon 14, of animal dung from Rampart Cave (plotted vertically) vs. the depth in the layer from which the sample was taken. The ages are in thousands of years, depths in centimeters.

Noticeable is the fact that a centimeter of depth taken from near 100 centimeters seems to span a much greater period of time than one from closer to the surface. This can be another indication that the older ages, given by carbon 14, are grossly inflated.

as far back as the early part of the second millennium B.C.,⁹ the termination of the sloth population in the Grand Canyon area can be placed with confidence prior to 2000 B.C. real time. Placing the entire occupancy of Rampart Cave by sloths within 1000 years of real time requires a reasonable average dung depth increase of only 1.37 mm/yr and a corresponding gross accumulation rate of 530 pints/yr.

This is another case in which condensation of the range of radiocarbon ages into the time allowed by a short chronology interpretation of the Bible gives a

more reasonable view than is obtained by assuming a one-to-one correspondence between radiocarbon age and real time over a 50,000 year period.

—Contributed by R. H. Brown

Gastric Brooding

Is it possible that vertebrates may retain their young within the stomach? This is not a new question; and I recall more than two decades ago discussing the matter in an undergraduate class. In spite of the fact that snakes, for instance, had been observed engulfing smaller specimens and allegedly later disgorging them as healthy individuals, more careful observations indicated that those released had been unborn young which exited through the mother's vent or an open wound in her body.

It is true that various vertebrates including amphibians, birds, fish, mammals and reptiles, will capture, consume and digest eggs or young of their own species. And many fish are known to carry eggs in the oral cavity, but these eggs later will hatch because they are not swallowed.

So after due consideration of available information, members of the scientific community have believed until recently that, because of conditions in the digestive tract, it would be impossible for any living vertebrates or their eggs to survive very long after having been swallowed and having entered the gastric cavity.

However, now it appears that there may be a frog possessing the unique ability of ingesting eggs or tadpoles and brooding them in its stomach. From Australia has come a report¹⁰ of the recently-described Queensland leptodactylid frog, *Rheobatrachus silus*, a single captive female of which was observed ejecting from the mouth several living tadpoles and 18 days later some juvenile frogs. During the 18-day time interval, movement of the young within the abdominal cavity could be observed.

After the tadpoles and juvenile frogs had been disgorged by the adult female, this adult was dissected. The stomach was found to be very large, thin-walled and lying in the median region. So it appears that the young were retained within the stomach for at least 37 days, the adult's time in captivity.

Such observations raise many questions. For instance, what physiological mechanisms would be involved in shutting down the normal digestive activities of the stomach and converting it into a brood pouch? This question alone suggests considerable research involving hormones and the nervous system. Then there is need for more complete understanding of the trophic needs especially of the tadpoles which apparently would obtain food from their eggs. So the heuristic value of this report of gastric brooding is great and considerable collection pressure upon the frogs might be expected.

It will be of interest to see if the observation of gastric brooding is confirmed; and if so, to learn more about the mechanisms involved. Some may call upon chance as the "god" who produced such phenomena. As with so many other of the well-integrated body functions, creationists indeed can recognize these

events as part of God's design and part of the creation over which He maintains control.

—Contributed by Wayne Frair

Acceptance of the Evolution Theory Can Result in Costly Errors in Basic Breeding Emphasis

The column, "Feedback," in the *New Scientist*¹¹ continues a most interesting story of the costly false claims made concerning a gamma radiation induced mutation in wheat called "Sharbati Sonora." What is not sufficiently stressed in this article is that it was the enthusiastic acceptance of the concept that evolution is the result of the natural selection of mutations, that led to the lack of critical evaluation of this mutation by the various scientists involved.

The man who made deceitful claims for the gamma radiation induced Sharbati Sonora was the powerful Dr. Monkombu Sambasivan Swaminathan, director general of the Indian Council of Agricultural Research (ICAR) and highly influential in the world food community. The story might never have been revealed had it not been for the campaign of a retired F. A. O. scientist, Dr. Ronald A. Silow.

Swaminathan's false claims gave a vital boost to the U. N. Food and Agricultural Organization's (F.A.O.) International Atomic Energy Agency (IAEA) joint division of the Atomic Energy in Food and Agriculture which was coming under increasing attack for producing no results, and wasting its nearly £ 1 million per year budget. Briefly the story is as follows:

In 1963, Dr. Norman Borlaug of the International Maize and Wheat Improvement Centre in Mexico (Cimmyt) distributed the dwarf wheat varieties for which he won the Nobel Prize in 1970. Dwarf varieties made possible plants with larger heads of grain that did not collapse as had plants of tall varieties. Accordingly more fertilizer and water could be used in growing the dwarf plants, and yield more than doubled.

One dwarf variety, Sonora 64, proved highly suitable for late sowing in India, but it was red instead of the amber grain preferred in India, and thus gave the chapati (bread) an unacceptable color, which meant a lower price.

In November 1963, a team headed by Swaminathan at the Indian Agricultural Research Institute (IARI) subjected some Sonora 64 seeds to a combination of gamma radiation and ultra violet light. In 1967, Swaminathan made the spectacular announcement that one of the mutants produced had, with one dose of radiation, been made better in four different ways!

Not only was the new mutant wheat, which he called Sharbati Sonora, the regular amber, but it was *higher* in both protein and lysine than the parent Sonora 64, and had better baking qualities. Lysine is usually low in plants, and thus often deficient in vegetarian diets. False claims for high protein were made at the New Delhi symposium in 1967, and in the *Food and Industries Journal*, November 1967, for 4.61 percent lysine as compared to only 1.86 for Sonora 64.

Almost immediately Edwin Mertz and Oliver Nelson of the Purdue University, the man who developed high lysine maize, showed by analysis that Sharbati

Sonora had only 2.6% lysine compared to 2.5 for Sonora 64. Tests at the University of Nebraska showed it had slightly less lysine than Sonora 64.

