

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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COVER ILLUSTRATION

The picture on the cover is a scene on Mars, taken by the Viking 1 lander. In the original picture almost everything showed a reddish tinge, although there were some tints of black or dark blue.

If someone should say: "There is really not so much of interest in that scene", the answer might be: "Exactly! And in particular there is no sign of anything living". Moreover, the other investigations which were carried out seem to have shown that nothing lives on Mars.

Some Creationists have been predicting, for a number of years, that no living things would be found elsewhere than on the Earth. And they seem now to have been proven right. Dr. Walter Lammerts, in another place in this issue of the *Quarterly*, discusses this matter at somewhat greater length. It appears that God made the Earth to be inhabited, the other planets and heavenly bodies for other purposes.

This picture was provided by the National Aeronautics and Space Administration, and is used here by permission. Mr. George Mullinger, of Bob Jones University, attended to getting the use of it for the *Quarterly*.

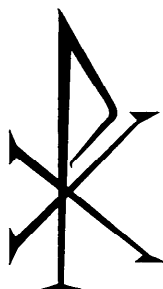


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ACCURATE PREDICTIONS CAN BE MADE ON THE BASIS OF BIBLICAL CREATION CONCEPTS

WALTER E. LAMMERTS*

Received January 16, 1978.

Creationists have predicted, on the basis of Biblical information, that no living things would be found on Mars. Another prediction is that the world would be seen to be still drying out after the Flood. It is pointed out that both of those predictions have been fulfilled.

The concept that the universe of stars, the solar system, and the earth gradually evolved, versus the belief that they were created by a personal God with a definite purpose or design in mind, lead to fundamentally different concepts as to their makeup and possibilities of being the habitation of life forms. Thus most evolutionists, such as Carl Sagan, are firmly convinced that life exists on the planets of certain stars, even though such planetary systems have not actually been demonstrated. In fact, until recently Sagan was convinced that some of the planets of our solar system such as Mars would be inhabited by at least lowly forms of life.¹ On the other hand, as pointed out by Henry Morris,² in 1974 the creation model leads to a number of predictions, one of which is that "no evidence of past or present life would be found anywhere in the solar system (or universe) except on earth.

Now one of the tests of a correct theory is that accurate predictions can be made from it. Thus on the basis of the concept that God created the earth, or designed it for habitation of various forms of life, especially man, a prediction could be made that the stars and planets were created for other purposes.

Also, on the postulate that the earth was destroyed by a world-wide flood, one could predict that as time went on and the earth gradually dried out certain parts of the earth would become much drier than others, so that the area and extent of deserts would greatly increase. Also, as a corollary of this, one could predict that areas adjacent to these deserts would become increasingly arid as the rainfall gradually continued to decrease; and that this pattern will continue to get worse.

What then are the facts as regards these predictions as judged by recent space explorations and a study of rainfall patterns in the Pacific Northwest?

Predictions About Mars

In the introduction to "Scientific Studies in Special Creation" I stated in 1971 that, "though some astronomers still have slight hope that some lowly form of life such lichens or mosses may be found on Mars, it is my prediction that none will be found." I based this prediction on two statements in the Bible. One is Isaiah 45:18: "For thus saith the Lord that created the heavens; God himself that formed the earth and made it; he hath established it, he created it not in vain, he formed it to be inhabited. I am the Lord; and there is none else." Also earlier in Isaiah 45:12 we read: "I have made the earth and created man upon it. I even my hands have stretched out the heavens and all their host

have I commanded." No mention is made here that any of the heavenly hosts were designed for the habitation of life in the form of various creatures. Rather in Genesis 1 the sun, moon, and stars are clearly stated as being designed to give light upon the earth and to be for signs and for seasons, for days and for years. Henry Morris in his book *Many Infallible Proofs* reaches the same conclusion.⁴

The Viking Explorations

Let us then examine what the two Viking spacecraft found according to Norman H. Horowitz in his article "The Search for Life on Mars".⁵

Horowitz starts out by observing that of all the extra-terrestrial bodies in the solar system Mars is the only one at all similar to the earth. Accordingly it is by far the most plausible candidate for life in the solar system.

The two Viking spacecraft were launched from Cape Canaveral in the summer of 1975. They arrived at Mars in July and August of 1976. On command from the earth each lander separated from its orbiter. Retro-engines and parachutes were used to effect a safe landing in the northern hemisphere of Mars when the season was summer. On July 20, 1976, Viking 1 lander came to rest in the Chryse Planitia region and six weeks later Viking 2 lander settled in the Utopia Planitia region. In longitude these regions are separated by almost 180 degrees. Chryse is 23 degrees north and Utopia 48 degrees north of the equator.

First the Martian air was analyzed by means of two mass spectrometers, one operating during descent and the other on the ground. 95% was carbon dioxide, 2.5% nitrogen, and 1.5% was argon, with traces of oxygen,

ELECTION RESULTS

217 ballots were cast in the annual election, held earlier this year. The following persons were elected to the Board of Directors for a term of three years, 1978-1980.

Clifford L. Burdick
Wayne Frair
George F. Howe
John R. Meyer
John N. Moore
George Mulfinger, Jr.

All of these were incumbent member of the Board.

The proposed amendment to the Constitution, the addition of Section 3, dealing with Student Chapters, to Article III, was approved almost unanimously.⁶

Only ballots postmarked not later than 1 March 1978 were counted, as had been announced.

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carbon monoxide, neon, krypton and xenon. The atmospheric pressure was 7.5 millibars compared to our earth's 1013. So the elements necessary for life are available with the exception of the critically important compound, water vapor, and of course adequate percentages of oxygen. Even in the north polar cap, the water vapor would form only a film 1/10 of a millimeter thick! So Mars is a very dry place. Though Mars does have ice at its poles, oceans and lakes are not found anywhere on its surface. This extreme dryness presents a difficult problem for Martian biology, since liquid water is essential for life as we know it. Channels do exist in the Martian desert that resemble dry river beds made by a liquid of some sort, most probably water. So if water once existed could life have evolved there so as to meet the changing conditions and so still exist in the present extremely dry desert?

Five different types of instruments were involved in the search for life. Many scientists, engineers, and managers pooled their efforts to make these investigations possible. Most important in the search were the two cameras which scanned the scene and made pictures in black and white, color, and stereo. Between them the two cameras could survey the entire horizon around the space craft. Positive results would prove unequivocally the existence of life. Thus if a tree, shrub, animal or footprints appeared, there would be no reason for doubting the existence of life. Wonderfully clear photographs were taken and eagerly scanned by alert and hopeful eyes, but no investigator has yet seen anything suggesting a living form. See the front cover.

Next the soil was analyzed for organic content. On earth of course carbon is unique for the number, variety, and complexity of compounds it forms. The attributes by which we identify living things, their capacity to replicate, repair themselves and be adapted to changes in the environment depend on the properties of large organic molecules, unique in the chemistry of the elements. It is the highly complex information rich proteins and nucleic acids—DNA—that endow even "simple" bacteria with their essential nature. Even the science fiction element silicon does not have the capacity to form large stable structures. So scientists have concluded that wherever life exists in the universe it will most likely be based on carbon chemistry. Now although the carbon compounds of meteors and clouds of dust in interstellar space are non-biological in origin, they do imply that carbon chemistry is the same throughout the universe.

So an organic analysis was made by the combined mass spectrometer, gas chromatograph, and pyrolysis furnace. The sample of soil was first heated in the furnace through a series of steps up to 500 degrees Celsius. The volatile material passed through the gas chromatograph and was there separated into the various constituent compounds, which were then analyzed by the mass spectrometer. Two soil samples were analyzed at each landing site. The only organic compounds detected were traces of cleaning solvents known to have been present in the apparatus! The samples gave off carbon dioxide and traces of water vapor. Nothing else was found.

The result was surprising and weighed heavily

against the existence of biological processes on Mars. The instruments on the Viking lander are highly sensitive, capable of detecting organic compounds at a concentration of a few parts per billion, a level 100 to 1000 times below that on the earth's desert soils. Even if there is no life on Mars, it had been expected that the fall of meteorites in the Martian atmosphere would have brought enough organic matter to the planet to have been easily detected. Indeed scientists had been concerned as to how organic meteorite material could be distinguished from biological organic material originating on the planet. Horowitz suggests that on the surface of Mars organic materials are actively destroyed, probably by the strong ultraviolet light or radiation from the sun. Creationists might well suggest that the lack of meteoritic organic matter indicates a "young Mars". That is, there simply has not been time enough since the creation of the solar system for it to accumulate.

The other three instruments were used to detect the metabolic activities of any micro-organisms that might be present in the Martian desert soil. On earth bacteria, yeasts and molds are the hardiest of all species, surviving in environments of extremely high temperatures and aridity. First a gas exchange experiment was designed to detect changes in the composition of the atmosphere caused by microbial metabolism. Second, a labeled release experiment was designed to detect decomposition of organic compounds by soil microbes when they were fed a nutrient. And third, the pyrolytic release experiment was designed to detect the synthesis of organic matter in Martian soil from gases in the atmosphere by either photosynthetic or non-photosynthetic processes.

A solution of organic compounds was mixed with a sample of Martian soil. The test chambers had to be heated to prevent the water from freezing and pressurized to prevent it from boiling. Now all known organisms give off gas as they metabolize food, namely carbon dioxide, methane, nitrogen, hydrogen and hydrogen sulfide. So at first a small volume of nutrients was added to the chamber in such a way that it humidified the chamber without actually wetting the soil. The soil was then incubated for nearly seven months to give whatever micro-organisms might be present time to signal their presence by producing or consuming gases. During this time the atmosphere in the chamber was periodically analyzed. Surprisingly immediately after humidification carbon dioxide and oxygen were released, but then all release of gases ceased. Thus at the Chryse site in a period of one Martian day or 24 hours and 19 minutes the quantity of carbon dioxide increased by a factor of five and the oxygen by a factor of 200! At the Utopia site the increases were less but still considerable.

The rapidity and brevity of the response recorded by both landers suggested the processes observed were chemical rather than biological. Thus carbon dioxide would be expected to be absorbed on the surface of the dry Martian soil, and when exposed to a very humid atmosphere, the gas would be displaced by water vapor. Production of the oxygen is more complex but most likely is due to decomposition of an oxygen rich compound such as a peroxide by water vapor. This is known to oc-

cur in the presence of iron compounds and the Martian soil is 13% iron.

When soil samples were saturated with the nutrient medium, carbon dioxide continued to be given off but gradually tapered off; and the oxygen gradually disappeared due to combination with ascorbic acid, one of the ingredients of the medium added. So it became clear after seven months that everything of interest had happened in the first humid stage of the experiment before the soil came in contact with the medium added.

In the labeled release experiment a few cosmically abundant compounds such as formic acid (HCOOH) and the amino acid glycine ($\text{NH}_2\text{CH}_2\text{COOH}$) were labeled with radioactive isotope carbon 14 and added as a nutrient medium to the chamber in such an amount that the chamber would be humidified. Then over the months any release of gases by the metabolism of organisms could be very accurately measured by radioactive disintegration in the released gases.

As in the gas exchange experiment, there was a surge of radioactive carbon dioxide, showing that it had been formed from the radioactive compounds of the medium and not from compounds in the soil. Non-radioactive carbon dioxide was also formed but of course not detectable in this experiment. Radioactive carbon dioxide release is easily explained by the fact that formic acid reacts with hydrogen peroxide to form one molecule of CO_2 and two of H_2O . The amount of radioactive carbon dioxide was only slightly less than what would have been expected if all the formic acid in the medium had been oxidized in this way.

If the source of the oxygen in the humid stage was indeed due to peroxides decomposed by water vapor then in the labeled release experiment all the peroxides should also have been decomposed by the first injection of nutrient, so that the next injection should evolve no additional radioactive gas in spite of the fact that part of the soil sample had not been wetted by the medium. This proved to be the case. Actually the amount of gas decreased since carbon dioxide is quite soluble in water. The above result was obtained with all soil samples at both landing sites. Very much in line with the above explanation of the carbon dioxide as being due to absorption by the Martian soil, is the fact that samples from under rocks yielded even less carbon dioxide than those from the surface.

When the soil was preheated to 160°C for three hours the reaction was abolished and when heated to 46°C the reaction was reduced by about half. A variety of both inorganic and organic peroxides are destroyed or evaporated at relatively low temperatures.

The final or third microbial experiment was the pyrolytic release one. It attempted to measure the synthesis of organic matter from atmospheric gases rather than its decomposition. Second, it was designed to operate under conditions of pressure, temperature, and atmospheric composition of Mars, since that is how any form of Martian life must exist. A sample of Martian soil was sealed in a chamber along with Martian atmosphere. A quartz window admitted simulated Martian sunlight from a xenon lamp. A small amount of radioactive carbon dioxide and carbon monoxide were introduced. After five days the lamp was turned off, the

atmosphere removed and the soil analyzed for presence of radioactive organic matter. This was done by heating it enough to crack any organic compounds into small volatile fragments which could be carried out of the chamber by a stream of helium and passed through a column designed to trap organic molecules but allow carbon dioxide and monoxide to escape. The radioactive organic molecules were then decomposed into radioactive carbon dioxide by copper oxide in the column and counted by a radiation counter.

Surprisingly, seven of the nine experiments gave positive results, the amount of carbon dioxide fixed in the soil being enough for between 100 and 1000 bacterial cells. Though the pyrolytic release experiment and instrument had been rigorously designed to eliminate non-biological sources of organic compounds, nevertheless it appears the findings of these experiments must also be interpreted non-biologically. The reason is that the reaction is less sensitive to heat than one would expect of a biological process. Thus in two of the experiments the soil was heated to 175°C for three hours and 90°C for two hours. The effect of the higher temperature was to reduce the reaction by 90% but not abolish it. 90°C had no effect. Now since the temperature at the soil surface does not rise above 0°C any time and below surface is even lower, it would seem than any organism would be killed by temperatures of 175°C or even 90°C .

It is also not easy to point to a non-biological explanation. Experiments are now under way to try and understand how these small amounts of organic molecules could have been formed. Some will insist that they are biologically formed by heat tolerant organisms even though no such creatures are known to exist. But the overwhelming weight of evidence is that life in any form simply does not exist on Mars.

As Horowitz rather wryly observes: "There are doubtless some who, unwilling to accept the notion of a lifeless Mars will maintain the interpretation I have given is unproved. They are right. It is equally impossible to prove from any result of the Viking experiment that the rocks seen at the landing sites are not living organisms that look like rocks. Once one abandons Occam's razor the field is open to every fantasy. Centuries of human experience warn us, however, that such an approach is not the way to discover truth."

What About Other Planets?

Sagan in his article "Life on Mars! What Could It Mean" (Op. Cit.) says: "Well here (on Mars) is a natural experiment that has been going on for four and a half billion years (sic) on a neighboring planet. If it turns out that there is life there as well then, I would say, it would convince large numbers of people that the origin of life exists. And that then opens the door to speculation that there is life on innumerable planets throughout the Milky Way galaxy."

Will Sagan now draw the opposite conclusion, namely that since life does not exist anywhere on Mars, it is unlikely to exist anywhere in the Milky Way galaxy? For surely Mars was their last hope for finding life in our solar system. Thus Mercury, being so close to the sun, has a hot interior with only a slight amount of car-

bon dioxide, hydrogen and argon on its surface. Venus has a surface temperature of about 800 °F (427 °C) due to the greenhouse effect of the mostly carbon dioxide atmosphere. Regarding Jupiter, an article by Andrew P. Ingersoll on the meteorology of this strange planet, points out that its atmosphere and interior are mostly hydrogen, with such elements as helium, carbon, oxygen, and nitrogen mixed with hydrogen in the same proportion as they are in the sun.⁶ Because of the high temperatures that mixture does not solidify, so Jupiter is probably gaseous or liquid throughout. It radiates about four times as much heat as it receives. This heat is presumed to be residual from its original gravitational contraction (or as we would say creation). Its atmosphere is predominantly molecular hydrogen (H₂) with smaller amounts of methane and ammonia. Its upper atmosphere is about -168 °C.

Regarding the three outer planets, Saturn has a density of only 13% of the earth, and a surface temperature of also about -168 °C (-270 °F). Its atmosphere is mainly methane, hydrogen, and helium. Uranus has a surface temperature of -200 °C, an atmosphere of 3 parts helium to one of hydrogen with some ammonia and methane. Finally Neptune has a density of .45 of the earth and a temperature at the visible surface also near -200 °C. Its atmosphere resembles that of Uranus, mostly hydrogen and helium.

Surely then not one of the other planets has either the type of surface or atmosphere needed for life, namely oceans, rivers, and lakes, and plenty of oxygen, nitrogen, and carbon dioxide in the air.

Earth's Spreading Deserts

In my article "On the Recent Origin of the Pacific Southwest Deserts" I pointed out that as recently as 1870 Lake Tulare was the largest lake west of the Rockies! In 1875 the sidewheel steamer, Mose Androsa, was used to carry hogs across this lake, and it was joined in 1875 by the Water Witch, a shallow draft schooner used to catch terrapin.⁷ The lake was 60 miles long north and south and 36 miles across at its widest, covering an area of 50,000 square miles. Dr. G. Ledyard Stebbins in his fascinating article "Ecological Islands and Vernal Pools"⁸ states that "One of my former students, whose grandparents came to the town of Lockeford, twenty miles northeast of Stockton, told me that his grandfather remembered a winter when he could navigate a sailboat from the Bay area all the way to his home on the inner edge of the valley." The Great Salt Lake once had an area of 50,000 square miles and was known as Lake Bonneville. The decrease in size still continues as shown by the fact that the amusement park built on the shore of the lake is now one mile from it!

As late as 1860 there were 318 artesian wells within a region six miles wide by 15 miles long near the town of Artesia, California. Now there are none, though as late as 1918 when my family first moved to Southern California, some were still functioning.

Similar changes occurred in New Mexico driving the Pueblo Indians first from the Pajarito plateau and then later from the Frijoles canyon (1550-1580).

As shown in my article this past record of rainfall decrease is still continuing. Thus in the 44 years from

1879-1880 through 1922-1923, the annual totals varied from 8.71 to 42.72 inches, with 29 seasons have 20-37.20 inches of rainfall. In contrast 1923-1924 until 1966-1967 varied from 8.71 to 36.59, only 18 seasons having a rainfall of 20-36.59 inches. In late December of 1977 the Watsonville-Pajaronian published a table of rainfall figures from 1879-1880 until 1976-1977. (Table 1). Breaking this into two parts, the 49 seasons from 1879-1880 until 1927-1928 had a total rainfall of 1109.96 inches or an annual average of 22.65 inches. The 49 seasons from 1928-1929 to 1976-1977 had a total of only 972.28 inches or an average of 19.84 inches. Clearly then the trend in rainfall is seriously

Table 1. This is a record of the yearly number of inches of rain at Watsonville, California, since 1879. The year for recording the rain begins on July 1.

Year	Rain	Year	Rain	Year	Rain
1879-80	15.11				
1880-81	18.91	1920-21	25.14	1960-61	10.53
1881-82	15.09	1921-22	28.25	1961-62	18.52
1882-83	16.90	1922-23	22.84	1962-63	25.41
1883-84	23.25	1923-24	8.71	1963-64	15.31
1884-85	11.02	1924-25	23.76	1964-64	21.31
1885-86	30.02	1925-26	18.37	1965-66	14.38
1886-87	12.98	1926-27	24.28	1966-67	31.93
1887-88	15.71	1927-28	14.92	1967-68	14.09
1888-89	18.42	1928-29	14.46	1968-69	28.22
1889-90	43.72	1929-30	16.45	1969-70	20.78
1890-91	18.76	1930-31	11.02	1970-71	18.48
1891-92	17.18	1931-32	24.50	1971-72	13.00
1892-93	27.64	1932-33	15.12	1972-73	31.79
1893-94	20.50	1933-34	12.46	1973-74	32.14
1894-95	37.29	1934-35	19.87	1974-75	17.10
1895-96	23.97	1935-36	21.04	1975-76	8.94
1896-97	23.74	1936-37	26.38	1976-77	11.07
1897-98	12.48	1937-38	25.97		
1898-99	23.45	1939-39	14.71		
1899-00	20.98	1939-40	24.14		
1900-01	25.77	1940-41	36.59		
1901-02	21.69	1941-42	24.80		
1902-03	20.80	1942-43	20.82		
1903-04	20.19	1943-44	18.55		
1904-05	26.11	1944-45	21.63		
1905-06	25.41	1945-46	18.66		
1906-07	36.96	1946-47	13.28		
1907-08	16.08	1947-48	17.84		
1908-09	31.99	1948-49	15.76		
1909-10	21.06	1949-50	19.30		
1910-11	29.33	1950-51	23.62		
1911-12	19.65	1951-52	27.78		
1912-13	12.92	1952-53	19.38		
1913-14	35.90	1953-54	14.26		
1914-15	35.12	1954-55	17.96		
1915-16	31.78	1955-56	26.63		
1916-17	20.29	1956-57	14.40		
1917-18	9.77	1957-58	29.82		
1918-19	35.74	1958-59	15.51		
1919-20	20.01	1959-60	17.07		

downward. The last few years, though exceptional, have really emphasized this; for with only 8.49 and 11.08 inches many cities and towns of California have really suffered from a lack of available water. So much so, in fact, that water was rationed in many areas such as Lafayette; and people had to give up their lawns and even such water-demanding shrubs as roses and camellias. No doubt many seasons of normal and even above-normal rain will occur in the future; but these will be the exception rather than the rule.

The prediction can then be made that within the next 50 years Central California, i.e., the part from about Santa Maria in the south to Fort Bragg in the north, will become as dry and desert-like as Southern California, or the area from Santa Barbara on south to Mexico. Were it not for the supply of Colorado River water, the vast population of Los Angeles area would long ago have had to pack up their tents and move elsewhere as the Pueblo Indians were forced to do. The area north of Fort Bragg will also have some decrease in rainfall. However, the mountains here come close to the ocean, and the elevation of the many coastal peaks such as Salmon (6954 ft.), Sawtooth (5822 ft.) and Baldy (6030 ft.) will cause precipitation as the moisture-laden air from the Pacific Ocean rises over them, long after the drought becomes serious in the Central California areas where the only high mountains are the inland Sierra Nevada.