Finally the *Cimmyt News* (July-August 1969) reported that "in no case was there a significant difference between the normal varieties and the mutation." Not only was the lysine about the same (2.9 per cent) but so was total protein; 14.6 percent for Sonora 64 and 14.25 for Sharbati Sonora.

The irony of all the false claims was that Sharbati Sonora may not be radiation mutation at all! Cimmyt uses it as a breeding stock in place of Sonora 64, treating it as a single gene mutant differing only in color. Such mutants *occur naturally*, and it could well have been a natural mutation which showed up in the radiated Sonora 64 seeds independently of the gamma rays.

In August, 1971, Swaminathan won the Ramon Magsaysay Award of \$10,000 for his contribution as a scientist, because he had recently developed a dwarf wheat variety, Sharbati Sonora, with amber grain containing 16.5 percent protein and 3.0% lysine.

Yet by this time both Sharbati Sonora and Sonora 64 were on the way out since both are so *susceptible to rust!* So in the late 1960's they were almost completely replaced by rust resistant strains from Cimmyt.

In spite of all these developments, in January, 1972, Swaminathan became director general of ICAR which oversees the IARI and other research institutes. Probably the whole Sharbati Sonora story would have been forgotten (or suppressed?) had it not been for the suicide of Dr. Vinod H. Shah, who in his 600 word suicide note to Swaminathan wrote:

I think the time has come again that a scientist will have to sacrifice his life so that other scientists may get proper treatment. . . . A lot of unscientific data are collected and passed on to you to fit your line of thinking.

It is now generally agreed that the first erroneous lysine measure occurred because a newly established analytical laboratory had difficulty with the complex test. "That initial report probably started the whole miserable mess," commented Professor Nelson, "After trumpeting the triumph of nuclear energy applied to plant improvement, no one was willing to admit the report was erroneous."

On an international level the most dramatic effect of Sharbati Sonora was to save the flagging FAO/IAEA atomic energy program. An article favorable to the program appeared in the *New Scientist* (Vol. 45, p. 450) in 1970 declaring that Swaminathan's "team has been one of most successful in applying the induced mutation technique." Three years ago Borlaug wrote:

Unfortunately, many of the data used to convince the governments of the value of (nuclear) mutation breeding were based on the ill-founded case of Sharbati Sonora. . . . Not only has an unrealistically large portion of the total research budgets of these countries (developing nations) been committed to mutation breeding, but many of the best scientists have been siphoned off into these government programs. This disease is now spreading to many of the smaller developing nations.

Though some dwarf varieties have been produced in mutation breeding by radiation induced mutation, Silow deputy director of the joint FAO/IAEA until 1966, has argued that it is much cheaper to search for natural dwarfs.

"If one-tenth of the money that was spent on mutation breeding was spent on searching for genetic variation that already exists, then plant breeding would have gone a great deal further," declared FAO's Dr. Erna Bennet.

Basically all of these scientists working in radiation induced breeding are believers in it because they accept the "evolution theory." And proponents of evolution of course propose that evolution proceeds by the natural selection of mutations. Hence it would follow according to their thinking that *increasing the number of mutations* by radiation should greatly speed up the breeding programs. Yet as I reported on my own research on neutron radiation induced variation in roses, "biologically all of the (induced) mutations were defective variations from the pattern of development characteristic of the variety radiated."¹²

It is too bad that these various scientists have not read the *Creation Research Society Quarterly* articles in which authors have pointed out the inadequacy of the mutation theory of evolution. A great deal of money would have been saved and much faster progress in plant breeding would have resulted.

By looking at the various species of plants as the result of creative design, and then by using the very great amount of existing variation within each species, plant breeders actually do make great progress. In this way the DNA patterns of the various species of a genus can be brought together. Even though partly inharmonious in their interaction, at least enough fertility is usually shown so that some recombination of characteristics can be obtained, such as the transfer of disease resistance from one species of rose to another having a lovely red colored flower of good form.

The very great success of the various F₁ hybrid flower seeds of the petunia, snapdragon, Dianthus, geranium, and Ageratum produced by Glenn Goldsmith of Gilroy, California, and the hybrid Portulacas of David Gilbert of St. Ana, Costa Rica, are proof of the great value of this basic approach in plant breeding. Similarly in vegetables the F₁ hybrid tomatoes are truly remarkable in their productivity.

My own roses such as Queen Elizabeth, Chrysler Imperial, Charlotte Armstrong, and the relatively new 1974 All American Rose selection, Bahia, were all F₁ hybrids. Bahia especially resulted from a very wide cross of the floribunda Rhumba with the hybrid tea called Superstar in Europe and Tropicana in this country.

Let us hope that government plant breeders will give up their attachment to radiation breeding and so-called plant evolution, and will become more practical in their basic approach.

—Contributed by Walter E. Lammerts

The Problem of Animal Descent

In the article in this issue entitled, "Conducting Vessels in Plants: Problems for Evolutionists and Creationists," Howe states quite truly that plants do not

give valid examples of "evolutionary" descent. It is true that in animals also, evolutionists encounter this difficulty. The different kinds **cannot** be arranged in an ascending gradient according to their structure. In many a "first course" in zoology the order of study is somewhat like this: Amoeba, Volvox, Hydra, Planaria, earthworm, grasshopper, clam, squid, starfish, perch, frog, lizard, cat and man.

Usually much emphasis is given to the suggestion that each type of animal is much like the former one only a bit more complex; and the instructor concludes that it actually is a descendant of the former type in the list. Even if true, however, such a gradient would not be proof that evolution occurred—only a suggestion—and would leave other difficulties.

The fact is that the animals in the above list represent types rather than illustrating a gradually increasing complexity of structure. In the century since Charles Darwin biologists have learned that even one-celled animals are complex in structure and accomplished in their life processes. The gastric vacuole of an Amoeba looks like a mere bubble, but digestive enzymes are added from the surrounding cytoplasm and the food is digested as well as in the stomach of a dog.