Drying Up Not Confined To California

Regarding other parts of the world, we find the same phenomena occurred in the Palestine area. Thus when spies reported on Canaan they said: "We came unto the land whither thou sentest us, and surely it floweth with milk and honey and this branch (of grapes) is the fruit of it." (Numbers 13—27) No one would describe the un-irrigated part of Israel in these terms now. Thus, though the Galilean hills, with elevations up to 3983 feet at Har Meirin (Jabal Jarmaq), receive up to 40 inches of rain, in the plains the rainfall decreases to from 24 inches in the north to 16 inches at Ascalon, 10 inches near Beersheba, and only 2-4 inches around the Dead Sea. The Jordan Valley is hotter and drier than the coastal area. The Negev or south part of Israel which extends up to a line from Sodom to Beersheba supports only desert

scrub. Also, the coastal sand dunes are quite devoid of much vegetation. The former glorious oak forests of Sharon and Galilee are represented now by isolated trees. Even the famous cedars of Lebanon in the high mountains (8000 to 9000 ft.) of the extreme north of Palestine have almost disappeared. Most certainly the rainfall trends since the time of Exodus, or even since our Lord's travels in A.D. 30-33 have been downward and will no doubt continue. Likewise, were it not for the annual overflowing of the Nile, Egypt would long ago have ceased to be a nation; for certainly most of this land is a desert. In fact the so-called "Fertile Crescent" is hardly very fertile now, except in patches and where irrigated. Unless the oil-rich Arabian nations, Egypt, and Israel forget their border disputes and unite their efforts to convert sea water into fresh water, the enormous populations of this area cannot long continue to exist with the rainfall as low as it now is, and gradually getting lower.

The Flood was Fairly Recent

The evidence just used, about the drying-out of the earth, may be turned around and used in a converse way, so to speak. If the earth is still drying out from the Flood, since it has dried noticeably in a century or less, the Flood can not have been so very long ago. In particular, a date something like that proposed by Ussher seems more likely than even a thousand years earlier, as some would have it.

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CREATION SOCIAL SCIENCE AND HUMANITIES SOCIETY

The Society mentioned, which has aims, organization, and a Statement of Belief similar to those of the Creation Research Society, has now, it is announced, a number of activities in progress. The first number of their *Quarterly Journal* is planned for this summer. Several members have taken part, or will do so, in seminars and conferences. And things are being done

about the presentation of Creation Science at Colleges and Universities. Information may be obtained from Dr. Paul D. Ackerman, President, at 1429 N. Holyoke, Wichita, Kansas 67208.

Members of the Creation Research Society will wish this new Society much success.

A (RECENTLY) LIVING PLESIOSAUR FOUND?

RALPH SWANSON*

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While I find it hard to recall an exact citation, I know that Creationists have predicted, or suggested, that creatures, believed to be extinct, may be found yet living. For Creationists, at least those who believe in a young Earth, believe that such creatures were living at the time of the Flood, no more than about five thousand years ago. And creatures of the sea, in particular, might well have survived the Flood, and a few might still be living in obscure places, although most of their kind may have disappeared.

A well known example is the coelacanth, which was believed to be extinct until living specimens were found some years ago. Another (possible) example occurred about a year ago. I have tried to collect information about it; and here am reporting what I have found.

On April 25, 1977, a Japanese fishing ship, east of New Zealand, about 30 miles from Christchurch, at the place called the Chatham Rise, brought up some kind of dead creature in the nets. It had decayed considerably, having apparently been dead for about a month, and some of the internal organs were missing. The thing was about 10 meters long, the neck being 1.5 meters and the tail 2; and it weighed about 2 tons. Figure 1 shows a photograph of the thing as it was hauled up on the ship.

Since the find was so badly decayed that it might have spoiled the cargo of fish, the fishermen, after taking photographs and getting as much information as possible, threw it back into the ocean.

When word of this find came out, some people in New Zealand said that they had seen similar creatures (alive, presumably). There were even some photographs, which look something like the Loch Ness monster.

A group of Japanese scientists investigated the infor-



Figure 1. This a picture of the thing—whatever it was—fished up off New Zealand. It clearly resembles the supposedly extinct plesiosaur to a considerable extent.

mation which was available about this find. When they made their report, on December 15, 1977, opinion was divided. Some held that the thing was some kind of basking shark. Others said that the shape was that of neither a shark nor a whale, but rather that of a reptile-like creature with a long neck.

The similarity of appearance to the plesiosaur is evident. But the plesiosaur is supposed to have been extinct for many millions of years, according to uniformitarian views. A Creationist, on the other hand, while he need not commit himself to the belief that such supposedly extinct creatures are still living, would not be so very surprised to find it so.

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MORE RECENT STALACTITES

JOHN AMER*

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Creationists have predicted that dripstones, such as stalactites and stalagmites, would be found to be able to form quite quickly; and in a number of cases the prediction has been fulfilled.¹ Thus the existence of dripstones in caves, for instance, is no proof of great age; the

dripstones could fit in well enough with a quite young Earth.

Another example has been found in—or rather under—the heart of London. This is an abandoned tunnel, formerly part of the London underground railway system. According to the report, there are stalactites two feet long; indeed, it would appear from the picture that some might be longer.² Since they could hardly

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have grown much before the completion of the tunnel in 1890, they must have grown about 0.7 centimeters per year, at least.

Indeed, these stalactites might be considerably younger. For the tunnel was used as an air raid shelter in 1941-45. It would seem likely that many stalactites might have been broken off then, so that many might have grown in only about 33 years.

The tunnel is bored through London clay of a Tertiary formation.

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This picture, showing stalactites in an abandoned tunnel, is by the Times of London, as cited, and is used here by permission.

RAPID STALACTITE FORMATION OBSERVED

ERIC B. CANNELL*

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Creationists have predicted that it would be found that dripstones, stalactites and stalagmites, can form very quickly under some conditions. Moreover, they have been able to find some instances in which such rapid growth is actually happening.

Here another piece of evidence is presented. Stalactites have been found growing rapidly in a cave-like environment. Some suggestions are made about circumstances which may have influenced the rate of growth.

Introduction

It is generally accepted by today's evolutionary-minded scientific community that dripstone is formed very slowly. Consequently large stalactites and stalagmites are considered to be hundreds of thousands to millions of years old. For those scientists who hold to a creation model of origins, however, such extensive time periods are inconsistent with their view of a young earth. Creationists are thus investigating the growth rates of stalactites and stalagmites and the conditions that affect their growth rates in search of evidence to support their rapid formation. Recent articles which have appeared in the *Creation Research Society Quarterly* show that creationists have achieved much success towards this goal.^{1,2}

This article was written to report on observations of rapid stalactite growth in two cement tunnels in a water-treatment plant located on the Ottawa River in the Canadian province of Quebec.

Cement Tunnels Simulate Natural Caves

The water treatment plant was built in 1967 and was put into service in December of that year. It was designed to sterilize and reduce the color of 20 million U.S. gallons of water per day for use in a Kraft pulp mill. As of August 26, 1977, it has treated a total of 48,600 mil-

lion U.S. gallons of water for an average of 13.7 million U.S. gallons per day over 9.7 years.

River water is continually pumped into the bottom of a pulsator clarifier (155' long x 90' wide). Chemicals are added to sterilize and clarify the water. (See Table 1). The pH in the clarifier averages 5.3 but ranges from 5.0-5.8. The water level is maintained at 16' by a system of overflow collection pipes. As the water leaves the top of the clarifier it is neutralized to a pH of 6.7 (ranges from 6.0-7.0). The water then enters a cement tunnel 210' long x 7.7' wide x 4.5' high which serves to distribute it to eleven sand filters. The water level in the tunnel is 3.5'.

Table 1. Chemicals added to the water.

Chemical	Main Components (% by wt)	Initial State	Addition Rate (lb/1,000,000 USG)
Alum*	48% $Al_2(SO_4)_3$, 52% H_2O	solution	270
Alkali*			
(1) 1967-'71	91% $Ca(OH)_2$ (hydrated lime)	powder	100
(2) 1971-'77	50% NaOH, 50% H_2O	solution	80
Polyelectrolyte	100% Polymer	powder	3
Chlorine	100% Cl_2	liquid	30

*Reacts together to form a floc, $Al(OH)_3$.

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The water temperature is virtually the same as the river temperature, ranging from 2°C in the winter to 24°C in the summer.

There are two tunnels in the water treatment plant in which stalactite growth may be observed. Tunnel A is located immediately below the clarifier, separated by 1.3' of cement roof. The tunnel is 155' long x 12.8' high x 10' wide. A two foot wide open-channel floor drain runs the length of the tunnel and there is a continual flow of water through it. Tunnel B is located immediately below the cement tunnel which distributes water to the sand filters. It is 210' long x 7.7' wide x 15' high and has a cement roof 0.7' thick. Because water is continually flowing along the floor of the tunnel, a walkway made of steel grating is supported 5' from the bottom. (See Figure 1).

The temperature in both tunnels is moderate the year-round (12°C in winter, 20°C in summer). The humidity is about 80%. There are no fans to force air circulation in the tunnels.

The conditions in these tunnels closely simulates those in natural caves. Tunnel A might be likened to a cave located under a small lake whereas Tunnel B is similar to a cave located below a small river.

High Stalactite Growth Rates

In Tunnel A there are about 300 stalactites, the majority of which are less than 75 mm in length. On August 26, 1977, the longest stalactite measured 425 mm long and 6 mm in diameter (Figure 2). This indicates a minimum growth rate of 44 mm/yr or 1.24

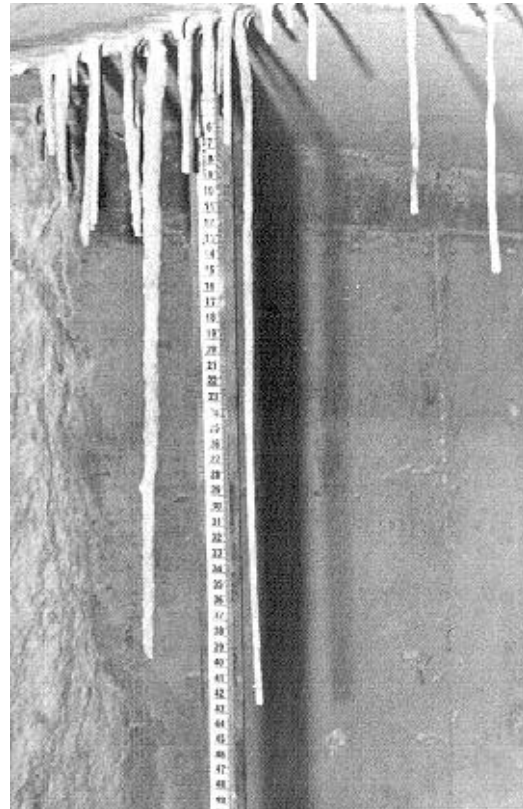


Figure 2. August 26, 1977, Tunnel A. The stalactite to the left of the scale measured 395 mm in length; the one to the right 425 mm. Notice the rock flow on the wall.

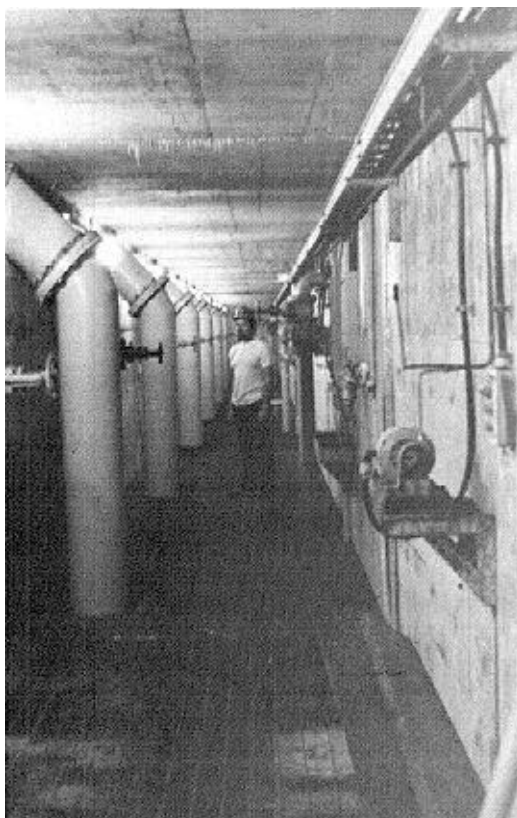


Figure 1. Tunnel B in Water Treatment Plant.

cm^3/yr over the 9.7 years that the water plant has been in operation. The largest stalactite was 395 mm long and 12 mm in diameter which indicates a minimum average growth rate of 41 mm/yr or $4.61 \text{ cm}^3/\text{yr}$ (Figure 2). This is 28 times greater than growth rate of $0.164 \text{ cm}^3/\text{year}$ ($1 \text{ in}^3/100 \text{ years}$) cited in geological literature.

In Tunnel B there are approximately 350 stalactites and again most of them are less than 75 mm in length. On August 26, 1977, the largest stalactite in Tunnel B was 250 mm long and 6 mm in diameter which indicates a growth rate of 26 mm/yr or $0.73 \text{ cm}^3/\text{yr}$.

Because the date on which the stalactites started growing is not known, the growth rates calculated here should be considered minimum values.

Although there are no stalagmites in the tunnels, there is some rock buildup on the floor beneath the stalactites in Tunnel A, indicating the beginnings of stalagmite growth. In Tunnel B stalagmites cannot form because of the water flowing along the tunnel floor.

There are several examples of flowstone on the walls of the tunnels. The largest is in Tunnel B (Figure 3). It measured 22 mm thick at its widest point.

Some Parameters Affecting Stalactite Growth Rate

Although these stalactites are growing in conditions closely akin to natural caves, there are several "un-

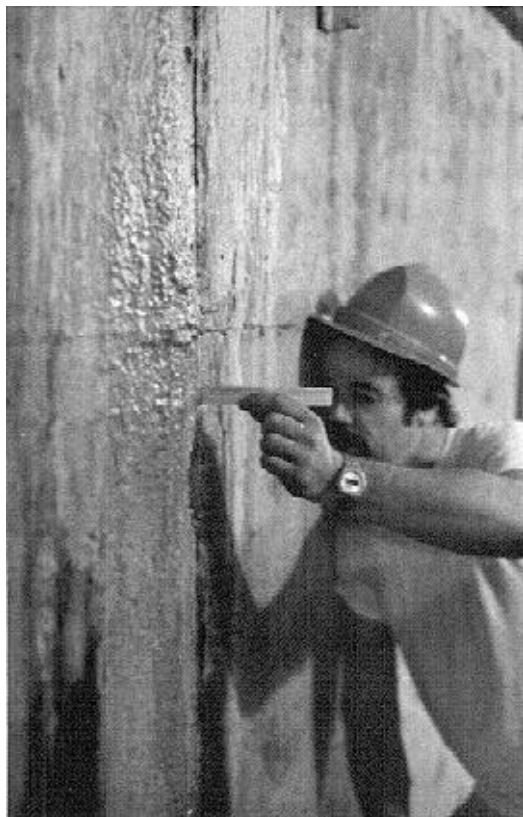


Figure 3. August 26, 1977. This rock flow in Tunnel B measured 22 mm thick.

natural" factors that may have affected their growth rate.

1. Chemicals are added to the water to facilitate floe formation in the clarifier (Table 1). The effect this would have on stalactite growth requires further investigation.

2. The acidic conditions of the water above Tunnel A (pH 5.3) and to a lesser extent above Tunnel B (pH 6.7) would aid in dissolving the cement as the water seeps through cracks in the roofs.
3. The $\text{Ca}(\text{OH})_2$ in the cement roofs is more soluble than the CaCO_3 of natural limestone.
4. There is an average water flow of 9500 U.S. G.P.M. above the tunnels. The water level above Tunnel A is 16' and above Tunnel B, 3.5'. There is a large amount of available water.
5. The roofs of the tunnels are very thin in comparison with natural caves (1.3' in Tunnel A and 0.7' in Tunnel B). The water dripping through the roof has only a short distance in which to dissolve the cement. In natural caves the distance would be much greater.

Conclusion

Rapid stalactite formation has been observed in cement tunnels in a water treatment plant. Although conditions in the tunnels closely simulate natural caves, the large volumes of water, the acidity of the water, the chemical additives in the water and the higher solubility of the cement roofs may have promoted rapid stalactite formation. These considerations, however, do not detract from the observed fact that under certain conditions stalactites do form rapidly.

Acknowledgement

The data given here are used by permission of Consolidated-Bathurst Ltd., of whose plant the tunnels mentioned form a part.

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Creationists' Taxonomy

(Continued from page 38)

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CREATION, EVOLUTION, AND CATASTROPHISM

JAMES E. STRICKLING*

Received December 30, 1977

Twenty or so years ago, a discerning Creationist—or another person—might have predicted that interest in former catastrophes would increase greatly. And that is what has happened. But the matter has come to be viewed in several different ways. Creationists know that there was one great catastrophe: the Flood. There are secular catastrophists, of whom Velikovsky is surely the best known. And many uniformitarians are admitting that the uniformity may have been punctuated by an occasional catastrophe.

In this article the implications of, and relation between, these three points of view are investigated.

Explicit in the concept of Creation is some degree of fixity of biological organisms; described in the Book of Genesis as “kinds”. It is generally assumed that considerable variation is possible within a kind, but always within some fixed limit. It is further often assumed that the limit is defined by fertility. This is indeed the criterion for “natural species”. On the basis of this, it is accepted (predicted) that distinct kinds are mutually infertile; they can not cross.

In contrast, contemporary “secular” catastrophists contend that gaps between species were not created but can arise under the proper “catastrophic” conditions; i.e., one kind can produce a different kind.

Many creationists, while rejecting the underlying philosophy of secular catastrophism, nevertheless seem to assume that Creation and Catastrophism are inseparable concepts. The mounting evidence that catastrophism has played a major role in earth’s history is sometimes viewed as the fulfillment of some implicit prediction based on Creation. The secular catastrophists also see a link between creation and catastrophism; although the secular catastrophists’ concept of creation is qualitatively different from that accepted by creationists.

For the sake of discussion, we can employ “creation” to include “introduction of new forms subsequently to the initial Creation” (*not* Genesis kinds, but bearing in mind that “kind” is not defined by Scripture). This allows an interesting examination of the relationship between creation and catastrophism.

Biological Change—Theories

Uniformitarian theories in this regard are sterile. (Except, maybe, as regards minor variations.) However, Immanuel Velikovsky has injected new thought by his rejection of the Darwinian concept with his contention that catastrophism is the mechanism of evolution.

“... if the genes of the germ plasma should be the target of a collision with a cosmic ray or secondary radiation, a mutation in the progeny might ensue; and should many such hits occur, the origin of a new species, most probably incapable of individual or genetic life, but in some cases capable, could be expected. In order for a simultaneous mutation of many characteristics to occur, with a new species as a resultant, a radiation shower of terrestrial or extraterrestrial origin must take place. Therefore we are led to the belief that evolution is a process initiated in

catastrophes. Numerous catastrophes or bursts of effective radiation must have taken place in the geological past in order to change so radically the living forms on earth, as the record of fossils embedded in lava and sediment bears witness.”¹

However, the evidence he offers attests to only a limited change of biological form, and it is far from conclusive.

“If, as the experiments with the vinegar fly demonstrated, a mutation of some gene can produce a wingless fly, many mutations simultaneously or in quick succession would be quite able to transform an animal or plant into a new species. In the bomb craters of London new plants, not previously known on the British Isles, and possibly not known anywhere, were seen to sprout. ‘Rare plants, unknown to modern British botany, were discovered in the bomb craters and ruins of London in 1943.’ It appears that the thermal action of bomb explosions was the cause of multiple metamorphoses in the genes of seeds and pollens.”²

Extrapolating from this, another proposal was put forward by Juenneman.

“Radiation incurs mutations by the absorption of various, but selective wavelengths, which may span the electromagnetic spectrum from direct current (zero wavelength) through the ultra-high radio frequencies to X-rays or gamma rays and beyond. By a statistical relationship a gaussian (bell-shaped) distribution of mutations would be engendered, but only those in the narrow main sequence would have a chance for survival, while at either extreme the mutants which had been subjected to unregenerative or fatal damage could not survive or have progeny.”³

Biological Change—Ancient Literary Evidence

Myths and legends from all over the world contain numerous allusions to changing characteristics of plants and animals. These are frequently associated with stories of great catastrophes.

One record comes from the Latin Poet Ovid (B.C. 43-c.17 A.D.): “And though fire and water are naturally at enmity, still heat and moisture produce all things, and this inharmonious harmony is fitted to the growth of life. When, therefore, the earth, covered with mud from the recent flood, became heated up by the hot and genial rays of the sun, she brought forth innumerable forms of life; in part she restored the ancient shapes, and in part she created creatures new and strange.”⁴

Minor changes to specific animals are also recounted in ancient tales from throughout the world; these too associated with some extraordinary catastrophe.

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Looking again to Ovid, man himself is mentioned in this record. In a mythological interpretation of a catastrophic natural phenomenon, Phaethon has persuaded his father, the sun, to let him drive the fiery orb across the sky. He thereupon loses control and swoops too near the earth.

"Then indeed does Phaethon see the earth aflame on every hand; he cannot endure the mighty heat, and the air he breathes is like the hot breath of a deep furnace. The chariot he feels growing white-hot beneath his feet. He can no longer bear the ashes and whirling sparks, and is completely shrouded in the dense hot smoke. In this pitchy darkness he cannot tell where he is or whither he is going, and is swept along at the will of his flying steeds.

"It was then, as men think, that the peoples of Aethiopia became black skinned, since the blood was drawn to the surface of their bodies by the heat. Then also Libya became a desert, for the heat dried up her moisture."⁵

The explanation offered here for the alleged change is certainly unacceptable, but the possibility exists of the change coming by other means—a genetic change due to irradiation.

Human biological change (deterioration) is reflected in the Book of Genesis in the shorter lifespans following the Flood. Hesiod⁶ and Ovid⁷ describe this same phenomenon and ascribe it to Zeus' (Jupiter's) several (serial) creations of man; each phase of a lower order and shorter lifespan (and a nastier disposition) than the one preceding it.

Two Interpretations

Given that there is some kernel of truth in the non-biblical literary accounts, secular catastrophists would argue for a "catastrophic creation" of completely new forms. Creationists naturally see this only as evidence for the possible variability within kinds; whether the result of some "catastrophic process" or anything else.

Few creationists would deny that catastrophism was responsible for the destruction of many past varieties of life. However, its introduction (creation) of a *new* kind would be incompatible with the concept of Creation. The proper definition of "kind" is therefore crucial. Refutation of a theory/prediction based on the wrong definition could be asserted as a refutation of the Scripture that led to it.

A Revised Definition

Perhaps the distinction between Genesis kinds is conceptually more "vertical" than "horizontal". If kinds were interpreted to mean different "levels of complexity", more variation could be envisioned under Creation than can presently be. This would mean that all members of one kind would not necessarily be able to interbreed—even parents and offspring. However, they would be destined from the beginning to remain on their one level of complexity ("after its kind"); perhaps correlated with the *number* of characteristics programmed into the genetic code. Granted, this would make determination of a kind virtually impossible. However,

if the presently defined limits should fail to hold, this or some similar definition would be unavoidable.