Hydra appears simple, just a tube with fringes at one end, but nematocysts are a kind of harpoon which can be shot out either to pierce an enemy or to entangle it in fiber. This complex structure is not developed further and used in "higher" animals; outside the Coelenterates it is not found.

Is the earthworm a descendant of the grasshopper, or is the reverse true? The earthworm has a complete system of blood tubes while the grasshopper has large arteries which empty the blood among the internal organs. The grasshopper has teeth, eyes, and skeleton which might place it "above" the earthworm, but the latter has a complex mode of reproduction. A wide band of skin loosens and slips off, receiving eggs and sperms as it goes. As the ends are pinched together, the band of skin becomes a capsule, a snug home for the developing worms inside. How the dogma of evolution would be strengthened if so-called "higher" animals inherited this complex process in an improved form! But it is found only among the Annelid worms.

Is the earthworm the grandfather *in one respect* while the grasshopper is ancestral in another respect? This is foolishness. Neither is ancestral; they are just different.

It is hard to think of a clam as being a worm or insect with just a little more development. It has no brain or nerve cord but three pairs of ganglia connected by nerves. Its skeleton is external, yet very different from that of the grasshopper. Colorless blood, if taken as a criterion, would place the clam below the earthworm; and the earthworm, having hemoglobin, might be placed in the vertebrate group. However, biologists take bones as the criterion of classification.

Paleontologists still cling to Darwin's hazy ideas of change and turn their backs on genetics. They accept the fact that the only way for significant change to occur is through mutation; but such a change re-

sults often in crippling, and quite regularly in loss of vigor. If 51 percent of mutations were favorable to increased vigor and reproduction, "evolution" might have a little scientific basis; but the agreed portion of beneficial mutations is only 1 percent. And it is very hard to identify even that small portion.

In the nineteenth century, certain persons formulated what they wished to believe about the nature of the world of life, and called it evolution. When they went to nature in search of examples to support their fabricated concept, many difficulties, both in plants and animals, were encountered. The claim that one complex type of animal developed into another resulted in endless debate among scientists as to which came from other. It is more logical to believe that they arose independently during Creation week.

—Contributed by William Tinkle

Plants Show Internal Communication Between Parts

In a fascinating article, R. G. S. Bidwell has reported on a possible mechanism by which plants control the production and movement of sugar fuels in plant tissues.¹³ While many ideas of interest by creationists are developed in the paper, perhaps the most striking is strong evidence to show how buds secrete a plant hormone (indole - 3 - acetic acid) when they begin to grow. The hormone, in turn, moves to the nearest leaf and stimulates that organ to carry out photosynthesis more rapidly. In short order, sucrose is translocated from the leaf back to the developing bud so that it grows effectively.

Here is a hormone control system in which one plant organ, a bud, triggers definite responses in another organ, a leaf. While this can hardly be called a nervous system, it is certainly a strikingly coordinated sequence. It shows that plants, as well as animals, have internal chemical controls which can be interpreted as a Creator's wise design.

Just as this system of chemical communication is hardly a nervous system; so the conducting system in plants is not a circulatory system, such as many animals have. They differ in two important respects, in that in the plants:

- (1) there is generally no return flow, but rather one-way transport of water in the xylem, and
- (2) there is no pump comparable with the heart of an animal.

As far as botanists can tell, the transport of water, for example, to the top of a tall tree involves evaporation of water from leaves, which is coupled with cohesion of water and tension within the minute water columns or xylem vessels. But this consideration becomes even more of a piece of evidence of creative providence—plants transport water great distances against the "pull" of gravity without the assistance of a pump.

Thus, in matters of control and transport, plants are unique. In every case living organisms manifest systems which could not have developed by chance in response to environmental conditions as evolutionists claim in clinging to their dogma of natural selection. Rather, the evidence can be interpreted much

more effectively that each organism was designed as a functioning entity in the environment, and designed for the way of life for which it was intended.

—Contributed by George F. Howe

One of the facts which supports our belief in Creation is the second law of thermodynamics, which says, or can be put into a form that says, that natural processes work in only one way. Heat flows from hotter to colder objects, but not the other way. Water runs down hill, but not up. (Of course, one could pump it up. But the pump might well be driven by electricity, and one might find that to provide the electricity more water went downhill somewhere else.) The net effect is always a levelling out, a loss of uniqueness everywhere. This is admitted in many books on physics and on the philosophy of science, under the heading of "the arrow of time."

Now any living being, if proper precautions are not taken, would die, and decompose into simple chemicals, in what is evidently a natural process. So the process in the other direction, the natural origin of living things from dead chemicals, could not have happened naturally. No more could the uniqueness found in living things have arisen naturally from a few simple forms.

These observations are nothing new. King Hezekiah knew that natural phenomena go in only one way. When Isaiah asked him whether, as a sign from God, he would have the shadow on the sundial go forward or back, Hezekiah replied: "It is a light thing for the shadow to go down ten degrees: nay, but let the shadow return backwards ten degrees." In other words, Hezekiah was saying that it is not so remarkable for a natural process to be speeded up. Nowadays, that is accomplished as a matter of routine in chemis-

try, with the help of catalysts. But if a natural process goes backwards there is something more than nature at work.

More on Tychonian Theory

Bulletins of the Tychonian Society are published irregularly by the Editor and Publisher, Mr. Walter van der Kamp, 14813 Harris Road, Pitt Meadows, British Columbia, Canada. An outline of the thesis maintained will be found under "Airy's Failure Reconsidered," in the article by George Mulfinger in 1973, "Review of Creationist Astronomy," *Creation Research Society Quarterly*, 10 (3):170-175.

The Tychonian theory might be considered as partly geocentric and partly heliocentric: geocentric as concerns the earth, sun, and moon; heliocentric as concerns the rest of the planets. Since it is like the heliocentric theory with a different viewpoint, it can of course, "save the appearances," as Plato used to say.

There are deep incidental questions raised about such matters as the nature of gravitation and the propagation of light. Since men, such as Dingle, Essen, Brown, McCausland, and others, are urging that these questions were closed prematurely, and should be re-opened, much of interest may come out of discussions of such questions.

Creationists believe what Scripture teaches. Mr. van der Kamp holds the geocentric view for the same reason. Yet creationists may or may not be persuaded that he is interpreting the Scripture properly. But let these things be considered carefully and in a true Christian spirit, lest some be found fighting against God.

—Contributed by Harold Armstrong

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BOOK REVIEWS

Many Infallible Proofs by Henry M. Morris. 1974. Creation-Life Publishers, San Diego, Calif. 381 + ii pp. Price \$4.95.

Reviewed by Erich A. von Fange*

This book is the quiet and confident testimony of a man who is at home in science and even more so in the Scriptures. The Bible is "incurably historic" despite the skeptics. The book is intended to strengthen the faith of the reader, to prepare him to witness effectively to the present generation, and to equip him to maintain an uncompromising stand on the full integrity of God and His Word.

Chapters deal with Old Testament prophecy, the uniqueness of Christ in His birth, life, death, and resurrection, and are intended to edify the reader in a day of compromise and uncertainty.

Of interest to *CRS Quarterly* readers are chapters on the Bible and science, fallacies of evolution, creation and the flood, and the Bible and ancient history.

Two topics are reserved for appendices: numerical designs in the Bible, and the book of God in the heavens; and these deserve some comment. Numerology can be a treacherous and vain pursuit. We must recognize, however, that the ancients were obsessed by numbers, and certain significant numbers play important but not fully understood roles in the Scriptures. Morris attempts somewhat apologetically to treat important number concepts without crossing the line into numerology. This treatment deserves study.

Similarly, the topic of stars and constellations is treated a bit gingerly. One can demonstrate that the ancients were fully acquainted with the heavens, and that the stars played an important part in the life of people. It is unfortunate that astrology has obscured a valid kind of preoccupation which ancient man had with the stars.

Morris treats some of the many Scriptural references to the stars, and a possible Christian interpretation of constellations known to the ancients; and this material is worth considering. As a sidelight, it is interesting to note that "consider" means "to consult with the stars."

Each chapter has a well-selected bibliography. There are three valuable indexes: subjects, authors, and Scriptures.

☆ ☆ ☆

The Truth: God or Evolution? by Marshall and Sandra Hall, 1974. The Criag Press, Nutley, New Jersey 07110. 186 + iv pages. Price, \$2.95.

Reviewed by Douglas E. Cox*

Evolution comes under a crushing attack in this book of logical reasoning and penetrating insight. The main reason people believe in evolution is because it seems to have the weight of scientific "authority" behind it. The scientific evidence for evolution is analyzed under the headings spontaneous generation, mutations, natural selection, kinds, fossils, and time.

Evolution clearly rests upon the supposed occur-

rence of spontaneous generation. Mutations, essential for evolutionary thinking, are known to cause only harmful or deadly changes, and natural selection eliminates variations, contrary to evolution. The mathematical probability for evolution to have happened is zero. Admissions of evolutionists themselves disprove evolution.

Only like kinds can reproduce, and the intricacies of DNA prove evolution could not have happened. Hoaxes (old and new) of "fossil men" and missing links provide no evidence to support evolution. The authors use the two laws of thermodynamics to show that no logical basis for evolution exists.

Only two viewpoints, evolution and creation, can be used when someone attempts to account for the origin of life; so disproving one establishes the other as true. The authors use evidence from a variety of fields, including the human eye, monkeys, the cow, thumbs, and the bark of trees to illustrate intelligent planning and design in nature.

Having been converted from evolutionary and leftist views themselves, the authors ably expose the inroads that evolution has made in science, education, modern behavior, and philosophy; and show how a belief in evolution favors communism. They outline some of the effects to be expected when confidence in evolution collapses, anticipating "world shaking changes" when evolution is thoroughly discredited. Because of the dominance of evolutionary thought in the intellectual world, science will lose a lot of its present status.

Comparing evolution with religious dogma, the authors contend that the "evolutionary theorists rest their case on a fantastic array of assumptions, postulations, and speculations which not only have no scientific support, but are actually refuted at every step by unassailable scientific laws."

The authors question the legality of "the daily perpetuation at taxpayers' expense of a religious myth based on faith alone."

Nihilism in today's youth has resulted from the teaching of evolution in schools. The climate for learning will improve when some purpose for life is discovered. Educators must replace the philosophy of Dewey, who based his views on evolution.

Freud's impact on modern behavior, particularly sexual matters, likewise has its roots in evolution. Communism, also, is based on evolution and the authors present a formula for its destruction. Philosophy, as a result of debunking the evolutionary theory, "no doubt will have a much more positive message as it moves from nihilism toward the logic of God, a logic which will be irresistible to mankind."

This is an exciting, concisely written book. It is evolutionists that shame-facedly cling to faith and backtrack into incoherent nonsense. The Halls have rendered an invaluable service for truth. The touch of humor throughout the book, the secular approach, and clear thought on an issue of prime importance make it a "must" for everyone.

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Scientific Creationism (General Edition), prepared by the technical staff and consultants of the Institute for Creation Research, edited by H. M. Morris. 1974. Creation-Life Publishers, San Diego, California. Price \$5.95 cloth, \$3.95 paper.

Reviewed by Gerald Seguin*

The purpose of this book is to provide school teachers and others with scientific, philosophic and religious arguments for creation and to point out some of the fallacies of evolution. Most of the ideas presented may be found elsewhere in one form or another and one of the objectives of this book is to gather this information under one cover.