Creation and Catastrophism: The Relationship

Secular catastrophists envision a creation process; a process that cannot proceed without catastrophism. However, one must ask how catastrophism can precede Creation. The proverbial "which came first . . . ?". This philosophy is helpless at this point, as evidenced in a statement by Velikovsky himself.

"... why do we assume that at creation the heavy elements like uranium predominated and not the simplest ones, hydrogen and helium? It is philosophically simpler to assume that all started—if *there ever was a start*—with the most elementary elements. A catastrophic event or many such events were necessary to build uranium from hydrogen." (emphasis added)

An earlier statement is even more revealing.

"The objection to the theory of natural selection, that the developed plan in a new species must appear suddenly or the race would expire—as in the case of the kangaroo pockets—is answerable within the framework of catastrophic evolution; however, the purposefulness of animal structures will remain a problem deserving of as much wonder as, for instance, the purposeful behavior of leucocytes in the blood that rush to combat a noxious intruder."⁹

Catastrophism among Uniformitarians

It might be noted, incidentally, that even uniformitarians are getting into the catastrophe business. One occasionally reads in their current literature about near collisions with giant comets and other extraordinary events. Of course, this was necessarily millions of years ago, or it might happen millions of years in the future—never in the present. Their contemporary philosophy might be restated as "Nothing can happen *now*."

Creationism and Catastrophism

The question remains, "Does catastrophism necessarily follow from Creation?" This might be answered with another question, "Why should it?" Catastrophism certainly contributed nothing to Creation; and Creation was complete and required no subsequent catastrophism (although catastrophism has probably made the world much more interesting variety-wise). Why, then, the close association of Creation and catastrophism in the minds of Creationists?

There are probably at least two reasons for this association. Creation and catastrophism are both central to the Book of Genesis. Prior to the time of Abraham, nearly all "biblical coverage" is subordinated to these two themes. This possibly creates the impression of some "natural association". Secondly, they have possibly been perceived as closely associated as a result of their both being systematically excluded from uniformitarian philosophy. However, there is no logical, physical, or Scriptural necessity for catastrophism to follow Creation. The Bible merely states that it did. Any prior expectation (prediction), explicit or implicit, of finding more and more evidence that catastrophism played a significant role in earth's history probably

resulted (whether consciously or unconsciously) only from the acceptance of biblical accounts describing great catastrophes. If the Bible had not provided such descriptions, Creation would not have been seen as a basis for asserting catastrophism's having occurred or the future finding of evidence that it did. Some see an inference of catastrophism in a perceived demand by Creation for a young earth in conjunction with the earth's appearance of having a great age. However, it is Scripture that possibly demands a young earth and not the act of Creation.

Conclusion

In summary, Creation and catastrophism are independent; one does not imply the other. Even so, taken together, Scripture, other ancient literary evidence, and physical evidence establish a sequential association of events: Creation → catastrophism → variation, (limited, i.e.); recurrence of the latter two not being precluded.

In contrast, the secular catastrophist sees creation and catastrophism as two sides of the same coin: one

cannot proceed without the other, seemingly making a beginning impossible—as incomprehensible as God, so to speak.

The uniformitarian sees catastrophism as an undesirable crutch, recourse to which is made to explain the otherwise inexplicable. This reflects both inconsistency and a lack of objectivity; these being only two of the many weaknesses with which this dogma is fraught.

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CREATIONIST PREDICTIONS INVOLVING C-14 DATING

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Radiocarbon dating was introduced in 1946 by W. F. Libby, who was recognized with a Nobel Chemistry Prize fourteen years later (1960). From the beginning, many variables which should be considered in using the technique were recognized, several by Libby and his co-workers:^{1, 2}

1. *Cosmic ray flux through the earth's atmosphere*
2. *C-14 concentration in the ocean and atmosphere*
3. *C-14 decay half-life*
4. *Migration of carbon atoms into or out of earth materials*
5. *Local variation in carbon isotope concentrations, called fractionation*

These variables will be discussed briefly from the viewpoint of creationist contributions to the subject.

Cosmic Ray Flux

Creationists have promoted two important mechanisms for the variability of the initial item on the above list. The first mechanism involves the existence of a pre-flood water vapor canopy surrounding the early earth. The origin of this canopy model has been traced by Bernard Ramm, unfortunately in a sarcastic setting.³ Ramm gives credit for early canopy literature to H. W. Kellogg (1936) and C. T. Schwarze (1947). This proposed canopy reduced the penetration of cosmic rays through the early earth's atmosphere by absorption. The reduced flux of cosmic rays in turn lessened the production of C-14 during pre-flood history. The result is an apparent radiocarbon age of pre-flood samples which is far greater than actual. An example is the flood-deposited coal resource which is largely free of C-14 as expected from the canopy model. The thick car-

bon dioxide cloud cover of Venus provides a present day example of a planetary canopy. Nevertheless, the existence of an initial earth canopy remains to be accepted by the scientific world.

The second mechanism for the quenching of incident cosmic rays, studied by Thomas Barnes, is an exponentially increasing terrestrial magnetic field as one moves *backward* through time.^{4, 5} An increased deflection of cosmic rays away from the earth results from an increasing magnetic field in accordance with the Lorentz force. Current discussion, however, is usually limited to multiple short term events during magnetic field reversals, the last one presumed to have occurred 20 millennia ago.⁶

The mechanism of a single intense magnetic field having blotted out C-14 production in history is simply not accepted by secular science. In fact, the official summary of increased, (i.e., increased in former times over the present figure) magnetic field values recorded since 1839 is no longer available, a discouragement to those who wish to investigate the magnetic field decay phenomenon.⁷

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C-14 Concentration

Melvin Cook pointed out in 1956 that the formation and decay rates of C-14 in the atmosphere were not in equilibrium.⁸ Today a 30 per cent difference in rates is measured; the amount of C-14 is currently increasing in the atmosphere as equilibrium is approached.⁹ This gradual C-14 isotope buildup, if extrapolated from zero initial C-14 concentration, predicts that the earth's atmosphere is younger than 15 thousand years as calculated by Cook.¹⁰ This present large-scale transient behavior of the C-14 concentration is not explainable on the basis of uniformitarian presuppositions.

Radioactive Lifetime

Perhaps Lord Kelvin (William Thompson, 1825-1907) should be credited as the first creationist to challenge radiometric dating in an indirect way, on the basis of half-life variation. Kelvin's life concluded during the rapid initial growth of radiometric studies, initiated by Becquerel's discovery of radioactivity in 1896. Kelvin stubbornly refused to concede that radioactivity was a spontaneous process, independent of all outside effects.¹¹ Today it is realized that the lifetime of many unstable nuclei including C-14 are dependent on external temperature, pressure, and chemical environment. Kelvin's biography shows that he became increasingly dissatisfied with the growing uniformitarian view of general geology during his lifetime, although he was always gracious in his arguments supporting a young earth.¹²

Migration, Fractionation

Selective movement and incorporation of carbon isotopes in nature are little understood phenomena. Many natural processes tend to concentrate particular isotopes, with the result of natural isotopic enrichment. In the case of carbon, C-14 has occasionally been found to be selectively excluded during organic incorporation of carbon dioxide, with a resultant enrichment of C-12 and C-13 isotopes.¹³ Radiometric analysis of such material shows an apparent date which is older than actual due to the lack of C-14. Future studies may show the variable processes of isotope movement and incorporation to be of major significance. The recalibration necessary to account for these factors is unknown for C-14 as well as for all other radiometric dating methods.

Predictions

Looking to the future, several predictions can be made regarding the area of C-14 dating. Some of the predictions have exciting implications for creationists; others are mere projections of present uniformitarian trends.

1. In the latter category, published radiocarbon dates will continue to become more ancient. Even though the oldest (possibly) absolute dating scale is less than 10 thousand years old (Bristlecone pines), the C-14 method is regularly extrapolated back 50 thousand years. Recently, the promise was made for 100 thousand year C-14 dating, using mass spectroscopic counting

of actual carbon atoms rather than the usual monitoring of the rate at which C-14 decay is taking place.¹⁴ Thus, in spite of a lack of detailed information on the five variables listed in the first paragraph, the C-14 method is now extrapolated through 17 half-lives (100 thousand years). Eventually the method will probably be credited with million and billion year ages, as stray C-14 atoms are detected and are fallaciously credited with being the remnant of ancient carbon concentrations. This C-14 trend parallels the ever-increasing age of the earth as publicized by uniformitarian geology.

2. It may someday be possible to differentiate between cosmic-ray-manufactured C-14 and the remaining originally created variety of C-14. This proposed difference may be in terms of some inherent physical property manifesting itself as high-resolution spectral fine-structure. It is traditionally assumed that no original C-14 exists: "Obviously no carbon-14 is primordial; the half-life is too short."¹⁵ However, just as geologists speak of "juvenile" water entering the hydrologic cycle for the first time, so there may well be "juvenile" C-14 in the environment. The detection of such primordial, juvenile C-14 would be strong evidence for a recent creation on the order of thousands of years.
3. Further experimental evidence of a large magnetic field in earth history awaits discovery. Thomas Barne's work predicts an earth magnetic field strength twenty times the present value, just 6000 years ago. The C-14 free coal deposits certainly provide an indication of cosmic ray shielding due to an intense magnetic field in the past. Another indication of intense former magnetism should be available in the record of magnetization of rocks. Does remnant magnetization indicate a much stronger earth field in history? There are indications that this is indeed the case, both for archaeological artifacts,¹⁶ and for magnetic minerals.¹⁷
4. It may be predicted that new data on the earth's magnetic field since the time of Thomas Barne's 1965 summary, when available will continue to show an exponential decrease in field value.
5. Only moderate variations in the half-life of radioactive nuclei have been directly measured thus far, 5.7 per cent being the largest change (for a metastable state of U-235).¹⁸ The change of the carbon-14 lifetime has been noticed only as a slight statistical variation. It may be predicted that *large-scale* changes will eventually be produced in the laboratory for isotope lifetimes. The critical combination of chemical, physical, and electromagnetic field environment has simply not yet been found in the laboratory. This combination may nevertheless occur frequently in nature. Robert Gentry of Oak Ridge National Laboratory has thoroughly studied pleochroic halos, or radiohalos, and has found indirect evidence for such substantial

variations in the lifetimes of several long-lived isotopes.^{19, 20}

Conclusion

The many variables present in the radiocarbon dating technique rule out calibration of the method beyond the short-term possibly absolute dendrochronology of bristlecone pines. Nevertheless, the method is irrationally being pushed ever backward in time. Creationists thus have the continued challenge and responsibility of demythologizing the radiocarbon technique. Predictions concerning C-14 dating show that the future holds tremendous possibilities for evidence of a recent creation.

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RADIOCARBON CALIBRATION—REVISED

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The radiocarbon dating method has been claimed to provide considerable support for evolutionary theories of the past which conflict with the Biblical record of the Earth's early history. This paper seeks to answer the question: how can the radiocarbon activity measurements be understood in a way that is consistent with the Biblical framework of history? The evidences for the non-equilibrium theory of radiocarbon variations are discussed and are shown to give the theory a sound theoretical foundation. The prediction that atmospheric C-14 activities have increased with time has been tested by studying the results obtained from known-age samples. Consistency between theory and observation is found for the period of the last 2600 years, but not before this. It follows that either the non-equilibrium model is wrong, or that the chronologies of Ancient Egypt and of the tree-ring sequences are in need of major revision. Evidences from Biblical archaeology which strongly suggest the need of a revision are briefly discussed. Using a revised chronological scheme, the C-14 activities of the archaeological samples have been recalculated, and it is found that the results are consistent with the non-equilibrium prediction. Consequently, the theory is self-consistent, and this promotes confidence in the general approach. The form of a creationistic calibration curve for C-14 dates is suggested, so that use may be made of the dating system when re-evaluating the facts relevant to prehistory.

1. Introduction

From the Biblical account of the early history of the earth, a number of important events or periods can be identified: 1. the relatively recent Creation in six days; 2 the Fall of man into sin followed by God's curse on the Creation; 3. the Antediluvian period with its long-lived inhabitants and advanced culture; 4. the worldwide Flood and the preservation of land creatures in the Ark; and 5. the dispersal of the descendants of Noah from Babel to the different regions of the earth. Most modern archaeologists and prehistorians regard each

component of this history as mythical. Instead, they advocate a comparatively slow evolutionary development of man over hundreds of thousands of years as pre-human animals; tens of thousands of years as Palaeolithic man; and thousands of years as Neolithic man. More recently, the view that civilizations arose independently in different parts of the earth and that men did not disperse from a central region has gained wide acceptance. In the study of prehistory, the radiocarbon dating method has given considerable authority and impetus to the evolutionary views.

It is the purpose of this paper to show that the results of radiocarbon dating are dependent on the presuppositions incorporated into the theory of the method. Also,

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that with different presuppositions, an alternative theoretical approach is possible, which enables the same data to be interpreted in a way which is consistent with the Biblical framework of history.

This paper explains the principles underlying the revision and re-examines the radiocarbon data normally used for calibration purposes. One of the interesting aspects of this dating method is its interdisciplinary nature, and this is particularly relevant in the dating of samples from Dynastic Egypt. The validity of current thinking about Egyptian chronology is discussed, and is shown to have a crucial bearing on the validity of the proposed revision of the dating method.

The outcome of the discussion is a calibration curve for radiocarbon dates which radically changes their significance for prehistory. In the revised scheme, support for evolutionary ideas about man's origin is lacking, and the data are fully consistent with the Biblical record.

2. The Hypothesis of Non-Equilibrium

The earth's reservoirs of radiocarbon are popularly considered to be in a state of near-equilibrium, small variations in C-14 production in the upper atmosphere giving rise to comparatively minor fluctuations in the level of radiocarbon activity. There are, however, several evidences that such thinking is erroneous and that the C-14 reservoirs are far from being in a state of near-equilibrium. The presupposition of near-equilibrium has been repeatedly questioned by Creationists, and reference is made to some relevant papers in the following discussion.

2.1 The Biblical History

Evidence that the earth is young and that many C-14 ages are considerably older than the samples they are supposed to date is provided by the Biblical record of origins. There is only one realistic way to account for this situation: the atmospheric C-14 activity at the time of the sample's growth must have been considerably lower than its present value.¹ This interpretation of the data certainly requires there to have been a state of non-equilibrium in the past. Furthermore, since equilibrium is considered to be reached after about 30,000 years under present conditions, and since the earth is not as old as this, it is probable that the state of non-equilibrium still exists, although the situation will have been influenced by the intermediate conditions of C-14 generation and reservoir mixing.

2.2 Carbon-14 Generation and Decay Rates

Positive evidence for non-equilibrium has been found in the discrepancy between generation and decay rates of C-14.^{2, 3} The argument, as it stands at present, may be summarized as follows. The total natural radiocarbon content of the earth's carbon exchange reservoirs is fairly accurately known, and is about 2.16×10^{30} atoms.⁴ With a half-life of 5730 years, the decay rate is 8.28×10^{18} atoms/s for the whole earth, or 1.62×10^4 atoms/m²s, using the figure of 5.1×10^{14} m² for the surface area of the earth. The generation rate has been calculated in two ways. An analysis of atmospheric

neutron measurements has given a global average of $2.5 \times 10^4 \pm 0.5 \times 10^4$ C-14 atoms/m²s. Production rates have also been calculated from the measured energy spectra and nuclear abundances of the cosmic ray flux at the top of the atmosphere, and an average figure of $2.2 \times 10^4 \pm 0.4 \times 10^4$ C-14 atoms/m²s has resulted.⁶ A weighted mean of these values is $2.3 \times 10^4 \pm 0.3 \times 10^4$ C-14 atoms/m²s, and this should be compared with the decay rate. The generation rate is about 40% higher than the decay rate, and the discrepancy should be regarded as well-established.

In 1965, Libby attempted to account for the difference by postulating a large and irretrievable loss of carbon by sedimentation on to the ocean floors, and this idea has been incorporated into the calculations of Ramarty and Lingenfelter.⁶ Cook⁷ has shown that the postulated large sedimentation rate leads to geological absurdities. However, it could be argued that the Holocene sedimentation rates are abnormally high, and that uniformitarian principles for assessing sedimentation rates are not realistic.

An estimate of the contemporary sedimentation rate of carbon from ocean water may be made in the following way. Carbon is present in ocean water in the form of bicarbonate and carbonate ions. It has been found that the waters are approximately saturated with calcium carbonate near the surface, but not saturated at depths below a few hundred meters. Consequently, as the calcareous skeletons of dead organisms sink from the surface waters to the deep waters, they tend to dissolve. This information is summarized by Fyfe.⁸

Considerable amounts of carbon, in the form of carbonates, are added this oceanic system by the rivers. If the oceans are in an equilibrium condition with respect to calcium carbonate, the total sedimentation rate can hardly be much greater than the rate at which carbon is added by the rivers. If the oceans are not in equilibrium, and the deep waters are still approaching saturation, the sedimentation rate will be less than the above figure.

The information required to calculate the rate at which rivers carry carbon into the oceans is supplied by Mason.⁹ The total dissolved material carried out to sea each year is estimated to be 2.735×10^{13} kg, of which 35.13% is carbonate. This leads to an estimated annual sedimentation rate of carbon of 3.8×10^{-4} kg/m². The total carbon of the biosphere-atmosphere-hydrosphere reservoirs is estimated to be 4.2×10^{16} kg, and⁴ the number of C-14 atoms 2.16×10^{30} . Consequently, the sedimentation rate calculated above represents a loss of radiocarbon of about 0.062×10^4 atoms/m²s. This is too small by a factor of 10 to account for the discrepancy between the generation rate and the decay rate, and it indicates that the sedimentation loss explanation of the discrepancy does not deserve further consideration.

If the discrepancy cannot be explained from within the carbon cycle, it is necessary to look at the C-14 generation rate. Has the rate increased by about 40% in recent years? Natural C-14 generation is a result of cosmic rays interacting with atoms in the earth's atmosphere. The cosmic ray flux reaching the earth is influenced by the magnetic fields of both the earth and the sun. Abnormal changes of the earth's magnetic field have not been observed, but only a slow reduction in the

dipole field moment. Similarly, the sun is thought to be behaving quite normally at present. Historical records suggest an abnormal period between 1645 and 1715 A.D., during which sunspots were almost completely absent.¹⁰ Since that time the 11-year cycle of solar activity has predominated. There is no indication, therefore, from the earth or from the sun, of any factors which could account for the present discrepancy between the generation and decay rates of C-14, and this effectively eliminates them from further discussion.

The only other relevant parameter is the cosmic ray flux itself. The origin of cosmic rays continues to be a subject of controversy, but the most widely held view is that supernovas are primarily responsible for accelerating these particles to such high energies. Some calculations have been made to assess the possible influence that nearby supernovas could have on C-14 generation rates. With the four most recent supernovas observed with the naked eye, the largest estimate is about 0.5% increase.⁶ All the figures are small because these stellar explosions occurred at such great distances from the earth: the cosmic ray flux decreases with distance from its source, and it also is diffused by the magnetic field of the galaxy.

Nevertheless, if it is accepted that supernovas are a source of cosmic rays, and also that one occurred comparatively near to the earth (about 100-200 parsecs), it would be possible to account for the C-14 generation rate becoming abnormally high. Such a supernova would have become visible in the last few hundred years, and it would certainly have been of extraordinary brilliance. However, it is also certain that a nearby supernova has not been observed; and so it is necessary to conclude that there is no explanation of the C-14 generation and decay rate discrepancy from such a source.

Furthermore, for about the last 25 years, earth-based cosmic ray monitoring systems have recorded steady levels of flux, with only the normal solar cycle variations, and this experimental evidence, albeit of limited value, does not support the idea of recent large changes in cosmic ray flux.

The discrepancy remains, and the following statement by Fairhall and Young⁴ is indicative of the lack of other ideas to solve the problem. "We note in passing that the total natural C-14 inventory of 2.16×10^{30} atoms . . . corresponds to a C-14 decay rate of 1.63×10^4 disintegrations/m²s of the earth, considerably below the estimated production rate of C-14 atoms averaged over the last 10 solar cycles (111 years) of $2.5 \times 10^4 \pm 0.5 \times 10^4$ atoms/m²s. From a geophysical point of view it would be very surprising if the decay rate and the production rate of C-14 were out of balance as seriously as the difference between the above two numbers would suggest. It is difficult to reconcile this discrepancy by errors in computing the C-14 inventory since the bulk of the C-14 is in the sea, where the C-14 concentration relative to the terrestrial biosphere is known fairly well . . . The source of the discrepancy is therefore unknown unless the present day production rate is indeed significantly higher than the average production rate over the last 8000 years, the mean life of C-14."

The least that can be concluded from this evidence is

that radiocarbon generation and decay rates are not in equilibrium at the moment. Is it possible to say whether this situation has existed in the past? Whilst no definite conclusions can be drawn from this evidence, in the absence of any realistic explanation of the discrepancy, the hypothesis that the present situation is normal rather than abnormal is considerably strengthened.

2.3 Anomalous results from dendrochronological samples

The principle of globally uniform radiocarbon activity in the atmosphere has an excellent physical basis, and, if it is found to break down, the implications for the C-14 dating method are very far-reaching. Anomalous results have been obtained from some dendrochronological samples which do suggest a breakdown of the uniform activity principle, and a discussion of their significance has been included in reference 11. It is sufficient to say here that whilst these results are inconsistent with the equilibrium approach to radiocarbon variations, they are not necessarily so with the non-equilibrium model. This because imbalances in radiocarbon transport which result from non-equilibrium can override the effectiveness of the atmospheric mixing processes which tend to produce a uniform C-14 activity level throughout the world.

3. The Non-Equilibrium Model and Biblical History

Evidence which favors a serious examination of the non-equilibrium model of radiocarbon variations has been presented in section 2. As the next step, it is proposed to link the model more carefully with the Biblical record of the past. The two major discontinuities in the history of the earth are the Creation and the Flood. How are these particular events related to the non-equilibrium model? Creationists have differed on this matter. On the one hand, Whitcomb and Morris¹ suggest that, before the Flood, the troposphere was kept virtually free of radiocarbon. According to their view, finite C-14 dates are obtained only from post-Flood samples. On the other hand, Whitelaw¹² permits large quantities of C-14 to penetrate into the troposphere during the Antediluvian period, and, by the time of the Flood, he estimates that the radiocarbon activity was only about 12% lower than the normal contemporary level.

The easiest way to come to some conclusions about these alternative views is to consider the samples that have been dated by radiocarbon and to note their chronological place in the history of the earth. As a general rule, finite C-14 dates are obtained from samples representing the Late Pleistocene and Holocene periods, and most Creationists are agreed that these periods are to be placed subsequent to the Flood. "Infinite" dates are normally obtained from samples classified as geologically earlier. Consequently, as Whitcomb and Morris maintain, these are Pre-Flood samples, and they have C-14 activities which would appear to be so low as to be undetectable. This suggests the behavior which is schematically illustrated in Fig. 1.

The means whereby C-14 activities were maintained at a low level during the Antediluvian period are not known. However, there is no shortage of possible

explanations: the shielding influence of the suggested vapor canopy, to reduce both C-14 generation and the conversion of C-14 to radioactive carbon dioxide; a stronger magnetic field of the earth which would reduce the cosmic ray flux interacting with the atmosphere; a lower transport rate of C-14 from the upper atmosphere to the troposphere, because of the equable global climate; and a considerably greater quantity of carbon in the carbon exchange reservoirs, which would tend to give low C-14 : C-12 ratios.

In the technical literature, it is noticeable that radiocarbon activity levels are often reported to fluctuate with time, although the research workers are unable to offer satisfactory explanations of these variations. Nevertheless, this lack of understanding does not hinder them in their work on radiocarbon calibration, because the data are derived from measurements using known-age samples. Exactly the same principle is applicable to this study of radiocarbon variations. From the framework of Biblical history, Antediluvian samples are generally found to have "infinite" ages, and even though it is not clear why the activities are so low, this information may be legitimately incorporated into the calibration of radiocarbon dates.

4. Testing the Non-Equilibrium Model Using Samples of Known Age

Fig. 1 illustrates an inescapable prediction about radiocarbon variations in the past which follows from the non-equilibrium model. The prediction is that the atmospheric C-14 activity has been steadily increasing with time. To test this prediction, it is necessary to obtain samples of known age and to measure their C-14 activities. Then, a simple calculation determines the atmospheric C-14 activity at the time when the sample was living. Two types of known-age sample are available: tree-rings, primarily from Giant Sequoia and Bristlecone Pine trees; and archaeological samples from chronologically well-defined sites. The accuracy of the chronologies has been discussed in a previous paper,¹¹ and arguments were given for questioning their reliability before about 500 B.C. In this section, C-14 variations over the last 2600 years are considered, and

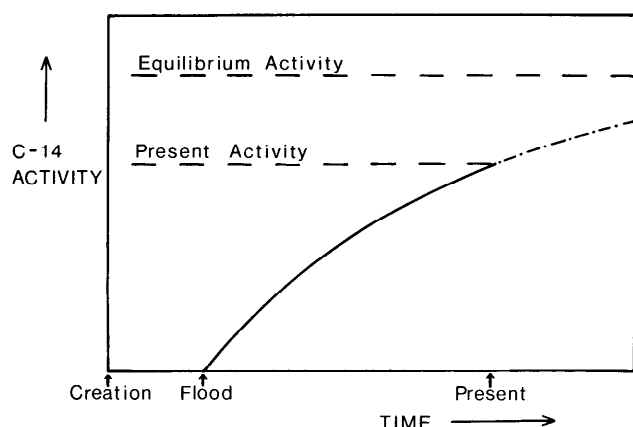


Figure 1. This shows the variation of radiocarbon activity with time according to the non-equilibrium model. The concentration is still building up and has not yet reached equilibrium.

particular attention is given to the trend predicted by the non-equilibrium model.

The radiocarbon activity of the atmosphere at the time when the sample was living is conveniently expressed by the term $\Delta\%$. This parameter expresses the activity as a per mil proportion of the "standard", which is considered to represent the atmospheric activity in the period 1860-1880 A.D. A 1% change in radiocarbon activity is a change of 10 in the parameter $\Delta\%$. In all calculations, the 5730 year half-life of C-14 has been used.

Fig. 2 plots the relevant data. Tree-ring dates are dots, and archaeological dates are closed circles. The data are taken from Refs. 18-22 of Reference 11; and in addition there are a few other archaeological dates taken from the journal *Radiocarbon*. The following notes and observations refer to Fig. 2. 1) In reference 11, tree-ring dates were considered to be suspect before about 500 B.C. After examination of the trends in more detail, it is found that the tree-ring data deviate from the archaeological data at about 250 B.C. Consequently, in Fig. 2, dendrochronological dates earlier than 250 B.C. are omitted.

2) Apart from the reduction since 1700 A.D., there has been a steady increase in atmospheric C-14 activity since 650 B.C. This increase is the basic prediction of the non-equilibrium model.

3) Whereas variations have been small for most of this period, this has not been the case over the last 500 years. The only trend that is widely accepted as having a satisfactory explanation has been the general decrease in activity since 1880 A.D., which is not clearly shown in Fig. 2. This decrease is known as the Suess Effect, and it is attributed to the large amounts of non-radiogenic carbon from fossil fuel that has been burned since the Industrial Revolution.

4) The baseline, $\Delta\%_0 = 0$, which has been chosen, is really rather arbitrary because of the variations that have occurred with time. As it happened, with this baseline, and with the C-14 half-life that was used for many years, the dating method did produce dates that agreed very well with historical dates. Consequently, the idea of "absolute" dating by radiocarbon measurement has entered the minds of the general public. This sense of "absoluteness" is still to be found, even though it is now known that atmospheric C-14 activity levels have not been constant and that C-14 dates must be calibrated. 5) The "anomalous" Egyptian dates of the Saite Period (of reference 11) are no longer anomalies in this presentation of the data. They continue the trend which is indicated in the graph and which is predicted by the non-equilibrium model.

To summarize, the observed trend over the last 2600 years is consistent with non-equilibrium. During this period, changes in C-14 in the atmosphere have not been very great, but nevertheless, a trend is clearly present.

This analysis of the data differs from that of Clementson,¹³ who has the C-14 activity decreasing, rather than increasing, during this period. The difference is primarily due to the limited data used by Clementson. However, according to the argument of this paper, a curve drawn through the three measurements at about

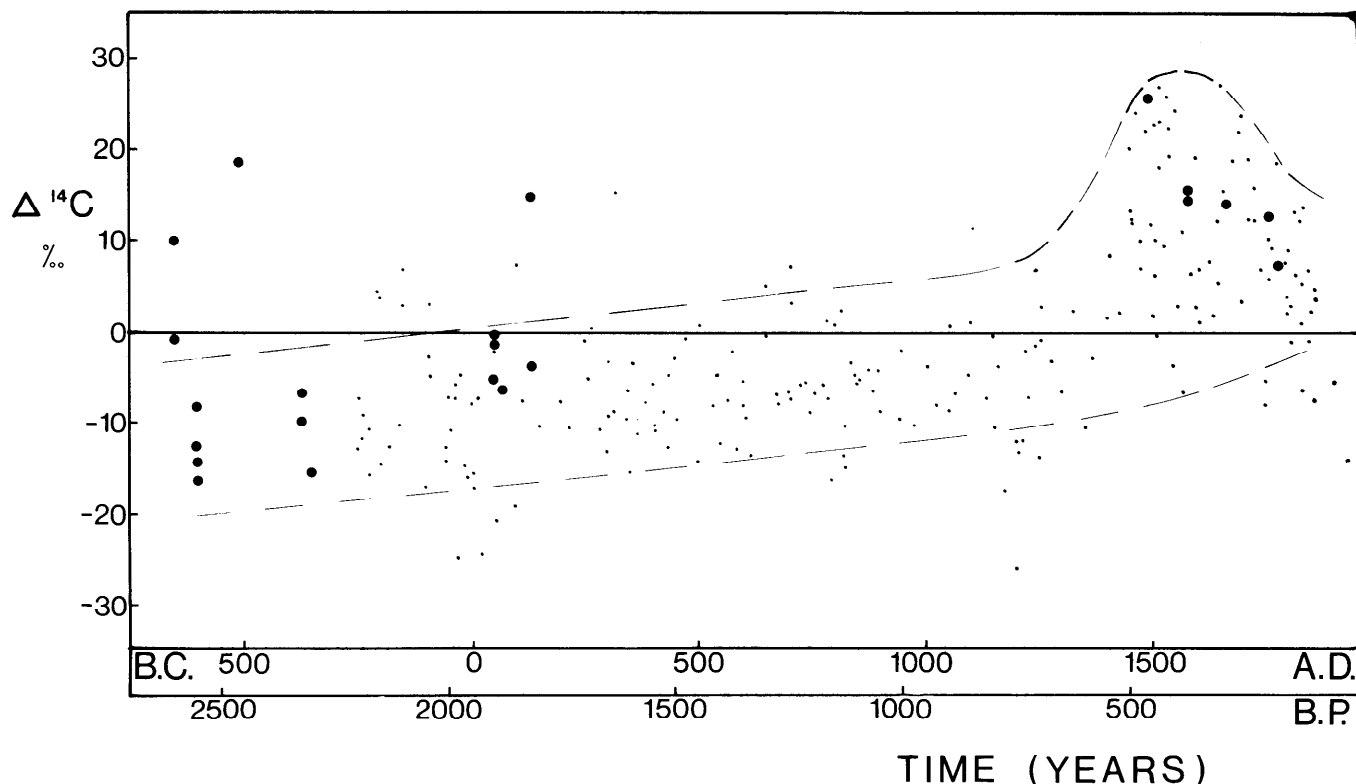


Figure 2. This shows the C-14 activity (proportional to the concentration) for the last 2600 years, as determined by tree rings and archaeological samples. The two curves may be considered to provide upper and lower limits.

2000 B.P., which are tabulated by Clementson but are not plotted on his Fig. 2, would give the trend more accurately than that which he suggests.

It has been shown that radiocarbon activity variations over the last 2600 years are consistent with the non-equilibrium model. It is now appropriate to consider the situation before 600 B.C. The trend is well-known to students of radiocarbon calibration, and it is illustrated in Fig. 1 of reference 11. The radiocarbon dates become younger than the historical ages assigned to the samples. If this is accepted, then the atmospheric C-14 activity before 500 B.C. was higher than the "standard" present activity, and this contradicts the prediction of the non-equilibrium model.

The observations bring the test of the model to a critical state. There are only two options. Either the non-equilibrium approach is wrong and it must be dropped; or, there are major errors in the currently accepted Egyptian and tree-ring chronologies before 600 B.C. In other words, if the observed trend is accepted, then the major prediction of the non-equilibrium model is found to be unreliable, and so the hypothesis is incorrect. Alternatively, the non-equilibrium approach can be sustained only if the real ages assigned to the samples are considerably younger than is generally accepted. It is not realistic to leave the verdict open for the time being, for the evidence is sufficiently strong to require that one of these two options be followed.

It is at this point that the argument of reference 11 becomes particularly relevant. The inconsistencies between the Egyptian and the dendrochronological results

suggest that there are errors in both chronologies. Therefore, before abandoning the non-equilibrium approach, it is of great importance to consider the second option in more detail. Since the difficulties of reinterpreting the dendrochronological data are immense, if not impossible, the discussion of section 5 is entirely devoted to the revision of Egyptian chronology.

5. A Revised Chronology of Ancient Egypt

The currently accepted absolute chronologies of the Near Eastern civilizations in the second and third millennia B.C. rely ultimately upon the Sothic dating method. Egyptian chronology stands alone as being "independently derived", and the other contemporary civilizations are dated by cross-reference to it. Powerful arguments against the validity of the Sothic dating method have been presented by Courville^{14, 15} and Velikovsky.¹⁶ In the light of the evidence these authors have amassed, it is likely that the main reason why the Sothic dating method continues to be accepted is that scholars are at a loss to find an alternative scheme. Their problem is: how is it possible to establish a reliable chronology without clear and accurate historical records?

Our approach to this difficulty is to turn to the chronological information provided in the Bible. The data are not meager and, since there are many points of contact between Israel and Egypt, it should be possible to tie Egyptian and Israelite history together. In this way, there is no need to have recourse to an unproven and doubtful scheme of astronomical dating. However,

most scholars have failed to use Biblical chronology as a guide. The tendency has nearly always been to work independently of the Biblical record, and then to examine the Bible in the "light" of the findings of archaeology. The result contributes to the so-called "higher criticism" of the Bible.

If there is a major error in Egyptian chronology, it is obvious that the archaeological record of Biblical history has been misinterpreted. A notable link between Egyptian and Israelite histories is at the time of the Exodus and, significantly, difficulties in interpreting the archaeological evidence have been recognized for years.

The Encyclopedia of Christianity has an article on "Biblical Archaeology"¹⁷ which indicates that the positive evidences of the Exodus and the settlement of the Israelites in Palestine are totally lacking. Summarizing the Egyptian evidence: "... we cannot be certain"; and "when we look at the evidence from Palestine, it is again inconclusive". Professor MacRae concludes this section of his article with these words: "Some new discovery may make the matter absolutely final, but up to the present, it must be considered a question on which we do not yet have sufficient light." However, this absence of any solid, positive evidence is incompatible

with the Biblical record. The Exodus was a catastrophe for Egypt: economically, politically and militarily. The Scriptures declare it to be a judgment upon that nation, and it was used as a warning to Israel not to ignore the word of God. (Genesis 15:14; Exodus 7:4, 11:2-4, 12:12; 1 Samuel 6:6; Amos 8:8, 9:5). Yet, this collapse of Egypt must have occurred, according to the conventional chronology, during the prosperous and powerful New Kingdom period. The extravagance and luxury of the New Kingdom rulers is well known, and illustrations of their treasures, their buildings and their statues may be found in profusion in popular histories of Ancient Egypt.

A study of the archaeological and historical problems associated with the Exodus has been made by Courville.¹⁴ He examines the most significant theories of the scholars, including the widely held view that Rameses II was the Paraoh of the oppression and of the Exodus, and concludes that these theories are woefully inadequate. The "evidences" might satisfy a scholar who thinks that there are exaggerations and errors in the Bible, but those who profess to believe in the divine inspiration and inerrancy of Scripture cannot accept this situation. They must conclude, as Courville has done, that there are significant errors in the chronology

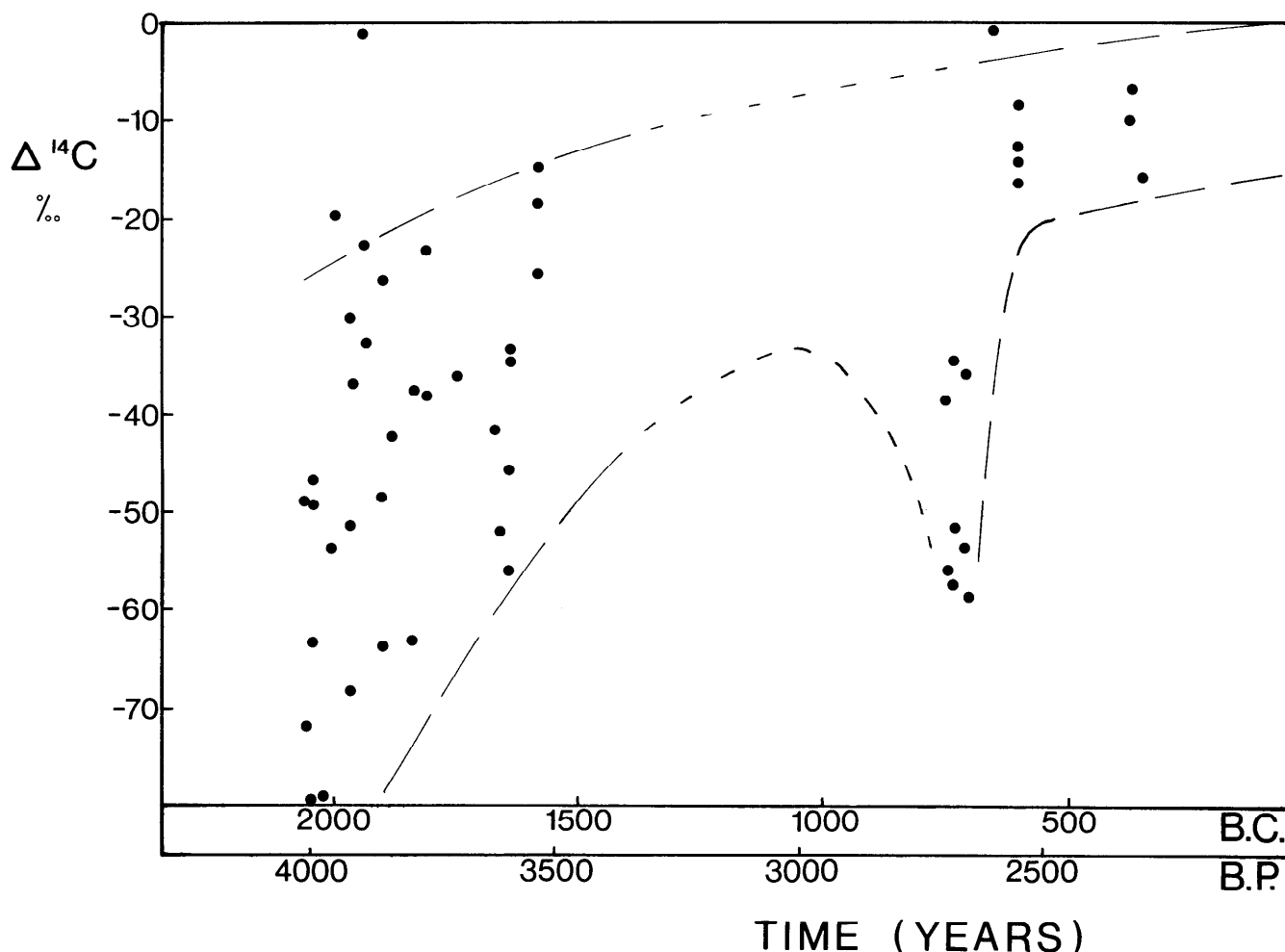


Figure 3. This shows the C-14 activity vs. time in the past as re-interpreted according to the revised chronology.

of Ancient Egypt, and that an attempt must be made to reinterpret the evidence.

The work of Courville¹⁴ should be consulted for a detailed discussion of chronological revision. Velikovsky¹⁸ has written a volume of major importance on the New Kingdom period. These works document many excellent synchronisms between Israelite and Egyptian history which are easily recognized once the conventional chronology is discarded. Close agreement is found between Courville and Velikovsky during the Hyksos and New Kingdom periods, but there are differences of view in the subsequent dynasties. Courville has also proposed a reconstructed chronology of the Old and Middle Kingdom periods. In my opinion, the scheme of Courville is linked, in all its essentials, to Biblical history, and so it provides a reliable chronology of Ancient Egypt.

It should be emphasized that the validity of the re-evaluation of the radiocarbon data, which follows in section 6, is totally dependent on the accuracy of the revised chronology. Although there is a good measure of agreement between Long¹⁹ and this paper, there are significant differences, and they should be evaluated on chronological grounds.

6. Radiocarbon Calibration and the Revised Chronology

Radiocarbon calibration makes use of C-14 activity measurements from samples of known age to determine the atmospheric activity at the time when the sample was living. This section reconsiders the Egyptian archaeological data (of reference 11) in the light of Courville's revised chronology.

The archaeological samples are associated with either a specific king or a dynastic period, and so each one can be assigned an age according to the revision. This age, together with the measured radiocarbon activity, enables the initial activity to be calculated. The result of this re-interpretation of the data is plotted in Fig. 3.

At 600 B.C. the C-14 activity level is about -10%. Before this, the atmospheric activity is observed to decrease in such a way that, by about 2000 B.C., it is of the order of -50%. Clearly, the trend for older samples to have progressively lower $\Delta\%$ levels is observed. In other words, the whole picture is now consistent with the non-equilibrium model.

Before 2160 B.C., there are no suitable materials available for calibration purposes, and so it is not possible to trace the curve back further in time. Nevertheless, from the non-equilibrium model illustrated in Fig. 1, it is predicted that the trend will continue, such that infinite ages correspond to the time of the Flood. The revised calibration curve, with an hypothetical extrapolation, is illustrated in Fig. 4. This curve has fluctuations in it at about 700 B.C. and 1700 A.D., but, as explained earlier, calibration merely records such variations, and it is not necessary to explain them.

This curve may now be used in the same way as any other calibration curve—to convert C-14 dates to calendar years. The major difference is that, whereas other C-14 calibration curves reckon C-14 dates to be too young before about 600 B.C., the curve of Fig. 4 shows them to be too old.

Conventional C-14 calibration has the effect of "stretching out" radiocarbon time, and slowing down, for example, the rate of man's cultural development. By contrast, this revised approach has the effect of "compressing" radiocarbon time, and speeding up the rate of man's cultural development. Thus, according to the revision, Palaeolithic and Neolithic Man may be considered to have existed for generations, rather than for millennia.

7. Summary and Conclusions

Creationists have repeatedly argued the case for the non-equilibrium model of radiocarbon variations. This paper has brought the evidence up to date, and has shown that the case for the non-equilibrium approach is as strong as, if not stronger than, it has ever been.

The Biblical record of the recent Creation implies that there must have been a time when plants grew in an atmosphere which was virtually free of C-14, and this is illustrated in the non-equilibrium model of section 3. A major geophysical evidence for non-equilibrium is the 40% discrepancy between the decay rate and the generation rate of C-14. This well-attested finding

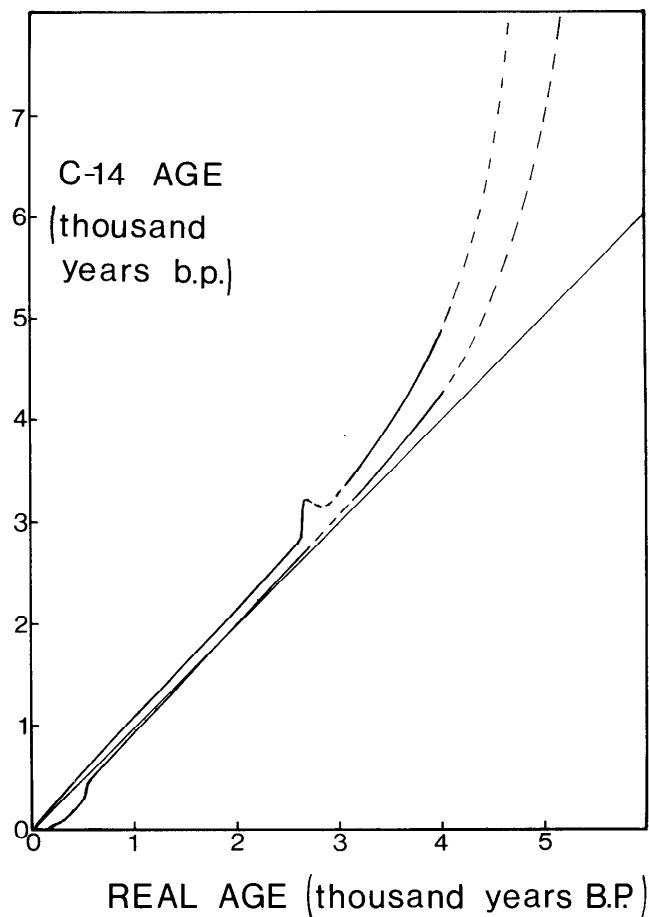


Figure 4. This is a revised calibration curve for C-14 dates, constructed in the light of the revised chronology and the principles discussed in this article. Note that very great C-14 ages indicate a real age of about four to five thousand years. Again, the two curves may be considered to provide upper and lower limits. The diagonal straight line merely shows what would be the case were the C-14 and real ages equal.

has not been explained by the research workers developing the radiocarbon dating method, although it is perfectly consistent with the non-equilibrium model. Furthermore, the breakdown of the principle of uniform atmospheric C-14 activity throughout the world is an indication of the need to revise the conventional theory, and these observations also can be understood within the framework of non-equilibrium.