The book is not meant to be highly technical and so everything is kept pretty well at the qualitative level. With the aid of the many references the interested reader may supplement this lack of technical arguments.

The approach of the book is to set up two models of the universe; the creation and the evolution models; and then to test the validity of each model by comparing specific predictions of each with existing data.

The bulk of the book is taken up with showing that the creation model fits the facts better than the evolution model. Many cogent arguments are brought forth to establish this point. Among these the discussion of geochronometers is very valuable. The conclusion from this particular discussion is that the earth is probably very young geologically speaking. Any one can see the tremendous implications of this fact, that is, all evolutionary theories are meaningless without immense time.

Another important topic covered is that of the fossil record since this is where the main "evidence" for evolution lies. The systematic gaps of the fossil record are clearly brought out, a fact hard to be accounted for if evolution were indeed true. Another more probable explanation of the fossil record is presented.

One point discussed at length, which in my opinion carries less weight, is the improbability of evolution. The reason the argument carries little weight is that it assumes evolution to be an open system; whereas it is commonly supposed to be a "feedback" system whereby only those organisms which pass a test (provided by the environment) be reintroduced into the environment. To cut off this loop is to cut off one of the main arteries of evolution.

To ask what is the probability that a horse could have evolved without the feedback mechanism suggested is somewhat similar to asking what is the probability that men could have invented the digital computer assuming that each generation destroys all previous knowledge acquired instead of passing it on to the next generation. If such a number could be computed it would clearly be meaningless. Perhaps the proposed feedback is what needs to be attacked.

Another point to be criticized is the often repeated statement "but the creation model predicts . . .". In

most cases it is not very clear how the creation model predicts whatever is suggested as a prediction. A lot of these so-called predictions were *explicitly* built into the model and so can hardly be called predictions. The phrase "... compatible with the creation model . . ." might have been better.

Barring these two criticisms, the book should prove very useful and is a welcomed addition to the class of books dealing with this most important subject. May it bring glory to God the Creator.

(It may be noted that there is a Public School Edition of this book, which contains no references to the Bible, and presents the case for creation on a purely scientific basis. It should be acceptable in any school; and ought to be present in as many schools as possible.—Editor)

☆ ☆ ☆

Human Engineering by John Lenihan. 1974. Weidenfeld and Nicolson, 11 St. John's Hill, London SW 11, England. 210 pages. Price £ 3.00 (about \$7.50).

Reviewed by H. L. Armstrong*

The title of this work does not mean "genetic engineering," i.e., meddling with God's Creation, but rather the consideration of the human body as the result of a design, just as an engineer might design a machine.

Some of the topics discussed include: bones as structural members; the lubricating system at the joints; muscles as engines; and, of course, the senses. All of these provide striking analogies to actual or possible engineering problems.

It is pointed out that any of three situations may be found. In some cases, the engineering solution and that found in the body are not too much different. For instance, apparently the excellent mechanical properties of bone are due to a principle which has been applied artificially not so long ago—that of a composite material. It is suggested, in fact, that bone is something like fiberglass. The result is that bone is, for an equal weight, stronger than steel.

In other cases, the obvious engineering solution of a problem is impracticable in the body of a living organism. An example would be wheels for locomotion; although, indeed, legs are advantageous anyway for locomotion over rough ground.

There are yet other cases, such as the kidney, which, as the author says: "... displays a mastery of chemical engineering and fluid mechanics which the technologist envies but cannot emulate."

The author refers occasionally to evolution; although how he can note all of this design and still believe in evolution by accident is beyond me. Here, as elsewhere, appeals to evolution are really of little help in explaining features. But the book is not blatantly evolutionistic.

In summary, here is an interesting collection of fact and observation, which could be useful in any collection or library.

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LETTERS TO THE EDITOR

Comment on "Beginnings"

Mr. Tilney's article on "Beginnings" is of considerable interest.¹ It may be of further interest, in regard to points on which Scripture gives little information, and on which we have to speculate, to compare what is contained in such apocryphal books as the Book of Jasher, the Book of Jubilees, and the Book of Adam and Eve. These three books do not entirely agree with one another; and, of course, no one claims that they have the same authority as canonical Scripture. But they may contain authentic information from sources now lost.

The Book of Jasher contains "Adam knew his wife Eve, and she bare him two sons and three daughters" (1:12). And in addition:

And (2:33) at that time (after the Lord had passed sentence on Cain) Cain went out from the presence of the Lord . . . and he went moving and wandering in the land toward the east of Eden, with all belonging to him (2:34). And Cain knew his wife in those days, and she conceived and bare a son, and called his name Enoch (2:35). And at that time Cain also began to build a city.

According to Jasher 2:1, "And it was in the hundred and thirtieth year of the life of Adam upon the earth, that he again knew Eve his wife, and she conceived and bare a son in his likeness, and in his image and she called his name Seth. . . ."

Whom did Cain marry? Neither the Bible nor Jasher contain the answer; but in the Book of Jubilees:

(4:1) And in the third week in the second Jubilee she (Eve) gave birth to Cain, and in the fourth she gave birth to Abel, and in the fifth she gave birth to her daughter Awan (4:2). And in the sixth year of the second Jubilee Cain slew Abel because God accepted the sacrifice of Abel, and did not accept the offering of Cain.

(4:4) And the Lord reproved Cain because of Abel, because he had slain him, and He made him a fugitive upon the earth, because of the blood of his brother, and He cursed him upon the earth.

(4:7) And Adam and his wife mourned for Abel four weeks of years, and in the fourth year of the fifth week . . . Adam knew his wife again, and she bare a son, and called his name Seth.

(4:8) And in the sixth week he begat his daughter Azura.

(4:9) And Cain took Awan his sister to be his wife, and she bare him Enoch.

(4:10) And Adam knew Eve his wife and she bare him yet nine sons.

(4:11) And in the fifth week of the fifth Jubilee, Seth took Azura his sister to be his wife.