The prediction of the non-equilibrium model, that radiocarbon activity levels have been rising with the passage of time, has been examined in two parts. With non-controversial known-age samples, covering the last 2600 years, the non-equilibrium theory is consistent with the facts. The activity variations are not large, but they do follow the predicted trend. Before 500 B.C., the postulate of non-equilibrium can only be sustained if the ages of Egyptian and dendrochronological samples are revised.

Evidence has been summarized to justify such an approach, for the testimony of Biblical archaeology virtually demands a radical revision. Courville's study of *The Exodus Problem* has provided the revision used in this work and, with this alternative chronology, all the relevant archaeological data have been found to be consistent with the non-equilibrium model.

Since the model has a substantial theoretical basis, and is consistent with the experimental data, a further step is justifiable. A calibration curve has been prepared to assist in the interpretation of radiocarbon dates, and to act as a Creationistic alternative to other calibration curves that have been published.

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CONTRARY AND CONTRADICTIONARY ARE DIFFERENT

In the days when logic was studied in earnest, "every schoolboy"—and the statement is about literally true—knew the difference between contrary and contradictory propositions or statements. But it would appear that nowadays many miss the distinction; at least, one might draw that conclusion upon reading the work of certain attackers of the doctrine of Creation.

For these people urge that Creation, being a supernatural notion, has no place in natural science. Indeed, there are reasons for disagreeing with such people even at that point. For suppose it firmly established—never mind how—that the world of nature came about, initially, by Creation. Do these people really mean that then one should sit on his hands, and refuse to study nature at all?

Again, surely to say that the world came about by Creation is analogous to saying that a certain building came about (first of all) by an architect's work of design. Of the workings of the architect's mind, while he was designing it, science may or may not have any account. But nobody would deny that it is possible to

grant that it was designed, and then to go on and study say the stresses in the various parts in a properly scientific way. If the case of the world not analogous?

However, return to the point, contrary vs. contradictory. First of all, what is meant by saying that something is natural? It seems hard to find a better explanation than the one which Aristotle (paraphrased a bit) gave. He said that the natural is that which happens always or for the most part (i.e., in given circumstances). And really, in practice, that is how it is judged.

Now Creation, being a unique thing, can not be said to happen always or for the most part. But neither could the alleged big bang happen always or for the most part. Even the most uniformitarian of uniformitarians would not claim that it happened more than once. So both Creation and the alleged big bang are not natural. As the logicians state it, the contradictory of natural is not-natural. Of two contradictory propositions, one must be false, one true. So both Creation and the big bang would be not-natural.

(Continued on page 26)

DENDROCHRONOLOGY, RADIOCARBON, AND BRISTLECONES†

HAROLD S. GLADWIN*

The first recorded instance of counting the number of rings of a tree for the purpose of dating was made by Leonardo da Vinci, 1452-1519. A copy of this record was obtained by me in 1956 from the Library of Vinciana in Los Angeles, and is now in the files of the Santa Barbara Botanic Garden.

There undoubtedly were a number of occasions between 1500 and 1900 when men observed or used the rings of a tree for various purposes, but it was not until 1916 that Dr. Andrew Ellicott Douglass, Director of the Steward Observatory at the University of Arizona, made a systematic study of the growth of trees.

Dr. Douglass selected the Ponderosa Pines growing at Flagstaff, Arizona, and noted the relative width of each ring by drawing vertical lines on a graph paper of 2 mm spaces. As a result of his investigation, Dr. Douglass announced that he had succeeded in correlating the growth pattern of Ponderosa Pines at Flagstaff with the Sun Spot Cycle over a period of 500 years.

Unfortunately, Dr. Douglass did not then proceed to transfer his shorthand memoranda to exact measurements of ring-widths, which would have satisfied astronomers, and his claims did not receive the attention they may have deserved. Since 1916 there has been no revival of his claims.

In 1918, Dr. Douglass happened to be talking to Dr. Clark Wissler, head of the Department of Anthropology in the American Museum of Natural History in New York. The Museum recently had excavated the Aztec Ruin in northwestern New Mexico, under the direction of Dr. Earl Morris, and had a large supply of timbers, both from Aztec and from Pueblo Bonito in Chaco Canyon, which had been partly excavated by Dr. Pepper. Dr. Wissler suggested that Dr. Douglass might make use of these logs and, by comparing the patterns of ring-widths, actually date the ruins in calendar years.

The dating attempts failed, as Dr. Douglass was unable to find any overlap with the oldest Flagstaff Ponderosas, but he did succeed in obtaining what he called a "floating chronology" from the beams of the two large ruins.

Archaeologists, working in other parts of the Southwest, were sending beams and charcoal in to Dr. Douglass. In 1929 he was successful in bridging the gaps and in building a continuous chronology from A.D. 700 to 1929.¹

Among the beams sent in to the Tree Ring Laboratory at the University of Arizona was a collection from the Hopi Towns, in northern central Arizona. One of these, from Oraibi on the southern flank of Black Mesa, showed a pattern of 23 narrow rings near the beginning of

the record, where rings are usually wider than the outer rings near the bark.

Dr. Douglass had come to believe that a narrow ring was an invariable indication of deficient moisture and was therefore persuaded that the 23 narrow rings of this particular beam provided evidence of a drought which had lasted from A.D. 1273 to 1299.

Archaeologists at the University of Arizona accepted the Douglass belief, using the supposititious drought as the explanation for the abandonment of the pueblos and cliff-dwellings in the Four Corners area, and the movement of the people to the Great Pueblos in the Jeddito district. To some, it may seem rather strange that people should have moved, voluntarily, from the relatively well-watered districts of Mesa Verde and Tsegi Canyon in order to crowd into a few Great Pueblos in the Jeddito area, where it is always dry. The Great Drought of A.D. 1273 to 1299, however, is a classic example of history based on little more than frequent repetition.² One does not need to look further than the arrival of the Athabaskan nomads, Navaho and Apache, in the 10th Century, to explain the gradual destruction of the ancient pueblo society.

Tree-Ring Dating at Gila Pueblo

It was at this point that I became concerned. It seemed to me that it was one thing to use tree growth patterns in order to date prehistoric Southwestern ruins, but quite another to employ the widths of tree-rings to interpret the climate of the Southwest as it might have affected the course of history.

During the Winter Term of 1930, accordingly, I and two other members of the staff of Gila Pueblo audited the course in "Dendrochronology" being given by Dr. Douglass at the University of Arizona. The results can be summed up by saying that none of us was satisfied. We had four fundamental points of disagreement with Dr. Douglass, none of which was ever settled.

1) We suggested that the widths of all tree-rings should be measured, rather than that relative widths should be recorded by arbitrary estimates, indicated by the length of a line.

Dr. Douglass refused on grounds that the widths of rings of different trees were quite variable, and that his estimates of relative widths were probably as correct as the most exact measurements. Furthermore, he knew of no instrument that could make such exact measurements.

2.) We then requested that the Tree-Ring Laboratory at the University should assume the responsibility for publishing an Estimated Continuous Chronology against which other charts, estimated or measured, could be compared.

Dr. Douglass again denied our request, for the reason that the Master Chart might need to be frequently revised. This, he said, would require too much clerical work to keep other dendrochronologists advised of changes.

3) We asked that some symbol or note should be added whenever a "missing ring" was needed in order to obtain correlation with a Master Chart.

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The *Anthropological Journal of Canada* is edited from 1575 Forlan Drive, Ottawa, Ontario, Canada. It contains much information about ancient men, in the New World and elsewhere.

The text is the same as in the original. There are a few small changes in layout, to conform to the practices of the *Quarterly*.

Dr. Douglass did not consent, but gave no reason for his refusal.

4) We questioned Dr. Douglass's belief that a narrow ring is an invariable indication of drought, and referred to the statement of Dr. D. T. MacDougal, Director of the Experiment Station of the Carnegie Institution of Washington, at Carmel, that "maximum growth occurred during years of minimal rainfall."³

Dr. Douglass, to my great surprise, became very angry with me, and terminated our discussion. It was several years later that I learned that, although Dr. Douglass's work was also supported by grants from Carnegie Institution through its president, Dr. John D. Merriam, neither Dr. Douglass nor Dr. MacDougal would speak to or communicate with one another; yet both of them were primarily concerned with the growth of trees.

Following our meeting and discussion in his office at the Steward Observatory, Dr. Douglass did not again attend the class, but delegated the teaching of the rest of the course to his assistants at the Tree-Ring Laboratory. We returned to Gila Pueblo, having learned little more than we already knew before we went to Tucson.

Upon returning to Gila Pueblo, I at once began to devise an instrument that could be used to measure the growth of ring-widths as accurately as possible. It also was necessary to prepare the surfaces of wood samples so that every cell could be seen under 10x magnification. At the same time, the surface had to be so smooth and even that it would remain in critical focus when moving under a binocular microscope at 25x magnification. The method of preparing a surface by chipping with a safety-razor blade, employed by Dr. Douglass, therefore would not be satisfactory for use with a measuring instrument or for close examination under higher powers of magnification.

Finally, after meeting all of these requirements, there was the problem of correlating measurements of the ring-widths of young trees with relatively broad rings, and those of old trees with extremely narrow rings.

All of the details of each step in these various processes have been described in the series of our Medallion Papers.⁴

Problems in Attempting Correlation of C-14 and Tree Ring Dating

The reason for this recapitulation of the history of Tree-Ring dating is that a question of great importance to archaeologists, both in the Eastern and Western Hemispheres, has been raised, due to the as yet unknown extent of uncertainty in regard to radiocarbon dating.

In *Before Civilization*, Dr. Colin Renfrew has successfully shattered confidence in the dating of prehistoric events based on the radiocarbon method of dating, invented by Dr. Willard F. Libby. In an attempt to correct such dating, however, Dr. Renfrew has turned to tree-ring growth. For this purpose he has used the antiquity of the Bristlecone Pine, *Pinus aristata*, for which ages of 6,000 years or more have been claimed.

For those who are neither radiocarbon physicists nor "dendrochronologists", it is essential to know that all trees are not of equal value for tree-ring dating. It prob-

ably would be safe to say that the great majority of deciduous trees are of little or no value, because of the difficulty in deciphering rings. I do not know of any instance of deciduous trees having been used for dating purposes, unless, possibly, some of the oaks.

Among the conifers, junipers are unsatisfactory to the point of being actually misleading, chiefly because many species are partly dead and consequently undependable; the living parts of the tree either grow no annual rings at all or very often grow multiple rings in the same year. It seems, sometimes, that trees which are largely dead, add a ring for every thunderstorm.

Among the pines, *Pinus aristata* is, if anything, even more undependable than the junipers principally because of the size of the tree, so much of which is dead. In one example, a tree that was three feet in diameter showed a cambium layer that was only eight inches in length. In other words, of the more than 100 inches in the circumference of this tree, only eight inches were alive. The tree for that year would show a missing ring, except for those eight inches.

We have many cores at the Santa Barbara Botanic Garden that were collected from Bristlecones growing in the White Mountains of California east of the Sierra Nevada, at altitudes of 10,000 feet, where the rainfall is very low and erratic. There are also a number of cores from Bristlecones growing at high altitudes in southwestern Utah and on the San Francisco Peaks at Flagstaff, Arizona. Comparison of charts of measured rings show no similarity whatever.

Dating by Radiocarbon

For the effects of the recent developments in dating by radiocarbon, I refer to the description on the dust-cover of *Before Civilization* by Dr. Colin Renfrew, 1974, published by Alfred A. Knopf.

"Nearly every assumption archaeologists have made about the development of prehistoric European cultures is brought into serious question by the recent dramatic revision of radiocarbon dating. And in this highly original and important book the distinguished British archaeologist-anthropologist Colin Renfrew considers the revolutionary implications of the new knowledge—a breakthrough that has made obsolete the formerly accepted theory that prehistoric culture began in the Near East and was only later diffused into 'barbarian' Europe.

"Demonstrating that we have completely undervalued the originality and creativity of the prehistoric societies of Europe and England, Professor Renfrew gives us the first full account of the new techniques through which their cultures have been discovered to be as much as 800 years older than previously thought possible. He makes clear how, on the evidence of radiocarbon dating methods when calibrated with tree-ring dates, it becomes apparent that:

"The megalithic tombs of Western Europe are older than the pyramids, which were believed to have preceded them.

"The early metal-using cultures of the Balkans antedate both Troy and the bronze-age Aegean,

from which they were presumed to have been derived.

"Britain's Stonehenge, once thought to have been inspired by Mycenaean builders, was completed well before Mycenaean civilization began.

"These drastic revisions of established chronology are merely the first fruits of the radiocarbon revolution, here described in fascinating and authoritative detail."

In 1949 I visited the laboratory of Dr. Willard F. Libby, in the Jones Chemical Building, on the campus of the University of Chicago. As I entered the building I was impressed by the fact that many of the doors had signs of warning against entering, because of radioactive experiments being conducted. Dr. Libby's office was on the second floor, with cartons of samples waiting to be dated, covering one entire wall. Dr. Libby's assistant, whose name, I think, was Arnold, was kind enough to show me the complete process—the burning of the sample, washing the resulting charcoal with sulphuric acid, rinsing by passage through a series of long glass tubes, washing again with hydrochloric acid, and a final rinsing before being placed in a Geiger counter. I thanked him for the demonstration, but there was no discussion, as Dr. Libby was too busy to waste time in idle conversation.

I mention the incident because, on pages 259-260 of his book, Dr. Renfrew stresses the importance of shielding specimens in the laboratory:

"The laboratory determination of the radioactivity of the samples to be dated is a delicate matter. The amount of radiation to be measured is very small, even with a modern sample, so that very sensitive detection methods are needed. Moreover the task is greatly complicated by the background radiation always present in the laboratory. Part of this comes from the presence of small quantities of radioactive isotopes in metal and other materials, and this can be eliminated by using 'clean' materials. More troublesome is the cosmic radiation which has successfully penetrated the earth's atmosphere and reached the earth's surface. The radioactivity which has to be measured in a typical carbon sample is of the order of 50 counts per minute. Yet the radiation level in the laboratory, unless special precautions are taken, is of the order of 800 counts per minute. So the effects to be measured, namely the radioactivity in the sample itself, risk being swamped completely by all the extraneous 'noise' of this background radiation. Even with heavy shielding of lead around the counter, the background radiation still amounts to some 600 counts per minute."

Dr. Renfrew was certainly not overstating the case (pp. 79-80) when he wrote, "The archaeological reaction to the calibration has been, in general, one of dismay tempered with a cautious scepticism. No one who accepted the validity of radiocarbon dating in general has come out and said, 'This must be wrong.' Yet the archaeological world, having recently adjusted itself to one new and surprising set of dates—the first radiocarbon revolution—has been understandably cautious about adjusting itself again." In an attempt to

restore some confidence, Renfrew mentioned that radiocarbon dating was probably accurate for the last 2,000 years. This period, however, covers most, if not all, of the history of the Southwest. As an example of uncertainty that even Dr. Renfrew's estimate of 2,000 years may be mistaken, I refer to the dating of Broken Flute Cave, an important site in Red Rock Valley in northeastern Arizona. A large number of beams and cores were obtained from Broken Flute, Obelisk, Atahonez, and other caves in the Valley, which provided an east-west pass between the Lukachukai and Carrizo Mountains. Correlations of tree-ring dates were extremely good, with the latest date for any of the beams at A.D. 625. It was, therefore, a surprise to learn that Dr. Libby's radiocarbon dates for some of the same specimens were A.D. 800 or later.

In view of the present chaotic condition of archaeology in both Europe and America, due to the uncertainties of dating by radiocarbon, it is very doubtful that confidence will be easily or quickly restored. It might be suggested, however, that if the chronology of *Pinus aristata* is to be used as a control of radiocarbon dating, a long step in this process would be to establish a detailed comparison between the tree-ring chronology of the Southwest, which does not include Bristlecones or Junipers, with a chronology of *Pinus aristata* over the last 2,000 years, omitting the addition of any missing rings. To include missing rings would merely correlate the opinion of the operator, not the evidence of actual tree-growth.

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Contrary and Contradictory

(Continued from page 23)

Note, though, that that is not to say that either, or both, are unnatural or supernatural. "Unnatural" or "supernatural" would be contraries of "natural", not contradictories. Now contrary propositions may be both false, although they can not be both true. So Creation, and the big bang, may be neither natural nor unnatural nor supernatural. In fact, the distinctions natural or un- (or super-) natural do not apply to them.

Again, the world is contingent, in that it could have been different from what it is. One can imagine many things different. Writers of science fiction do so regularly; and so do writers of fairy tales. Now the contingent,

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THE CANOPY AND ANCIENT LONGEVITY

JOSEPH C. DILLOW*

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It is commonly held that the pre-flood vapor canopy shielded the earth from cosmic radiation and also reduced surface ozone levels. These effects supposedly contributed to the longevity of the antediluvian patriarchs. However, radiation studies and research in molecular biology seems to rule this out. Even if the earth were 100 percent shielded from radiation and if ozone levels in the pre-flood world were zero, no appreciable improvement would have resulted. Studies in molecular biology, however, do suggest that possibly certain specific enzymes may have been present prior to the flood and absent afterward, their disappearance resulting the reduction of longevity noted in the exponential decay curve of lifetimes in Genesis 11. Also, increased atmospheric pressure under such a canopy could conceivably have had a minor effect on longevity and also on gigantism.

The earth is constantly being bombarded by radiation from the sun and from deep space. Thanks to the shielding effect of our present atmosphere, life on this planet is effectively protected from the lethal effects of this cosmic assault. However, with a canopy, in which many believe, surrounding the earth, an even greater degree of protection would have been afforded; and one might predict a reduced radiation level. This is often thought to have a possible connection with antediluvian longevity and with carbon 14 production.

Nearly seventy-five years ago, Isaac Vail proposed that the shielding effect of the water heaven reduced radiation levels, and, as a result, the pre-flood conditions simply, "impelled long life."¹ More recently, V. L. Westberg argued that the life shortening of the post-flood patriarchs (see Genesis 11) was caused by accumulated exposure from space radiation that had not been present prior to the flood.² In 1961, Morris and Whitcomb suggested that the decrease in longevity was due to increased radiation levels.

Much of this decline, as well as other effects we have already discussed, can undoubtedly be attributed to the greatly increased incidence of radiation upon the earth's surface and upon its inhabitants.³

Donald Patten made the ingenious observation that there seemed to be an exponential variable involved in the decline of longevity of the post-flood patriarchs. Prior to the flood, men lived an average of 912 years, but immediately after the flood, longevity began to decline exponentially!⁴ Patten attributed this exponential variable to the sudden increase of ultra-violet radiation and to the washdown of ozone with the canopy.

The Exponential Decay Curve in Genesis 11

In order to test the validity of Patten's observation of an exponential variable in the declining longevity of the post-diluvian patriarchs, the age at death versus the number of the generation from Noah was plotted on semi-log paper. When this was done, a straight line described the best fit of the points. A linear regression analysis was made using the data given in Genesis 11 to determine the equation of this line and the correlation coefficient. The data in Table 1 were used for this regression calculation.

In Table 1, it should be noted that Moses did not die at age 70. However, Moses says that in his time, 70

years had become the expected average lifespan:

As for the days of our life, they contain seventy years, Or if due to strength, eighty years . . . (Psa. 90:10, NASB).⁵

According to the Biblical genealogies,⁶ Moses' generation falls in the 17th generation from Noah if Noah's generation is numbered zero. A linear regression yields,

$$Y = 652e^{-0.136x}$$

where Y = the age at death, and x = the number of generations from Noah where at Noah's generation, $x = 0$. In order to find out the statistical validity of this curve, a correlation coefficient must be determined. The correlation coefficient, r , measures the degree of fit of the given points to the least-squares straight line. When $r = 1$, the correlation is said to be exact. When $r = 0$, the variables are said to be uncorrelated with a linear equation. The correlation coefficient derived from Table 1 is $r = 0.95$! That means there is an extremely high correlation between the variables in the above equation, and hence an exponential variable is likely.⁷ The plot of the data in Genesis 11 is illustrated in Figure 1.

This result has significant implications. First of all, it gives some degree of credibility to the historical nature

Table 1. This gives the ages at death of some of the patriarchs. Note that the figure 70 is not assigned to Moses himself; rather it seems to be what was common among his contemporaries. Incidentally, the inclusion of data from Exodus 6:16-20 causes very little change in the result.

Patriarch	Age at Death	Number of Generation from Noah
Noah	950	0
Shem	600	1
Arphaxad	438	2
Salah	433	3
Eber	464	4
Peleg	239	5
Reu	239	6
Serug	230	7
Nahor	148	8
Terah	205	9
Abraham	175	10
Isaac	180	11
Jacob	147	12
Moses' contemporaries	70	17

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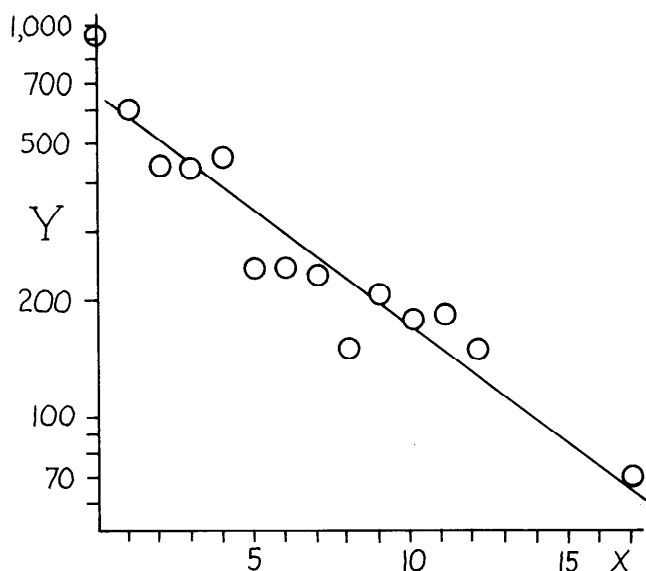


Figure 1. This shows the age Y at death of some of the patriarchs plotted vs. x, the number of their generation from Noah. The vertical scale is logarithmic; thus the straight line indicates an exponential relationship, as stated.