The Book of Jasher speaks of three sons and three daughters of Adam. Syncellus (1:18) assigns to him 33 sons and 27 daughters.

The Book of Adam and Eve—a translation from the Ethiopic (1882) by Rev. S. C. Malan, D.D.—men-

tions in Chapter 74 the birth of Cain and a twin daughter whom they named Luluwa. Chapter 75 mentions a second set of twins: the son named Abel and a daughter Aklia.

According to this book Cain was 17½ when he killed Abel, who was then 15½. It states also that Adam and Eve did not come together again after the death of Abel until seven years later, when the resulting child was named Seth. Also, according to Book 2, Chapter 2: "As for Adam, he knew not again his wife Eve, all the days of his life, neither was any more offspring born of them, but only these five: Cain, Luluwa, Abel, Aklia, and Seth alone."

Thus these several different sources—not saying how true some of them may be—can be of interest if read along with the Bible source, which is admittedly quite sketchy in parts.

I have wondered, incidentally, whether the "mark" of Cain could have been a change of color for him. Such a mark, perhaps, would have successfully hid him from any family avenger.

Reference

¹Tilney, A. G. 1974. Beginnings, *Creation Research Society Quarterly*, 11 (2):104-107.

With kind regards, Sir,
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☆ ☆ ☆

On the Date of the Flood

Johnson, in his recent article, stated that the Bible does not give the year of the Flood.¹ It is true, of course, that it is not stated to have happened in such and such a year B.C. However, it is stated to have been the six hundredth year of Noah's life, which, from the genealogies, comes to be 1656 A.M.

On the other hand, it is possible to work backwards, using the chronologies and genealogies, to get a date not far from, although not identical with, that given by Ussher. In fact, from such a calculation, 2520 B.C. can be determined for the date of the Flood, as will be shown.

The Bible is very brief at times. However, dates of events may be corroborated by books such as Jasher, which goes into great detail concerning some of these events. These include, for instance, the birth of Abraham, the offering of Isaac, and the life and bondage of the Children of Israel in Egypt. Of course, no one claims that such books as Jasher have the authority of canonical Scripture, but they may well embody valid traditions.

It is generally considered that the destruction of Jerusalem and the Temple, and the end of the Kingdom of Judah, was in 586 B.C. This was 507 years after the appointing of Saul as the first King of Israel. Before this the nation had judges for 330 years; and

previously, the Elders were set up for a period of 17 years. This takes us to the death of Joshua who died 28 years after the crossing of Jordan; which, in turn, was 40 years after the Exodus from Egypt. Now, so far we have gone back 922 years from the fall of Jerusalem in 586 B.C.; so adding this on gives 1508 B.C. for the Exodus. The Children of Israel were in Goshen (Egypt) for 430 years (Exodus 12:40 and 41); Jacob (Israel) was 130 years old when the Israel clan entered Goshen (Genesis 47:9); and Jacob was born when Isaac was 60 years of age. Isaac, in turn, was born when Abraham was 100 years old; and Abraham was born 292 years after the Flood. Adding all of these dates results in 2520 B.C. for the date of the Flood.

Incidentally, a striking feature of this date is the fact that seven cycles, or seven "times," are given for God's plan from the Flood to Christ.

Reference

¹Johnson, G. L. 1974. The Genesis Flood and the geological record, *Creation Research Society Quarterly*, 11 (2):108-110.

Faithfully yours,
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☆ ☆ ☆

Authors of these two Letters have referred to the Book of Jasher, which is mentioned in the Old Testament, in Joshua 10:13 and 2 Samuel 1:18. It has commonly been supposed that the book has been lost since ancient times. A correspondent tells me that Fairbairn's Bible Encyclopedia says that a forgery was issued about 1750. The volume which I have seen, however, and to which I suppose, the letters refer, carries dates of about 1830 and 1840. In the Preface it is admitted that forgeries, purporting to be the Book of Jasher, have appeared, one of them, presumably the one mentioned above, about 1750.

On the other hand, it is certainly not impossible that a book, which had been lost for centuries, might be re-discovered. The Book of Enoch, for instance, was lost to much of the world until it was found in the Ethiopic. And Aristotle's Athenian Constitution was lost from antiquity until a manuscript was found in the last century. Again, there are those who maintain that Deuteronomy and Daniel are forgeries.

Presumably good policy, concerning all non-canonical books, is to look at them and to use tentatively the information found, provided it does not disagree with Scripture or with common sense. As a matter of fact, neither of the two Letters here depends exclusively or mainly on the Book of Jasher.—EDITOR.

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On the Confusion of Tongues

Both Dr. D. A. Courville¹ and Mr. J. E. Strickling,² in referring in the *Quarterly* to the confusion of tongues, have used the same Assyrian account, which is similar to the Biblical account in Genesis 11:1-9. Dr. Courville used a reference³ from 1876; Mr. Strickling one⁴ from 1901.

I should like to bring to the readers' attention a more recent reference⁵ to a Sumerian version of the story of the Tower of Babel. This version seems much clearer about the confusion of tongues than the Assyrian version mentioned above. It is very clear in

saying that until the confusion of tongues man had spoken with one tongue.

I should question Mr. Strickling's interpretation (page 100), where he implied that since God confused the language of all the world, there is no reason to suppose that the population of the world was confined to the area of the Tower of Babel. Genesis 11:1-9 seems to imply that all the people of the world were yet one, with one language, and as a result of the confusion of tongues were scattered over "the face of all the earth."

Also, Mr. Strickling seems to have found legends of the story of the Tower of Babel from only Mesopotamia and North America. There is evidence of such a legend from Indonesia (New Guinea) which makes mention of a tower, a god's anger, and the scattering of people over all the earth.⁶

More research will undoubtedly bring a better understanding of where the Biblical story of the Tower of Babel fits into the secular record of the history of man.