The data used here are those from the Masoretic text. The figures given in the Septuagint give about as good an exponential relationship. Thus it is impossible, on this basis alone, to decide which version is preferable.

of the genealogy. The probability that this account with such a variation, was a result of mythical influences is virtually zero. The odds that such a curve could result from anything but an actual historical circumstance are remote. There is nothing comparable in the Sumerian data. It is conceivable that scribes could have manufactured these numbers from exponential functions known in their time;⁸ but the data in Table 1 are not *exactly* exponential. They scatter about such a function, thereby attesting to naturalness rather than artificiality.⁹

It must be admitted that this result does not fit Noah himself. The formula found would make his lifetime about 652 years, rather than the actual 950. It may be that his 600 years of life under the conditions prevailing before the flood had a considerable effect on him; and, incidentally, Shem's approximately 100 some on him.

If Noah and Shem are left out of the graph and the calculation, the figure before the exponent becomes 436, and the factor along with the exponent becomes -0.119 instead of -0.136. The correlation coefficient is not much changed.

There seems to be no support in Scripture for the suggestion, which has sometimes been made, that the decrease in the ages at death actually indicates an increase in the length of the year, or what was called a year. Besides, Genesis 7:11 and 8:3 & 4 indicate that then, as now, 5 months consisted of about 150 days. Moreover, to have much shorter periods of time called years would conflict with the fact that Mahalaleel and Enoch begot children at no older than sixty-five. ("No older"; for it is not said that the children mentioned were necessarily their firstborn.) (Genesis 5:15 & 21.)

Finally, the result obtained here would tell against the suggestion of gaps in the genealogy. It would be strange indeed, if gaps were such as to fit in, by being systematic and specific and not random. Thus, unless those who believe in such gaps are willing also to argue that the gaps are consistent and systematic, the mathematical probabilities of the correctness of their view would seem small. Furthermore, an absence of gaps seems to be attested to by Genesis 4:25, 26, in which a father-son (not a father-descendant) relationship is traced through the first three of the ten generations of the pre-flood patriarchs in the genealogy of Genesis 5. Also, Jude 14 informs us that Enoch is the seventh. Thus, there are no gaps in the first seven of the ten pre-flood generations. Finally, the fact that the age at paternity (birth of first child) as given can only be for chronological purposes.¹⁰ This, of course, means that Bishop Ussher was not far off when he calculated the creation of the world in 4004 B.C. The present writer would be inclined, then, to date the flood in the year 2346 B.C.¹¹

A final and most significant implication of this decay curve is that it attests to some kind of environmental change that drastically affected the physiology of man and reduced his longevity from an average of 912 years prior to the flood to 70 years 850 years after the Deluge. Such a decay curve is common whenever a system in equilibrium is suddenly acted upon in a way that results in a shift toward a new equilibrium. It can be seen in the discharge of a capacitor in the laboratory and in many other scientific experiments. It suggests that new factors were present in the post-flood environment.

Could this curve be a result of new levels of ionizing radiation that scoured the earth as a result of the loss of its protective vapor shield? Those who answer that question in the affirmative argue from the extensive evidence which has established a definite link between radiation intensity and longevity in radiologists and in laboratory test animals.

The Radiation Flux at the Earth's Surface

The earth is constantly being bombarded by cosmic and other radiation from the stars and from the sun. This radiation is of two basic kinds: electromagnetic and particle radiation. Particle radiation is composed of: that in cosmic rays (streams of positively charged hydrogen nuclei); alpha rays (streams of positively charged helium nuclei); and beta rays (streams of negatively charged electrons).¹² Also, high energy neutron particles play an important part in the production of carbon 14 by upper atmospheric bombardment of nitrogen.

The second kind of radiation hitting the earth is electromagnetic. Table 2 presents the electromagnetic spectrum.¹³

Thanks to our protective atmospheric blanket, very little of these harmful radiations ever reach the surface of the earth. In fact, our atmosphere is so effective in this regard that for instance "essentially all of the incident solar radiation at wavelengths below 2950Å is absorbed by the atmospheric bases, mainly the Hartley band of ozone."¹⁶

Careful measurements have computed the total ex-

Table 2. This shows the names, wavelengths, and quantum energies, i.e., energies of photons, of the various kinds of electromagnetic radiation. The wavelengths are in Angstrom units—units of 10^{-8} cm.. These may be converted to microns by dividing by 10,000, or to millimicrons or nanometers by dividing by 10. The quantum energies are in electron volts, the energy involved in moving an electron through a difference in potential of one volt. The larger these energies, the greater the potentiality of the radiation for doing genetic or other damage.

Band of radiation	Wavelength, Angstroms	Quantum energies, electron volts
Cosmic rays	0.0005-0.005	2.5×10^7 - 2.5×10^6
Gamma rays	0.005-1.4	2.5×10^6 -9,000
X-rays ¹⁴	0.1-100	1.25×10^5 -125
Extreme UV ¹⁵	100-1,000	125-12.5
Far UV	1,000-2,000	12.5-6.25
Middle UV	2,000-3,000	6.25-4.2
Near UV	3,000-4,000	4.2-3.2
Visible	4,000-7,000	3.2-1.8
Infra-red	longer than 7,000	less than 1.8

posure to the sex cells of men that come from these and other radiations, both natural and man-made. Table 3 records these data.¹⁷

The Biological Effects of Electromagnetic Radiation

It has long been observed that short electromagnetic radiations such as X-rays have serious biological effects on human beings when absorbed in sufficient doses. In 1957, for example, Shields Warren reported:

There is much evidence that overdoses of radiation lead to premature aging. Both animal experiments and observation of the life spans of radiologists indicate that doses of 1000 roentgens received over a long period of time may well shorten the life span about 10 percent. Data on the longevity of more than 82,000 physicians indicated that the average length of life of those not known to have had contact with radiation in the period 1930 through 1954 was 65.7 years, as against an average life span of 60.5 years for the radiologists.¹⁹

Radiation has an effect on both body tissue (somatic)¹⁰ and sex cells (genetic). When X-rays or gamma rays hit a human sex cell, they ionize the cell and cause it to mutate.²¹ These mutations are nearly always harmful and result in a general weakening of the species. The more seriously undesirable they are, the more likely they are to be removed by natural selection. The sum of these deleterious genes in the gene pool is called the genetic load. The size of the genetic load depends upon two factors: the rate of production and of removal. When the rate of removal equals the rate of production, a condition of genetic equilibrium is reached and the level of occurrence of that gene remains stable over the generations.²²

When earth's vapor canopy shield condensed, the exposure to solar radiation increased and undoubtedly had an effect in increasing the genetic load. Could this

have had any possible effect on longevity? The answer seems to be "probably not." As will be discussed below, the levels of radiation necessary to have significantly burdened the gene pool with "weakening" genes are not present today in natural background radiation.

It might be theorized that when the canopy condensed, a "burst" of radiation flooded the gene pool with new mutations. However, the wavelengths which produce ionizing effects on the germ cells would never have penetrated the present atmosphere. Even if the protective ozone layer were distributed when the canopy precipitated (which it must have been), X-rays and gamma rays would never have penetrated to the surface, and it is these rays that cause genetic effects—not ultraviolet rays. Even if some X-rays did make it through and by chance mutate a sex cell of one of Noah's sons, it would have had to mutate a specific gene loci, i.e., one related to aging.²³ Then the problem is that this same loci would have to be mutated in all three of Noah's sons in order for the decrease in longevity to be explained. In view of the fact that nearly 10 million different combinations of chromosomes are possible in the sex cells of a single individual,²⁴ the probability that the same gene loci on all three individuals could be affected is small. Thus even though the genetic effects in experimental test animals have indicated a decrease in the longevity of their descendants after exposure to certain types of radiation,²⁵ it is highly unlikely that this analogy is applicable to the post-flood patriarchs.

From Table 3 it can be seen that less than 25 percent of the radiation the germ cells receive is from atmospheric sources. Furthermore, it is now known that less than 1 percent of all human mutations are caused by background radiation.²⁰ Thus, even if 100 percent of all background radiation were removed by the canopy (and only 25 percent of them could be removed), it would have absolutely no effect on the mutation of human sex cells, and hence on the decreased longevity of Noah's descendants; nor could it have had any bearing on the longevity of the pre-flood patriarchs.

It is generally acknowledged today that somatic mutations are a major cause of the aging process. Could the reduction in radiation levels prior to the flood have had any bearing on a decreased rate of somatic mutation in human body tissue? Could a burst of radiation with the condensation of the canopy have any effect on radiation? The answer to both of these questions seems to be "no."

Many studies have been performed on mice to determine the effects of X-rays and gamma radiation on longevity.²⁷ As for humans, present evidence suggests a shortening of human life of 11 percent per 1,000 rads²⁸ for an entire lifetime. Since from Table 3, the average dosage a man receives is only 12 rads in a lifetime ($0.192 \text{ rad/yr} \times 67 \text{ yrs}$), it can be seen that present radiation levels have no effect on reduced longevity. Furthermore, these studies involve bombardment with X-rays; and, even without a canopy, no X-rays reach the surface of the earth. Only ultraviolet radiation reaches the surface in any appreciable amount. Ultraviolet radiation is not very penetrating and will not penetrate deeply below the skin.²⁹ Thus, while it is probable that somatic mutations have an effect on the aging process,

Table 3. This shows the exposures, common in the United States, to radiation which might have some genetic effect.

	Millirems/yr. ¹⁸
Natural Sources	
A. External to the body	
1. From cosmic radiation	50.0
2. From the earth	47.0
3. From building materials	3.0
B. Inside the body	
1. Inhalation of air	5.0
2. Elements found naturally in human tissues	<u>21.0</u>
Total, Natural Sources	126.0
Man-Made Sources	
A. Medical procedures (X-rays, etc.)	61.0
B. Atomic energy industry, laboratories	0.2
C. Luminous watch dials, television tubes, radioactive industrial wastes, etc.	2.0
D. Radioactive fallout	<u>4.0</u>
Total, Man-Made Sources	<u>67.2</u>
Overall Total	193.2

it seems fairly well established that cosmic radiation contributes only in a minor way to somatic mutations.

It should not be inferred that radiations cause the mutations responsible for natural aging. The natural background radiations of our environment, caused by cosmic rays, etc., are very much too weak for that. The cause of these mutations is not yet known.³⁰

Experiments have been conducted in which mice were placed hundreds of feet below the ground to shield them from all cosmic radiation. There was no indication of an increase in longevity in either the parents or their offspring.³¹

Thus, it appears that canopy theorists have been in error when they appealed to the shielding effect of the canopy as a possible explanation for antediluvian longevity. Furthermore, it also seems incorrect to posit that increased levels of radiation after the canopy precipitated had any bearing on the decrease of longevity. This is true because the levels of radiation experienced today are insufficient to have any effect; and are moreover of the wrong kind, i.e., mostly ultraviolet instead of X-ray, gamma ray, etc. Furthermore, even if there were a "burst" of radiation when the canopy precipitated, there would be no permanent effects on aging. This is because that burst would consist largely of ultraviolet light which had been shielded out by the ozone in the upper levels of the canopy. Ultraviolet light has no effect on germ cells and hence could only effect longevity of Shem, Ham and Japheth. Shem might have

died early due to skin cancer caused by this burst, etc.; but this gives no explanation for the continuing decrease in longevity observed in the descendants. This is so because the ozone shield once disturbed will gradually build itself up to present levels within thirty years, and present levels of ozone shield out the majority of ultraviolet radiation.

It appears that some *sustained* environmental change other than radiation must be the explanation of decreasing longevity.³²

The Canopy and the Cross-linkage Theory of Aging

The exponential variable discussed above in decreasing longevity requires explanation. At present it does not appear possible to explain it fully. This difficulty is increased by the fact that there is no certainty as to exactly what causes the aging process.³³ Thus, before the speculations on how the canopy may be related to aging can be advanced, science must first unravel the secrets involved in senescence.

At the present time, the cross-linkage theory of aging seems to be the only one gaining general acceptance. The theory suggests that, beginning at birth, certain cross-linking agents begin to form bridges or links between large molecules in the body. In this way, the giant molecules of the body are rendered progressively more and more inactive. Over a lifetime, large aggregates of these cross-linked molecules accumulate, resulting in a greater and greater inability of these molecules to carry out biological functions at the molecular level. When genetic matter is involved in these cross-links, mutations are often induced.³⁴

In a lifetime billions of crosslinkages will thus unavoidably be formed. Most of these can be reversed, but some of them cannot. These latter will accumulate over the years. The resultant aggregates are composed of proteins, nucleotids, polymeric fats, polysaccharides, and any available large molecule at all which can react with any crosslinking agent at all, or which can be directly interlocked, will form parts in the resultant aggregates.³⁵

When these aggregates of cross-linked molecules become dense enough, the body enzymes that aid in the dissolving of these aggregates can no longer penetrate, and cellular function is lost. It has been noted that the body produces more of these enzymes with increasing age. Thus, the quest for the fountain of youth is presently being focused on the discovery of enzymes of low enough molecular weight that can penetrate these aggregates and dissolve them. Bjorksten argues that it is self evident that the enzymes which can cope with these (cross-linked molecular aggregates), exist "for otherwise, large fossil deposits of such crosslinked proteins would have been found."³⁶

One such enzyme now being produced commercially under the name, Microprotease MPB, was isolated in 1973.³⁷ However, it has not yet been tested in human populations. In fact, no experimental work has yet been done to establish the potentially beneficial effect of this enzyme, although it has been used to dissolve cross-linked aggregates taken from autopsy victims.³⁸

It appears, then, that in order to connect the canopy

with longevity it will be necessary to demonstrate that conditions under the canopy were such that the body might have naturally produced this enzyme, and that conditions after the canopy condensed hindered the natural bodily function of these enzymes in some way. Another possibility is that in the post-flood era certain chemical changes in the environment, and notably in the atmosphere, may have introduced additional cross-linkage agents into the human body that were not present prior to the flood.³⁹

Gigantism in the Fossil Record

One of the marvels of the ancient world was the surprisingly large size of its faunal inhabitants. When we were young children, our hearts have been stirred as the pages of books on dinosaur history were turned. Giant lizards weighing over 40 tons were common. Why is it that these animals flourished at one time and are now absent? Why are there no giants (except for aquatic animals like whales) today? Since climatic conditions that are thought to have prevailed in ancient times do prevail today in certain areas of the earth, it is unlikely that gigantism can be explained in terms of abundant food supply and tropical climate. A number of discussions of why ancient climates may have been favorable to gigantism have been published. Some have argued that "spacing" was a factor.⁴⁰ Fewer animals per square mile of forage area, it is argued, would mean less effort in acquiring food. For a large animal that requires much food, this would enable him to survive more easily in that there would be less competition.

It has also been pointed out that the large size of dinosaurs would have been favorable for the maintaining of a constant body temperature in a cold-blooded organism. Large size means large heat capacity and resistance to minor climate variations. Hence, a cold-blooded animal could have survived more easily if it was larger because its body temperature was regulated by ambient temperature.⁴¹

Neither of these explanations accounts for why there are no giants today. It would be plausible if their absence could be explained by some environmental condition that is not present today but that may have been present then. One such environmental condition could have been increased oxygen partial pressure in the atmosphere.

Gigantism and Oxygen

The large size of these animals raises the theoretical question of how they were able to supply oxygen to their tissue mass. This question is also relevant to the gigantic insects and shells which used to live on the earth, as well as to vertebrates. Insects and shells, arachnids, and many other invertebrates, taken in oxygen at least partly through the skin, by diffusion. This raises the question of how large such an animal could become before it would be unable to acquire sufficient oxygen to maintain its metabolism:

Further, if oxygen can make its way in only by diffusion from the surface, the bigger an animal the lower, under given conditions, will be the concentration of oxygen at its center. It is obvious that there must be some size at which the concentration

becomes too low for activity, and that animal cannot exceed this size.⁴²

Thus, the invertebrates can exist only up to certain size limits; for the oxygen from the atmosphere has to diffuse to the center in sufficient concentration to sustain metabolic processes. Why are insects with 25-inch wingspans no longer found? Why are the giant shells, spiders and other invertebrates not in existence today? If these animals lived in an atmosphere where the partial pressure of oxygen was greater than today, they would have been able to grow to larger sizes.

Thus, for both the giant lizard and the invertebrate, the theoretical possibility exists: that the reason they no longer exist in these large sizes is because of the partial pressure of oxygen in our atmosphere has dropped. If the earth had been surrounded by a vapor canopy containing enough water to sustain a global rainfall of 0.5 in/hr for 40 days (40 feet of precipitable water), the atmospheric pressure would have been 2.18 atm, and partial pressure of oxygen would have been 348.73 mm of Hg⁴³ instead of today's value of 159.97.

An increase in the partial pressure of oxygen does not increase the amount of oxygen carried by the hemoglobin in the blood of vertebrates. But it does increase the oxygen tension in the plasma. Presently, the oxygen tension in man in the alveolar sacs is about 100 mm of Hg. By the time it passes through the capillaries, it is reduced to about 45 mm of Hg. Since the oxygen tension in the interstitial fluids (body fluids between the capillaries and the cells) is only 40 mm of Hg, there is a net diffusion driving force of at least 5 mm of Hg of O₂ forcing oxygen into the cells of the body through the interstitial fluids. Could it be that, due to the greater oxygen requirements of the large vertebrates, they required more oxygen than the present diffusion driving force could supply? If the oxygen tension in the alveolar sacs was doubled due to increased atmospheric pressure, this would increase the oxygen diffusion force (it would probably not be a linear increase) and hence enable the animal effectively to deliver more oxygen to its body cells.

Due to the variables involved, there seems to be no way of meaningfully extrapolating back to ancient animals to check this. But a reduced oxygen tension in the atmosphere due to the condensation of the vapor canopy could have been one change which might have some bearing on why giant animals do not live today.

Presumably, Noah would have taken young dinosaurs on the ark. As they entered the post-flood environment, and grew, they would have been unable to survive in the lower concentration of oxygen and would actually have suffocated!

Longevity and Oxygen

There is evidence that higher oxygen tension can be decidedly beneficial to biological systems. When a team of aquanauts were submerged in a diving bell for two weeks at 10 atmospheres, a striking healing occurred after one of them severely cut his hand. It was reported that the wound completely healed in 24 hours! It was theorized that the reason for this was that the higher oxygen tension created a greater diffusion driving force and imparted more oxygen at a greater rate into the

wound. As a result, experiments in high-pressure surgery were begun, and hyperbaric surgery is now a common practice in certain situations. Also, it has been discovered that an effective treatment for some kinds of gangrene is to place the patient in a high-pressure chamber for a period of time.⁴⁴ Thus, it would seem that a higher atmospheric pressure could have resulted in conditions that were favorable for the cure of some illnesses, and hence could have some bearing on longevity of life indicated in Genesis 5.

At the HBO Center in Lauderdale-by-the-Sea, Florida, Claude Kirk has been administering hyperbaric oxygen treatments for many years with startling results. Patients treated (for short periods of time) at 2.5 atm of pure oxygen and gradually decompressed showed remarkable relief from the effects of aging. Dr. Edgar End of Milwaukee, one of the nation's leading experts in hyperbaric oxygen treatment, said,

Unquestionably, hyperbaric oxygenation can often reverse the effects of aging. I've seen it work in scores of cases. It improves memory, increases energy and works remarkably well with men and women who were demonstrably senile. In addition, it is a highly effective treatment for strokes. I've had patients carried into the hyperbaric chamber after a verified stroke and walk out after the first treatment. It has been used successfully for gas gangrene, osteomyelitis, smoke inhalation and other problems.⁴⁵

While 2.5 atm of pure oxygen (1520 mm Hg of O₂) is considerably greater than the partial pressure of oxygen under a 40-foot vapor canopy (348.73 mm of Hg), the remarkable effects of this treatment do suggest an area for fruitful research. Could a relatively small increase in the partial pressure of oxygen when extended over an entire lifetime have similar or even greater effects than hyperbaric oxygen administered to senile patients in their 70's?

Dinosaur Size and Longevity

The great size of some of the dinosaurs may indicate longevity. It is well known that, within size and skeletal limitations, reptiles continue to grow until death.⁴⁶ In this respect, reptiles are different from mammals. Mammals have secondary centers of ossification in the growing ends of the bones. When these centers have replaced most of the surrounding cartilage, they fuse with the bone shaft so that no further increase can take place. Most reptiles do not possess these secondary centers; so their bones are free to grow throughout life.⁴⁷ Thus, great size is sometimes an indication of old age in these animals. If the dinosaurs lived to great ages this would correlate well with the biblical data that state that men did so also (Genesis 5 and 11).

Ozone and the Canopy

Donald Patten has suggested that the presence of the canopy would have reduced ozone levels at the surface of the earth and resulted in increased longevity. He suggests that, in the pre-flood world under the canopy, the ozone concentration at the surface varied from zero to several parts per trillion.⁴⁸ However, when the possibi-

ty of reduced ozone levels having any significant bearing on longevity was presented to Dr. Johan Bjorksten, he pointed out that present levels of ozone concentration have only a minor effect in the production of cross-linked molecules, and thus if all ozone were removed, the gain in longevity would be negligible.⁴⁹

Carbon 14 and Ancient Longevity

One effect of a vapor canopy would be to shield the nitrogen below the canopy from cosmic radiation. Under such conditions, no carbon 14 would be produced. It has been suggested that, even though the absence of radiation would have a negligible effect on longevity, as discussed above, yet the absence of carbon 14 might have an effect, perhaps as follows.

Under present conditions, all living things have a certain amount of carbon 14 incorporated into them, and in particular into their DNA. In time, the carbon 14 will decay into nitrogen 14, which has 3 bonds, not 4. Thus one adjacent bond would be left open; and it might hook a cross-linked molecule. See Figure 2. Thus the presence of carbon 14 might contribute to the formation of cross-linkages; or might block a body molecule or act as a point mutation; or the result might act to block biochemical pathways. In some of these ways, then, the presence of carbon 14 might contribute to aging; and, if so, its former absence would have contributed to longevity. This whole matter needs further study; for it seems quite possible that the amount of carbon 14 present might have built up in a way which would correlate with the decrease in longevity.