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²Strickling, J. E. 1974. Legendary evidence for the confusion of tongues, *Creation Research Society Quarterly*, 11 (2):97-101.

³Sayce, A. H. Editor 1876. *Records of the Past*. New Series. Vol. VIII. Assyrian Texts. London

⁴W. St. Chad Boscawen. (Translator) *The World's Greatest Literature*. The Cooperative Publication Society.

⁵Kramer, S. N. 1968. The "Babel of Tongues": a Sumerian version, *Journal of the American Oriental Society*, 88:108-111.

⁶Koentjaraningrat, R. M. *Villages in Indonesia*, 157-188; referred to in Oosterwal, Gottfried. 1968. Bible stories: Truth or nonsense, *These Times*, 28 (1 November):4-7.

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☆ ☆ ☆

Concerning the Natural vs. the Supernatural A Reply to Henry M. Morris

Diversity of opinion among creationists is a healthy state of affairs provided it leads to more careful research into the facts of nature and also a more painstaking study of just what is said in the Bible about the original creations and later modifications thereof.

So at the very start of this letter in reply to that of Henry M. Morris¹ let me state that in no way are "multiple creations" postulated. Nor did I ever imply that the horse "evolved" from Eohippus to Equus in the post-Flood period. Perhaps Morris is referring to Bernard Northrup here, though I fail to find this proposition clearly indicated in his "Comment on Stuart Nevin's Paper."²

Though undoubtedly Adam and Eve were created with all the potential for the racial diversity we now see, I wonder if Morris has considered how much of a miracle would have been involved for Noah to have inherited this capacity of giving rise to the many races

of mankind? Thus there are 24 pairs of chromosomes in the cells of a human being and, as Curt Stern³ points out, even assuming only one pair of allelic genic loci per chromosome, the number of combinations is astounding, as shown in Table 1.

Table 1

Number of pairs of Alleles	Number of kinds of Gametes
1	$2 = 2^1$
2	$4 = 2^2$
3	$8 = 2^3$
4	$16 = 2^4$
...	...
...	...
...	...
24	$16,777,216 = 2^{24}$

Now of course each chromosome contains not only one pair of loci but a great many. And since crossing over occurs, the number of possible recombinations approaches infinity.

Considering one pair of chromosomes and only one allelic difference, there are two heterozygous individuals in the population of four individuals needed to express the variation-potential for this allele, ie. 1 AA: 2 Aa: 1 aa. As shown in Table 2, population size becomes considerable when only ten character differences are considered:

Table 2

Number of character differences	Number of heterozygous individuals for all characters or factors	Population size
1	2	4
2	4	16
3	8	64
4	16	256
5	32	1024
6	64	4096
7	128	16,376
8	256	65,536
9	512	262,144
10	1024	11,048,576

So only one individual in 1024 is heterozygous for all factors. For 24 characteristics only one individual in 16,777,216 is heterozygous! And this does not, as mentioned above, even begin to cover the total allelic diversity in the human race.

This of course assumes *random breeding*. But there is considerable evidence that the godly line of human beings tended to intermarry and avoid relations with the ungodly line. Thus Cain's family dwelt in an area separate from the godly children of Seth. (Genesis 4:16-24) Also Noah appears to have been the last of the decreasing group of godly men and women who did not intermarry with the ever-increasing population of debauched and evil men.

In order then for Noah to be heterozygous for all the thousands of genes in mankind (estimated at between 5000 and 120,000 by Curt Stern, page 29) a truly remarkable miracle would have to be postulated. There is nothing in the Bible to indicate such a miraculous event connected with the selection of Noah as

the sole survivor of the then-existing human race. His selection was clearly based on the fact that "he walked with God." (Genesis 6:9)

Furthermore the population of mankind is stated as being of one language and one speech. (Genesis 11:1) and only after the creation of languages at the Tower of Babel confrontation do we find races of mankind mentioned.

Yet, already in the year 1921 B.C., 326 years after the confusion of tongues, we find Abram leaving famine-stricken Bethel and going to Egypt, evidently a well-known nation already! This was about ten generations after mankind was scattered over the face of the earth.

If Noah did not have the potential for transmitting the gene differences for the various races of mankind then how did they originate? As discussed in the article on "Plant Succession Studies in Relation to Microevolution"⁴ I am of the opinion that God greatly increased man's genetic variability potential coincident with the creation of languages. This was done by altering the DNA pattern of nucleotides to bring about more basic racial distinctions, such as found in skin color, facial features, hair, and skeletal proportions.

Similarly I proposed that the surviving plants and animals were broken up into various subspecies and varieties so that they could more rapidly spread over the face of the earth. Henry Morris takes exception to this proposition since, as he says, the only miracle recorded is the confusion of tongues.

One might point out that Flood geologists, such as Morris, accept the idea of a glacial period and glaciation,⁵ though not hundreds of thousands of years of it occurring in at least four periods. Yet nothing is mentioned about glaciation in the Flood narrative or discussion of events thereafter!

Now I quite agree with Morris that in *this part* of the Bible there is no direct statement of an alteration of God's original creation. There is however reference to it in other parts. Thus in Psalm 104:30 we read "Thou sendest forth thy spirit, they are created: and thou renewest the face of the earth." Now this is in the same chapter as the reference to the Flood in Psalm 104:9: "Thou hast set a bound that they may not pass over; that they turn not again to cover the earth."

So evidently these verses are referring to *real events* and renewing the face of the earth coupled with "they are created" must refer to the renewal of the earth's creatures after the Flood when so many were destroyed. As a matter of fact this chapter even gets *very specific botanically* and says: "The trees of the Lord are full of sap; the cedars of Lebanon (Cedrus libani) which *he hath planted*;" (Psalm 104:16)

Matthew Henry, whom no one could accuse of not being a good conservative Bible scholar, makes this comment on Psalm 104:30: "The same spirit by which they were all created at first still preserves the several creatures in their being, and place, and usefulness so that though one generation of them passes away, another comes, *and from time to time they are created*, new ones rise up instead of old ones and there is a continual creation."⁶ Now though I certainly would

not go so far as Matthew Henry seems to, there are at least two definitely mentioned and another implied following the Flood.

Also of interest in the Catholic Vulgate edition of the Bible Psalm 104 (called Psalm 103 in that edition), verse 30: "Then thou sendest forth thy spirit, and *there is fresh creation*; thou dost repeople the face of the earth."

Morris states that "there is surely an economy of the miraculous in God's orderly world," and that the Bible "emphasizes strongly the uniqueness of the creation period."

Yet he surely will have to admit that the snake was radically changed in habit of motion, and obviously form also, being "cursed *above* all cattle and every beast of the field" (Genesis 3:14). All other creatures were also cursed and no doubt changed, for as St. Paul says: "For we know that the whole creation groaneth and travaileth in pain together until now." (Romans 8:21-22) As Matthew Henry comments, "There is an impurity, *deformity*, and infirmity which the creature has contracted by the fall of man."⁷

As regards plants we read that "thorns and thistles shall it bring forth to thee, and thou shalt eat the herb of the field" (Genesis 3:18).

Most certainly these changes in the habit and form of the snake, to a lesser extent other animals, and the creation of entire genera and families of plants in order to have thorns and thistles (for many are in distinct genera and families) could only come about by radically altering the DNA system of already existing plants and animals. This then is a second period of creative activity, in addition to the original "unique creation period!"

Again the Flood itself, and the origin of languages were supernatural events. One could go through the Old Testament and find dozens of such events recorded from Sarah having a child in her old age to the destruction of 185,000 Assyrians by the angel of the Lord (Isaiah 37:36). Even the New Testament is replete with miracles, from the birth of our Lord Jesus Christ until the healing of the father of Publius by Paul (Acts 28:8).

In conclusion, I will say that if Morris can explain how Noah could have been heterozygous for all the distinctive characteristics of human beings, and then how the races of mankind could have originated by *natural means* I will be most happy to accept such an explanation. But he will have to accomplish this by segregation in only 326 years! The adaptation of plants and animals are even more complex as shown by the six races of the Golden Whistler on the Solomon Islands or the intergrading forms of the leopard frog (*Rana pipiens*) ranging from New England to Florida and Texas.⁸

Evolutionists are hard put to account for this complexity in hundreds of thousands of years, yet Morris would have this occur in the 5300 or so years since the Flood, by natural selection of the variation potential which existed in the survivors of the Flood. Perhaps it could have occurred *naturally*, but if so let us have research to show just how it was accomplished.

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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.

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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 scientifically 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.

CONTRADICTION VS. NON-CONTRADICTION

Those who do not want to believe Scripture often point to alleged contradictions in it. But, upon closer examination, the alleged contradiction disappears. Indeed, the very resolution of an apparent contradiction often results in additional information.

A striking example, which was noted by Josephus and by Whiston in his translation of Josephus' works, is provided by Jeremiah 32:4 and 34:3 on the one hand, and Ezekiel 12:13 on the other hand. For Jeremiah prophesied that Zedekiah would see the King of Babylon, and go to Babylon; while Ezekiel prophesied that Zedekiah would not see Babylon. All of which came true, of course: Zedekiah was captured

at or near Jerusalem, and brought to Nebuchadnezzar. Later Zedekiah was taken to Babylon, but—his eyes were put out before that, so he indeed did not see Babylon.

Whiston suggested that those around Zedekiah may well have pointed out to him the apparent contradiction as an excuse for ignoring both prophets.

Note that if we had all of the facts but one: that Zedekiah was blind when he arrived in Babylon, we should have been able to deduce that, if we really took the Scriptures seriously. Is the moral not plain? The more strongly we believe, the more we shall find out.

—Contributed by Harold Armstrong

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⁷A "clone" of plants is a group of adult plants originally derived from one parent plant by means of vegetative reproduction.

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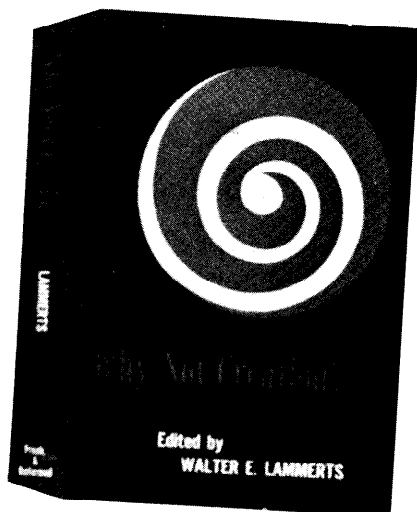
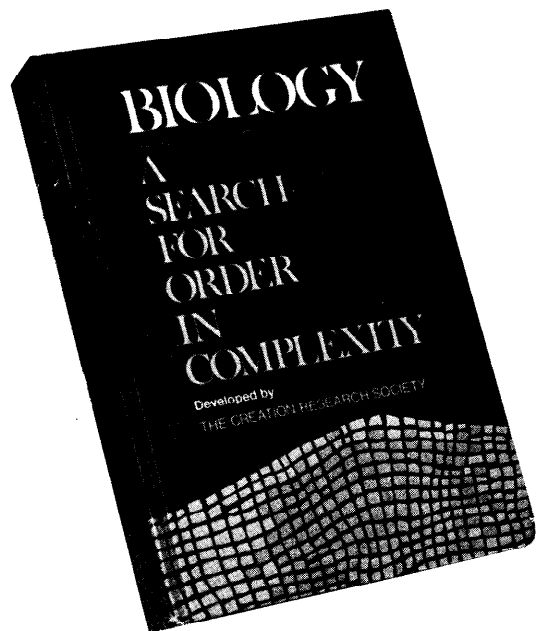
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