It must be added, however, that Dr. Johan Bjorksten, in a personal communication, expressed great doubt that the amount of carbon 14 in living things would ever have been enough for such an effect to be important.

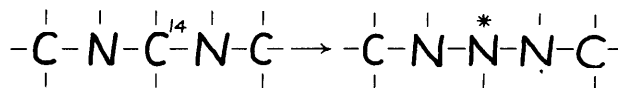


Figure 2. This shows how, if a molecule of e.g., DNA contained an atom of carbon 14, upon the decay of that atom to nitrogen a dangling bond would be left somewhere adjacent. The formation of enough such dangling bonds might have something to do with the formation of cross-linkages, as discussed in the text. Note that atoms of carbon not marked otherwise are of ordinary carbon 12. The asterisk shows where an adjacent bond might be left dangling.

Conclusion

At present, it is not clear what was the cause of antediluvian longevity. Creationists should be careful about attributing longevity to either the shielding effects of the canopy against radiation or to reduced ozone levels. The ideas concerning increased partial pressure of oxygen are still only speculative and lack any long-term laboratory testing, as are those about carbon 14 and cross-linkages.

For some reason, the biosystems of pre-flood animals apparently produced an enzyme that cleaned out cross-linked molecules. Subsequent to the flood, either due to inbreeding, mutation, a radiation burst or some unknown cause, this enzyme was gradually eliminated and longevity declined.

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- ³Morris, Henry M., and John C. Whitcomb, 1965. The Genesis Flood. Presbyterian and Reformed, Philadelphia. p. 404.
- ⁴Patten, Donald Wesley, 1966. The Biblical Flood and the ice epoch. Pacific Meridian Publishing Company, Seattle. pp. 214-216.
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- ¹⁴Note: there is an overlap between Gamma rays and X-rays.
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- ¹⁶Coulson, op. cit., p. 143.
- ¹⁷Asimov and Dobzhansky, op. cit., p. 37.
- ¹⁸A millirem = 1/1000th of a rem. A rem is the "roentgen equivalent, man." The "rad" = the radiation absorbed dose. A rad of X-rays, gamma rays, or beta particles has a rem of 1, while a rad of alpha particles has a rem of 10 to 20. Also, 1 rad = 100 erg/gm or 6.24×10^9 electron volts/gm.
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- ³¹Dr. Johan Bjorksten, Director Bjorksten Research Foundation, P. O. Box 775, Madison, Wisconsin, personal communication, October 27, 1976. Dr. Bjorksten is one of the leading researchers in the world in the quest for the mechanisms of aging.
- ³²An intriguing explanation for the extinction of the dinosaurs involving a burst of cosmic ray flux due to exploding supernovae may have some relevance to the exponential function noted in Genesis 11. Terry and Tucker suggest several incidents in the past involving with such a flux of 1000r of X-rays and gamma rays. Flux of this intensity would make it to the surface and cause vast mutation and loading of the gene pool and mass extinctions, also. See Tucker, W. H., and K. D. Terry, 1963. Biologic effects of supernovae, *Science* 159(3813):421-23; and Terry, K. D., and W. H. Tucker, 1968. Cosmic rays from nearby supernovae: biological effects. *Science* 160(3832):1138-39.
- ³³For a review of some of the contemporary theories, see Price, G. B., and T. Makinodan, 1973. Aging: alteration of DNA-protein information. *Gerontologia* 19, 58-70; Upton, A. C., 1957. Ionizing radiation and the aging process, *Journal of Gerontology* 12, 306-13; and Bjorksten, Johan, 1976. The crosslinkage theory of aging: clinical implications. *Comprehensive Therapy* 2, 65-74.
- ³⁴Bjorksten, Johan, 1963. Aging, primary mechanism. *Gerontologia* 8, 179-92.
- ³⁵Bjorksten, Johan, 1976. Some therapeutic implications of the crosslinkage theory of aging. Paper presented to the American Chemical Society, San Francisco, California, September 2. p. 8.
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- ³⁷Schenk, R. U., and J. Bjorksten, 1973. The search for microenzymes: the enzyme of bacillus cereus. *Finska Kemists. Medd.* 82, 26-46.
- ³⁸Bjorksten, reference 33, p. 72.
- ³⁹For the molecular biologist desiring to pursue the possible connections between canopy-induced environmental conditions and the existence of various cross-linking agents, a discussion of known cross-linking agents is presented by Bjorksten, reference 34, p. 183; and 1971. The cross-linkage theory of aging. *Finska Kemists. Medd.* 80, 23-38. They include aldehydes, sulfur, alkylating and acylating agents, quinones, antibodies, free radicals induced by ionizing radiation, and many metals and numerous other compounds.
- ⁴⁰Colbert, Edwin H., 1965. The age of reptiles. W. W. Norton & Company, Inc., New York. Pp. 144-145.
- ⁴¹See Spotila, James R., et al., 1973. A mathematical model for body temperatures of large reptiles: implications for dinosaur ecology, *The American Naturalist* 107, (955):391-404; Porter, Warren P., and David M. Gates, 1969. Thermodynamic equilibria of animals with environment. *Ecological Monographs* 39, 227-44.
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⁴³Apparently the upper limit of tolerance of oxygen over an unlimited period of time, incidentally, is 380 mm. of mercury, 0.5 atmosphere. See Mountcastle, Vernon B., 1974. Medical physiology, thirteenth edition, C. V. Mosby Co., St. Louis, Missouri. Vol. 2, p. 1565.

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LIFE BEGINS AT 140†

CAPTAIN GEOFFREY T. WHITEHOUSE*

The people Georgia in Southern Russia, birthplace of Stalin, are reputed to be the world's longest lived.

From time to time news of these remarkable people reaches a somewhat incredulous outside world. We find it hard to believe that there are, in fact, hundreds of men and women in Georgia, long past the century mark, who are still perfectly fit and active.

In the mid 'sixties the *Sunday Times* magazine thought the matter would be well worth investigating so they sent reporter Gloria Stewart and photographer Eve Arnold to Georgia for that purpose and results were published in the *Sunday Times* magazine on April 3, 1966. Before I give you a resume of what these two investigators found in Georgia, I would point out that when the centenarians of Georgia were born there were no birth certificates. However, ages mentioned have been verified by the Soviet Institute of Gerontology, after years of study, uncolored by any sort of medical nationalism.

At the last census the Republic of Georgia produced two thousand people over the age of 100. The surprising thing about these ancients is their remarkable activity. The investigators, whom I am quoting, found them striding miles over the mountains weighted with cartridge-belts, rifles and long knives. They played a ferocious Georgian version of polo, worked in the vineyards, not infrequently fathered children in their nineties and when the occasion warranted drank unnering quantities of the local alcoholic dynamite: grape vodka.

"The first place the investigators stopped was at Dzerba, a tobacco-growing village with four centenarians among its 500 people. Here they met Astan Shlarba, a 123-year-old farmer.

"Astan, by Russian standards, is wealthy and in the previous year he earned \$1,200 from his farm, and from work on a local collective farm. His income enables him to have plenty of leisure for hunting trips

which he loves, when he goes off into the mountains with younger men.

"Apart from this Astan and his 70-year-old wife, Nutsa, live an uneventful life seldom leaving their village. Although many families have television Astan declines to admit its existence. His idea of relaxation is to enjoy a drink with his neighbor Teb Sharmat, a younger man of 101. They sit on Astan's ample veranda and play the tari (a sort of Georgian mandolin) since both are in the famous Centenarians Orchestra.

"Further up the mountains the travelers came to the tea-growing village of Lyxny which has a celebrated Council of Elders, all over 100, who deal with the village delinquents and advise on village affairs, such as running the tea factory.

"Until last year, the council had six members, but the oldest, Anton Pilya, who was 135, married a woman of 27, and died of a stroke five months later. This is generally held among the centenarian community to be a warning not to presume too far against mortality. The senior member is now Senat Dzeniye, a farmer of 120, who strides around the village in a long, goat-hair cloak. Senat, whose family numbers 50, with one son of 95, was elected toast-master at the feast which was given to the investigators by 112-year-old Temur Tarba.

"Temur, his 85-year-old wife, Dusya, and two of their six sons, live in a two-story brick house. As the travelers walked into the courtyard full of chickens, Dusya greeted them in a traditional Georgian mountain fashion. She kissed them on both cheeks, guaranteed that no ill would befall them in her house and 'clean food'. She then brought out a jug of clear, cold water and a snowy white towel. When they had washed their hands she invited them to come inside and seated them at a long wooden table heaped with dishes of food. There was chicken and goat's flesh supplemented by huge plates of steaming *mameliga*, a doughy substance made from maize. This is eaten with everything, and has to be rolled in the fingers and dipped in a sauce of garlic and pepper.

"The drinking of a liquor called *Chacha*, or grape vodka, is a vital part of a Georgia feast of this kind and during the meal which followed many toasts were proposed. These began with Peace and Friendship between Britain and Russia and included the women of the house who were too busy serving to eat and drink themselves.

"We are not told what other foods were eaten at the

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†This is an excerpt from an article, by the same name, by Captain Whitehouse, in *Grace* 18 (4):28-31, Winter 1977. That, in turn, is based on material republished from *The Sunday Times*, London, April 3, 1966. This item is used here by permission.

Grace is published at Gerard House, 736 Christchurch Road, Boscombe, Bournemouth, Dorset, England. It is concerned with healthful living and food, inspirational prose and poetry, and *mens sana in corpore sano*.

feast but in a country so richly endowed there would be an abundance of fruit and vegetables.

"As their journey continued the travelers encountered many more centenarians, one of whom was the 140-year-old Vanno Djachiazi who was pruning his vines outside the village of Telavi. When asked if he had a retiring age in mind he was horrified. His wife he said nagged him quite enough as it was.

"Dr. Pitskelauri of the Gerontological Institute stationed at the Georgian capital Tbilisi told the visitors that in the neighboring Caucasian state of Azerbaïfan there dwelt the current title-holder of the longest lived, Shirali Muslimov, who is 160. Several Georgians met in the course of the journey said they felt 200 should be easy enough to reach. Teb Sharmat, from Dzerda, now 101, told that his reason for marrying a third wife, a 50-year-old, when in his nineties, was that he might well live another 100 years, and he did not think it would be a good thing to get out of the habit.

"The scientists of the Gerontological Institute set up by the Soviet Government in 1959 to study the estimated two million of its citizens said to be over the age of 80, came to some interesting conclusions about factors which favor longevity after analyzing detailed questionnaires which asked the old men and women to tell them what foods they ate throughout their lives, how many children they have had, whether they smoked or drank, and when their sexual powers began to decline.

"An overwhelmingly important point was thought to be the fact that they all lived physically vigorous lives almost entirely free from urban strain—indeed insulated from social upheaval to a large extent. They found that almost exclusively centenarians were people who did manual work and lived in remote areas. Women, they found, more frequently passed the age of 80 than men but are outnumbered, three to one, by men beyond the age of 100.

"One fact the Institute investigators were able to confirm and which agrees with the evidence presented by the Georgians is that sexual frustration is absent from the pattern. Octogenarians and centenarians alike invariably have large families and many have had several marriage partners. Only eight out of 400 studied had never had children.

"Dr. Pitskelauri, the local representative of the Research Institute, remarked that his centenarians always lived extremely regular lives: rising at the same early hour every day, taking three or four meals a day and retiring early at a regular time. All four hundred he had personally studied were of average intelligence or higher, and remarkably stable emotionally. Their diet, although not strictly vegetarian, includes an abundance of fresh fruit and vegetables. Although, as we have seen, much strong drink is consumed at a banquet such as that given in honor of the *Sunday Times* magazine travelers, the centenarians on the whole drink and smoke very little. Georgian women seldom drink and never smoke whilst the men, although enjoying any reasonable excuse for some hearty toasting, are hardly ever seen drunk. The centenarians whom the visitors met had all given up smoking in their nineties or soon after, except for three who never smoked.

"Dr. Pitskelauri believes that Georgian longevity is due to a combination of ideal circumstances. Given a near-perfect climate, high altitude, ample fresh and well-balanced foods, plenty of exercise, strong family ties, stable social conditions, reasonable temperance, intelligence and plenty of sleep, there should be nothing to stop almost anybody getting well past 100 he thinks."

Editor's note: This information, along with similar reports from Hunza and from South America, would seem to show that there still exists longevity comparable with that recorded in the Bible from Abraham on.

Creationist Science

(Continued from page 52)

²⁷Antediluvian topography was not similar to postdiluvian topography as Young indicates (pp. 210-12). Precisely because of the difficulties of correlating Genesis 2:10-14 with present topography W. F. Albright in his classic paper decided it was a mythical place. Albright, W. F. 1922. The location of the garden of eden. *American Journal of Semitic Literature*, 29:15-31. Creationists, of course, explain the discrepancies between Genesis 2:10-14 topography and present topography as a result of the earth-renovating flood as Luther did centuries before.

²⁸Young, *Op. cit.*, pp. 177-85.

²⁹Carmichael, Ian, S. E. et. al. 1974. *Igneous petrology*. McGraw-Hill Book Co., NY, pp. 5-6.

³⁰In this day of fossil-fuel shortages had the creationist-catastrophic mentality of quickly-produced coal and oil controlled the past several decades of research, who could tell what economical synthetic processes might have been discovered by now?

³¹Young, *Op. cit.*, pp. 185-93.

³²*Ibid.*, pp. 193-7.

³³Hyndmann, David. W. 1972. *Petrology of igneous and metamorphic rocks*. McGraw-Hill Book Co., NY.

³⁴See context of reference 22.

³⁵Young, *Op. cit.*, pp. 198-210.

³⁶Northrup, Bernard E. 1977. A critique of the contemporary division/flood model. *Bible-Science Newsletter*, 15(12):2-5.

Contrary and Contradictory

(Continued from page 26)

that which might be otherwise, is, in so far as it is contingent, not the concern of science. For science works with regularities. But if the world is contingent, its coming into being as it did was a contingent matter. So it was not a subject of science.

The fact is, that those who uphold uniformitarianism assume, often without examination, that the world runs like a clockwork. Thus by "natural" they really mean "going according to something like clockwork". Hence they can hardly bring themselves to admit the possibility of an exception. But such a position is futile. For to be logical they would have to admit that their thoughts proceed in some such way, and hence have no more meaning than the gyrations of a clockwork toy. But if one admits that free will, (which seems to be necessary for logical thought), exists, and leads to contingent things, why not admit that the contingent world could be the result of an act of free will be a sufficiently powerful Being?

A CREATIONISTS' TAXONOMY

HILBERT R. SIEGLER*

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The amount of data uncovered by creationists in recent years warrants application of such information in various branches of science, of which one is in the field of plant and animal taxonomy. This branch of science is currently totally evolution-oriented, as is seen particularly in the determination of species, since the evolutionist considers each species the newly evolved kind. Nevertheless, there is no overall consensus as to what constitutes a species. This article lists a number of instances in which taxonomists ignore their own definition of species.

A creationist's approach to taxonomy is proposed, by establishing a category which would encompass all variants of each created "kind". This category should be called baramin, its position in the classification system varying for each species. All organisms would be placed in a particular baramin category whose eggs and sperm, when brought together, can produce true fertilization, thus making this the one truly biological category. Morphologically similar organisms could also be tentatively placed in the same category pending further studies.

Introduction

In recent years creationists have uncovered and produced a considerable amount of information demonstrating the fact that the Genesis account of creation can be as valid, indeed more so, from a scientific basis as is the theory of origins advanced by evolutionists. I believe the creationists have now reached a point in time at which their data need to be synthesized and utilized in the various branches of science. Until we as creationists demonstrate that our concepts are applicable in practice, other scientists will have reason or at least excuse to ignore our findings.

One area in which creationism will eventually have to stand or fall exists in the field of plant and animal taxonomy. At present, this phase of biological science is based entirely on the belief that all living species evolved through natural processes out of less complex forms of life. For this reason, when a systematist classifies a plant or animal, his goal is not only to give this organism an identity, but also, to determine what that organism's relationship is to other organisms evolution-wise. The 1965-66 Annual Report of the Harvard University Museum of Comparative Zoology frankly stated on p. 28: "Almost all the research carried out in the Museum has an evolutionary aspect. This is as true for the purely taxonomic research as for that dealing with biogeography, behavior, or ecology." Nowhere does this approach to the science of taxonomy manifest itself more than in the determination of "species". It is probably for this reason, too, that there is still no overall consensus as to the definition of the term "species".

What is a Species?

In *Each After His Kind* Cole wrote: "... systematics plays a double role, viz., the defining, describing and naming of groups, with inference that in arranging them their descent, and hence their genetic relationship, is being portrayed at the same time. This duality of modern taxonomy has often been pointed out and the proposal to divorce naming completely from any implications as to a relationship has been suggested by a number of authors as a panacea for nomenclatorial ills ... There is much disagreement as to whether there is

really any such definite entity as a species, and although numberless attempts have been made to define it, and tomes have been written on the subject, no universally acceptable definition has been forthcoming".¹ In an effort to overcome some of the shortcomings of the current concept involving "species", Blair proposed two categories of species populations: 1) those that are isolated from all other populations by reason of sterility, and 2) those that are isolated at any given moment by mechanisms short of intersterility.² Dobzhansky suggested that: "The development of reproductive isolation between two or more related populations may reasonably be considered the attainment by these populations of the rank of separate species".³ In his classic attempt to summarize the status of the species concept, Huxley wrote: "It would appear that species may be properly regarded as natural units, in that they are groups which (a) have a geographical distribution area; (b) are self-perpetuating as groups; (c) are morphologically (or in rare cases only physiologically) distinguishable from other related groups; and (d) normally do not interbreed with related groups, in most cases showing partial or total infertility on crossing with them (though neither the lack of crossing or of fertility is universal)."⁴ Mayr devoted more than 600 pages toward an effort to develop his own concept of what constitutes a species. For him the decisive criterion is the reproductive isolation of a population.⁵

Species Difficulties

The foregoing seem, on the face of it, to present us with clear-cut definitions of the terms "species". As pointed out by this author, in *Evolution or Degeneration—Which?* there are involved, however, some formidable difficulties, of which at least three are called to our attention:

1. There are many "reproductively isolated" groups of animals and of plants which should be classified as "good species"; among which, however, numerous individuals have many characteristics that are different from those of other individuals in that same group. The taxonomist trying to work up an overall description of that species must then either give these differing groups subspecific rank; or, ignoring the definition of species he has set up for himself, make separate species of these groups—despite the fact that they interbreed naturally. Here are some examples.

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In a certain section of Italy two groups of sparrows interbreed readily, nevertheless one is classified as House Sparrow (*Passer domesticus*) and the other as Will Sparrow (*Passer hispaniolensis*).

Along the edge of an African rain forest there are three different appearing Paradise Flycatchers that interbreed naturally. They are, however, listed as three separate species: *Terpsiphone rufiventer*, *T. rufocinerea*, and *T. viridis*.

There are two towhees which look quite different: the Red-eyed Towhee (*Pipelo erythrophthalmus*) and the Collared Towhee (*Pipelo ocai*). Nevertheless, in various parts of Mexico they readily interbreed.

The yellow and red-shafted flickers (*Colaptes auratus* and *C. cafer*) interbreed freely over a wide range.

There is extensive interbreeding of various species of Juncoes.

The Spangled Drongos (*Dicrurus hottentottus*) exhibit such a variety of forms that some taxonomists recognize about a dozen subspecies, which again some authors classify as full species. They interbreed.

The Common Toad (*Bufo americanus*) and Fowler's Toad (*B. fowleri*) interbreed readily.

The Whitefooted or Deer Mouse (*Peromyscus*) groups readily interbreed and produce offspring when caged, to wit: *leucopus* and *gossypinus*, *polionotus* and *maniculatus*, and *leucocephalus* and *polionotus*.

2. One of the most formidable difficulties the taxonomist encounters occurs when he applies his present concept of "species" to asexually reproducing organisms. For how can there be reproductive isolation where there is no sexual reproduction? For this reason the classification of these thousands of organisms into different "species" is normally done on a morphological basis.

3. Finally, any groups of organisms that have been lumped together as one species should theoretically be reproductively isolated from all other groups of organisms. There are, however, an amazing number of exceptions to this rule. Not only can we list many species which will crossbreed with other species, but there are even species now placed in separate families which produce hybrid offspring (Guineafowl, *Numida meleagris*, by Domestic Fowl, *Gallus gallus*).

Furthermore, crossings between different genera are fairly common. The Capercaillie (*Tetrao urogallus*) will occasionally mate with blackcocks (*Lyrurus tetrix*) and produce hybrids. Prairie chickens (*Tympanuchus cupido*) have been known to cross with Sharp-tailed Grouse (*Pediacetes phasianellus*). Recently an intergenetic hybrid flounder was found, the result of a cross between *Parophyrus vetulus* and *Platichthys stellatus*. Many other examples of crossbreeding could be listed.⁶

A New Approach to Taxonomy

It would thus seem that the creationist is here presented with an unusual challenge and opportunity to develop a new system of plant and animal classification—one that will help lead the evolutionist out of his present morass. Is not the latter's problem primarily due to the fact that he considers each species the newly evolved (created) kind? That particular problem could

be eliminated by the creationist were he to establish a system of taxonomy revolving around the originally created "kinds" of plants and animals. These would be considered the dynamic organisms with their vast potentials from which have arisen a multitude of subkinds. An attempt to establish such a system would, of course, not be without some major difficulties. The Genesis account of creation presents but a minimum of clues as to what constitutes a "kind", as translated from the Hebrew "Min". The oft-repeated statement, however, that God's creatures brought forth progeny "after their kind" would strongly indicate that plants and animals which can interbreed and produce offspring would be of the same "kind". A corollary conclusion would then be that production of offspring from matings between two different kinds would be impossible.

The Genesis "kind" would consequently be the one truly biological taxonomic category. All other, from phyla to so-called "species" would be artificial categories, established only to help the systematist with his task of classifying. There would be no need to make any changes in them; however, one purpose for such groupings would have to be eradicated. The moment the taxonomist accepts the fact that the Genesis "kind" was the one biological natural category in the classification system, the concept of evolution would have to collapse. The term "phylogeny", as now used, would become meaningless. Along with it, I believe, would vanish many of the insurmountable difficulties now encountered by taxonomists.

How would the creationist systematist approach the problem of classifying living organisms? He would keep in mind at least two criteria: 1. All individuals which can successfully crossbreed to the extent that ova are fertilized, even if these finally prove non-viable, would be considered the same "kind", and 2. All individuals which can successfully crossbreed to the extent that ova are fertilized must be members of the same "kind" with any other individuals which can successfully crossbreed with related individuals. Included, too, would be those asexually reproducing organisms giving rise to saltants, mutants, or aberrant forms of life.

Due to the vast potentials placed in each created kind, this division of organisms would then be that category which has given rise to countless new varieties of plants and animals down through the centuries. The writer believes this has been happening through a process of degeneration, as described in *Evolution or Degeneration—Which?*⁷ Regardless of the process involved, organisms belonging to this category would henceforth require intensive research.

A New Taxonomic Category

It would first of all have to be determined where such a category would most logically fit in the present classification system. In *After its Kind* Nelson considered the "species" to be synonymous with Genesis "kind".⁸ He could point to many examples justifying his position, *Homo sapiens* and *Zea mays* to mention but two. Siegler considered certain of the broader categories, particularly "genus" as more representative of the Genesis "kind", and for that reason suggested

that the term "genus" be applied to "kind".⁹ In light of known plant and animal crosses not only between species or genera, but even between families, Marsh proposed a new name which would suggest none of the "confused and arbitrary categories of present-day nomenclature". His choice of the term baramin (from the Hebrew roots, *bara* created, and *min*, kind),^{10, 11} seems particularly appropriate. It would seem, then, that a concerted effort should be made by creationists to utilize and popularize this explicit and meaningful term. I would furthermore propose that technical names in the baramin category be given the suffix "min", to give them a distinguishing identity.

Where To Place the New Category

Where would it be most appropriate to place the baramin category in the classification system now used by taxonomists? I believe its position would vary with each plant and animal species. In each case it would depend on the extent of our current knowledge about that species. The criterion would always be that all organisms be placed in the baramin category whose eggs and sperm, when brought together, can produce true fertilization. The geneticists, the plant and animal breeders, zoo-keepers and horticulturists: these would be the specialists on whom the creationists would have to rely, to determine which organisms to group into a baramin. A start can, however, be made for every known living organism, simply by using the knowledge now available.

Since we know that there is no evidence of any case of true fertilization taking place between *Homo sapiens* and any other species of mammal, the baramin in this case would be at the species level.

Since successful crosses have been made between the following species of *Peromyscus* mice: *P. leucocephalus*, *maniculatus*, and *polionotus*,^{12, 13} the baramin for these would be at the genus level. All other *Peromyscus* species should be included on a provisional basis, for morphological reasons, until their true status is determined through breeding experiments.

Since crossings have been reported between swans and geese, between geese and ducks, and between various species of each tribe,^{14, 15} the baramin for these would be above the family level. In other words, the baramin waterfowl would include ducks, geese, and swans. The taxonomic table would appear as follows:

Phylum: Chordata
 Subphylum: Vertebrata
 Class: Aves
 Subclass: Neornithes (True Birds)
 Superorder: Neognathae (Typical Birds)
 Order: Anseriformes (Lamellate-billed Swimmers)
 BARAMIN: ANATMIN (WATERFOWL)
 Family: Anatidae (Swans, Geese, and Ducks)
 Cygninae: Swans
 Anseranatinae: Semi-palmated Geese
 Anserinae: Geese

Subfamily: Dendrocygnae: Tree Ducks
 Anatinae: Dabbling Ducks
 Nyrociniae: Bay, Sea or Diving Ducks
 Oxyurinae: Ruddy and Masked Ducks
 Merginae: Mergansers

Genus
 Species
 Subspecies

The taxonomist's Family category embraces at least eight different subfamilies exhibiting combinations of certain obvious morphological peculiarities. Thus, when baramin is here placed above the Family category, the creationist is indicating that he has evidence that most, if not all, of the species of birds found below this category are probably variants of an originally created type of waterfowl. While a certain number of species are as yet included primarily on a morphological basis, guess-work can eventually be eliminated through breeding experiments.

The Magnificence Of Kinds

There may be those who will fear that we are here admitting an evolutionary process at work. This we would deny, for several reasons. The creationist does not doubt or deny the potential for variation in God's created "kinds". In fact, in the case of these many waterfowl species we have here a remarkable demonstration of the magnificence of our Lord's created kinds. He imbued His creatures with vast potentials for variation. But he also indicated that each would produce after his kind, thereby giving each "kind" a fixity which would forever insure the fact that it would retain its identity. Had this not been done, these unique creatures would long ago have lost their distinction.¹⁶ This has not happened. We can tell waterfowl from sparrows or eagles today as well as could men centuries ago. Neither do we believe that the development of these approximately 250 species of waterfowl took place through an evolutionary process as visualized by the evolutionist. The mere fact that an originally created kind of waterfowl had the genetic potential for so great a variety of offspring, whereas these descendants lack this genetic potential, would seem to indicate that rather a process of degeneration has taken place.¹⁷

Conclusion

The system of taxonomy currently in use, can be utilized by the creationist through the use of one additional category. By inserting the term "baramin" for any organism, at the systematic level at which our present knowledge indicates cross-fertilization can occur, he can indicate what he considers the Genesis kind to have been.

Acknowledgement

By permission, material from *Evolution or Degeneration—Which?* by H. R. Siegler; published and (Continued on page 11)

THE VENUS FLYTRAP—A CAGEY PLANT

GEORGE F. HOWE*

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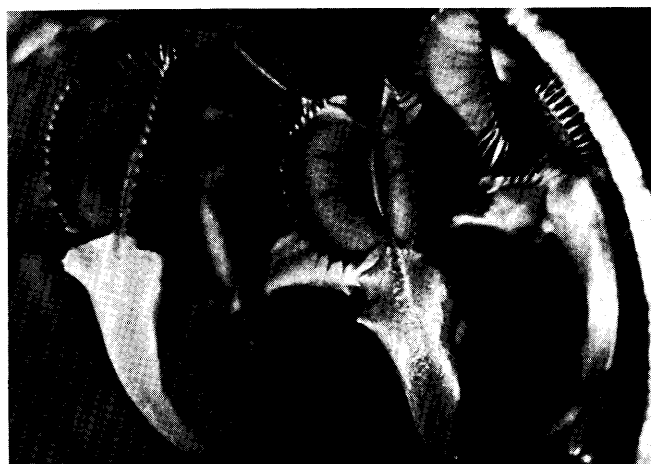


Figure 1. Venus flytrap leaves, showing terminal "traps". Four traps in the upper center and slightly left are open and demonstrate the finger-like projections at their margins. Trigger hairs (not visible at this angle) are found on the surface of the trap. The center part of the trap is deeply stained a beautiful red color. Further research should be conducted to see if perhaps this pattern of coloration plays some role in attracting insects. The trap at the far right, next to the glass of the confining jar, is in the first stage of closure where it is only loosely closed, confining an insect. Final squeezing or "narrowing" follows upon death of the trapped insect.

The tip of the Venus flytrap leaf is a hinged trap that snaps shut when the trigger hairs inside are touched—Figure 1. When the trap closes, it forms a leafy cage that holds, squeezes, and finally digests its prey.

It is widely believed that the Venus flytrap secretes a scent which attracts insects (especially flies). But F. T. Lichtner and S. E. Williams' found by analyzing leaf traps in nature (Brunswick County, North Carolina) that ants are a far more common prey in the traps than flies. They found representatives of five insect orders and three classes of arthropods in the traps they studied. Such wide diversity among insects and other forms rules out the idea that insects are lured to the trap by scent.

Furthermore, they found certain traps with cargo-laden ants inside indicating that these ants were not lured by a food "bait." The insects they found most commonly in the traps were either poor fliers, clumsy fliers, or non-flying forms and therefore the authors concluded that the insects walk through the open trap and stimulate the trigger mechanism by chance.

It is not widely realized that there are two phases of trap movement—(1) closure, which takes place quickly upon stimulating the trigger hairs inside, and (2) squeezing or "narrowing" whereby the trap presses inward on the insect prey.

Lichtner and Williams reviewed literature showing that any two taps (mechanical stimuli) of the trigger hairs will lead to rapid closure. They concluded that this first snapping motion results from an action potential wave much like the wave that moves along a neuron (nerve cell) in an animal or human.

The writers were most interested in the narrowing of the trap or the final movement, about which they found that a different mechanism is apparently involved. Inner trap surfaces secrete acid digestive juices which at first kill the insect prey and later digest it. When the insect dies, it releases haemolymph (blood fluid which contains sodium ions in low concentration.) When artificial solutions of sodium and/or ammonium ions (of concentrations approximating those found in ant haemolymph) were pumped through the closed traps, the traps squeezed more tightly shut.

Solutions of glucose, egg albumen, and other substances including potassium ions did not produce the "narrowing response." A century earlier Charles Darwin reported that trap narrowing occurred when the plant was fed egg albumen but Lichtner and Williams suggested that Darwin probably worked with the albumen that was not salt-free and the salt in the albumen stimulated the trap.

Incidentally, Creationists can grant that Charles Darwin was a worthy observer of nature. Many of his observations are contained in books which have been overshadowed, in the common view, by the Origin. It is his unwarranted speculation far from what can be determined by observation, which must be challenged.

In retrospect, the first response of the plant to trapping prey is the action potential wave that causes quick trap closure. The plant then secretes digestive acids and the dying insect gives off weak solutions of sodium and ammonium ions. As a result, the leaf slowly closes more firmly—bringing the insect into closer contact with the digestive inner surfaces of the leaf.

Such features of flytrap action present problems to evolutionists attempting to square the origin of the traps with the neo-Darwinian model. The plant must have had a full-formed trap mechanism complete with trigger hairs, digestive glands, living bars, and actin potential response before insects of any type could be incarcerated. Next, the trap would also have to have the capability of responding to the sodium ions secreted by the dying ants so that proper "narrowing" and digestion would occur.

Venus flytraps can be raised in moist peat moss within a large covered glass jar with holes perforating the lid. This provides conditions approximating its normal environment. The jar should be well-lighted but not exposed to bright sunlight as the latter increases the heat load to oppressive levels. Although I did feed the Venus flytrap plants which I raised injured flies now and then, I saw no direct relationship between such sporadic feeding and the reproductive success of the plant. It is common knowledge that these plants will

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grow, produce flowers, set seed, and fully propagate without ever eating flies or other insects (see Figure 2). It is hardly in keeping with evolutionary strategy to suggest that Venus flytrap plants would produce such highly adapted traps when the plants can survive quite well without ever trapping insects. It may be, of course, that insect food is required under certain conditions of nitrogen "nutrition" in the soil and such experiments would possibly make a valuable creationist contribution to the literature. It may be on the other hand that these plants thrive in nature whether or not they "eat" prey. Such matters might be more thoroughly investigated by creation-oriented biologists in the future.

A reasonable alternative to evolutionary proposals about this plant is that a Designer formed these systems and balanced the interactions between body chemistry of insects and Venus flytrap plant. Such a view is neither illogical nor unscientific.

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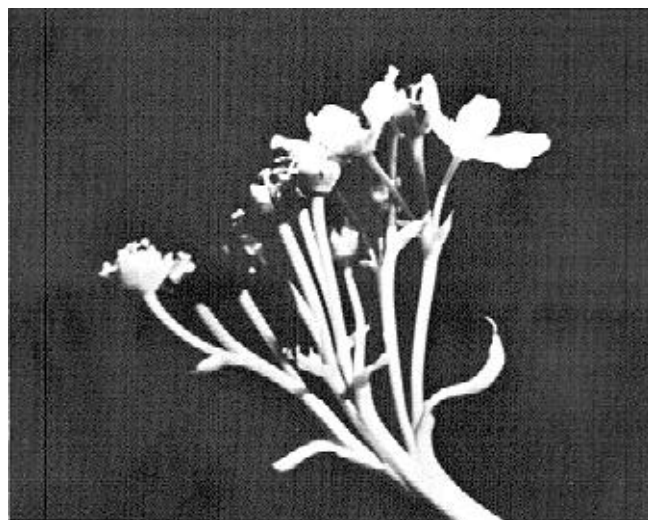


Figure 2. Venus flytrap or inflorescence flower cluster. These flowers bloom in a cymose or "determinate" sequence and are quite "typical" being regular and polypetalous in their flower morphology. I pollinated these flowers artificially with a paint brush and viable seed were set which produced a second generation.

THE LAW OF CAUSE: AN EXAMINATION OF THE NEED FOR CAUSAL FACTORS

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Everyone believes that for every contingent being or event, i.e., one which might have been otherwise, there must be a cause. Philosophers have sometimes called this the principle of sufficient reason, or universal causality. The world around us is clearly contingent, hence one may look for a cause for it. Creationists see God as the Cause; and many natural theologians, such as Paley, have considered this fact so certain that they have gone on to deduce things about God's nature from the Creation.

The evolutionary dogma, on the other hand, is really a denial of any sufficient reason.

It is pointed out also that many, not only among the people in general, but also among students and faculty at universities, are disillusioned with evolution. The opportunity for Creationism is apparent.

One of the oldest (dating back at least to the early Hebrews), and for many people the most convincing line of reasoning used to prove the existence of a Creator (and thus the creation model as opposed to the evolution model) is the following: the existence of a *creation* demands a *Creator*, just as the existence of a *watch* demands a *watchmaker*. One seeing a watch does not need to prove the existence of a watchmaker—the existence of the watch itself is proof enough. Likewise the act of something being "moved" proves the existence of a "mover" i.e., if an object moves, something has caused it to move.

Note that the proof being considered here is more like proof in a court of law than like a mathematical proof.

Causes Known from Effects

When a mother finds wet mud tracked across the kitchen floor, she does not need actually to see the culprit

with the muddy shoes track across her floor to deduce what happened. The mud on the floor is proof enough that *someone* walked across her floor with muddy shoes on. Likewise, in proving the existence of a Creator the creation itself is sufficient, i.e., some cause or being must have made or created what exists. This line of logic is illustrated in the following conversation Isaac Newton had with a good friend of his.

One day, as Newton sat reading in his study with his (mechanical model of the universe) on a large table near him, his infidel friend stepped in. Scientist that he was, he recognized at a glance what was before him. Stepping up to it, he slowly turned the crank, and with undisguised admiration watched the heavenly bodies all move in their relative speed in their orbits. Standing off a few feet he exclaimed, 'My! What an exquisite thing this is! Who made it?' Without looking up from his book, Newton answered, 'Nobody!'

Quickly turning to Newton, the infidel said, 'Evidently you did not understand my question. I asked who made this?' Looking up now, Newton

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solemnly assured him that nobody made it, but that the aggregation of matter so much admired had just happened to assume the form it was in. But the astonished infidel replied with some heat, 'You must think I am a fool! Of course somebody made it, and he is a genius, and I'd like to know who he is.'

Laying his book aside, Newton rose and laid a hand on his friend's shoulder. 'This thing is but a puny imitation of a much grander system whose laws you know, and I am not able to convince you that this mere toy is without a designer and maker; yet you profess to believe that the great original from which the design is taken has come into being without either designer or maker! Now tell me by what sort of reasoning do you reach such an incongruous conclusion?'¹

In his *Principia* Newton concluded: "... it is not to be conceived that mere mechanical causes could give birth to so many regular motions... this most beautiful system of the sun, planets and comets, could only proceed from the council and dominion of an intelligent and powerful being. And if the six stars are the centers of other like systems, these, being formed by the likewise council, must be all subject to the dominion of one: especially since the light of the six stars is of the same nature with the light of the sun... this Being governs all things, not as the Lord of the world but as Lord over all; and on account of His dominion He is wont to be called Lord God, or universal ruler: for God... is a being eternal, infinite, absolutely perfect... it is allowed by all that the Supreme God exists necessarily..."² Some idea of Newton's status in the scientific world is indicated by Isaac Asimov's statement that "most historians of science would declare that Isaac Newton was the greatest scientific mind the world has ever seen."

Reasoning from Effect to Cause in Detection

The writer's experience in correctional research enabled him to spend considerable time reviewing the modern process of crime detection. The process of finding an offender guilty in a court of law, by and large, relies on the same principle, i.e., the offender leaves behind some sign—fingerprints, mud from his shoes, shoe tracks, threads of clothing, a bullet from a gun registered to him—and from this evidence is convicted. This evidence, even though not as "perfect" as the evidence of several reliable persons directly observing the offender committing the crime, is, in most cases, conclusive enough that the offender can be found guilty on this type of evidence alone.

In some cases it took nothing more than a footprint of a cracked heel in the mud by the house of the victim (and the demonstration that the accused owns a pair of shoes with a sole which matches the footprint) to convict the accused. Blood on a knife owned by the accused, or even threads belonging to the accused found in the house of the victim, are important evidence often used to successfully convict one charged with offenses ranging from homicide to burglary. This evidence is the *main* type of evidence utilized to convict an accused of a serious crime. Without this type of evidence few of-

fenders would be convicted. This is the same type of evidence, the same line of reasoning, creationists commonly utilize in proving the existence of a Creator.

This line of reasoning is important in many of the more exact sciences—archaeology, chemistry, physics, history, as well as such fields as crime detection and even iliantology. Often times we cannot locate (and thus measure or evaluate) the causer but we can look at what is *affected* and from there interpolate the qualities of the *affector*. In the field of paleontology, much of what is known about former life was deduced from remains such as the tracks, dung, or skeletons of e.g., dinosaurs. Dinosaur tracks (and skeletal structures) provide any ideas as to how fast dinosaurs walked (or ran), how heavy they were, specifically how they walked, the shape of their feet, as well as the shape of many of their foot bones.

This same line of evidence is the most common type of proof the Scriptures utilize to demonstrate the existence of a Creator. For example, Psalms 19:1 (Byington Version) says: "The skies tell the tale of the Deity's glory, and the firmament announces the work of His hands." The Good News Bible states: "How clearly the sky reveals God's glory! How plainly it shows what He has done!" and Moffat's Version says: "The heavens proclaim God's splendor, the sky speaks of His handiwork."

The watch and watchmaker illustration can be carried one step further. A watch is a mechanical instrument which is used primarily to channel energy into controlled movement of the watch hands. The energy stored in the spring results from someone winding the spring; or in other devices from charging the battery or moving the pendulum (or whatever pertains to the energy source used). Without the power to drive the watch, the watch is useless. Except for any value as parts or an ornament, its purpose cannot be served without energy.

Because energy is something beyond or apart from material objects, man can only study the *effects* of energy on material reality; he cannot study the energy itself. Likewise the human body is only a support network (like the watch) for what Genesis 2:7 calls: "the breath of life."³ This life force must be present in the body. Without it man is simply a shell or a corpse. The breath of life, when put into the body of man, causes man to become a living person. Similarly, energy, when put into the mainspring, causes the watch to become a working, functioning watch. Again we are looking back to a "causer."

Causation Indicates Intelligent Action

Beyond the realization that a watch requires a watchmaker is the fact that also required is a high level of design for the watch to serve its purpose. This design excludes even a small degree of randomness; for the entire system must operate as a unified whole for the watch to function. The malfunction of any part renders the entire watch inoperative. There is more flexibility built into the human system, sometimes through redundancy; e.g. the system can survive without one kidney but not without both kidneys. The human system is highly complex, yet highly dependent on almost every part of the

system for the whole to function. In reference to this inner dependence, Szent-Gyorgyi⁴ stated:

... biological reactions are chain reactions (which) must fit together most precisely, as the cog wheels of a Swiss watch do. But if this is so, then how can such a system develop at all? For if any one of the specific cog wheels in these is changed, then the whole must simply become inoperative. Saying that it can be improved by random mutation of one link (is) like saying that you can improve a Swiss watch by dropping it and thus bending one of its wheels or axles. To get a better watch all the wheels must be changed simultaneously to make a good fit again.

The existence of a watch not only proves the existence of a watchmaker, but it also tells us a great deal about the watchmaker's person. The existence of plant and animal life demonstrates a maker of that plant and animal life, as well as something about the maker of that plant and animal life. As Szent-Gyorgyi stated: "If there was a creator he could have not been a molecular biologist only. He must also have known a great deal of quantumechanics and mathematics, too, and must have been a good geneticist and physiologist. He must have been all that, and so too if we want to follow his trail and read in the book of creation, we must be a bit of everything."⁵ As in detection, an examination of the crime tells us a lot about the criminal, in physical and biological science an examination of the creation tells us a lot about the creator. This is only one step beyond the more elementary reasoning that a creation requires a Creator, and is a basis for our learning about the creator's person.

Paley's Arguments

In his famous *Natural Theology*, Paley appeals to the cause-effect type of reasoning to prove the existence of God.⁶ One of his well known illustrations was that "if one found a stone and was then asked how it came to be there, one could argue that it has been there forever." But if one found a watch upon the ground and inquired as to how it happened to be there, one could hardly argue that "it was there forever." Does not the argument which, for some, "explains" the existence of the stone likewise explain the existence of the watch? Paley answers that "when we come to inspect the watch we perceive that its several parts are framed and put together for a purpose."⁷ The complexity of the watch, and the obvious intent of its design and purpose is such that it is obvious the watch must have had a maker who understood its construction and designed it for a specific use. Paley then turns to the design of the body of man and animals as evidence of a maker.

Much of the rest of his *Natural Theology* is based upon this reasoning, which was so convincing that Osborn⁸ stated that, "Huxley (the famous evolutionist) once told me that Paley's argument for the direct handiwork of the Creator was so logically, so ingeniously and so convincingly written that he (Huxley) always kept it at his bedside for last reading at night." Osborn, a well known theistic evolutionist who lived and wrote at the turn of the century, added his own comments, namely, "So long as the chance of fortuitous hypothesis of adaptation reigned Paley's argument for the ex-

istence of God was set aside, but our more profound knowledge... gained by direct observation of divine nature, leaves Paley's arguments just as strong as it ever was: Paley's 'evidence' may be challenged now no more effectively than it could be challenged in 1858."⁹

Natural Law and Order

The existence of laws implies a law-giver or someone to "cause" or produce the conditions which cause the laws to exist. For a law (a non-tangible, non-physical, or metaphysical reality) to exist, physical realities must logically exist. The material universe could not exist without laws. Even the existence of chaos (negation of law) implies laws or rules which can predict. Likewise for laws to exist, or at least for them to act, there must be something for them to act on.

Law might be called a statement of or prescription for order. One of the most basic assumptions in science is that there is "order" in the universe—that laws exist, always operate, and are unchanging (giving total order). That there is "order" in the universe must be assumed by all sciences for research to take place to discover "laws" that can be relied upon. If gravity sometimes held and sometimes did not, the universe would be an incredibly insecure place and, in fact, could not exist except as space; and mechanics would be confusion. Especially are the natural sciences, such as physics and chemistry, based on this necessary assumption.

If a law appears to fail, that is taken to mean that it was a special case of some more far-reaching law. E.g., Boyle's law, that the pressure of a gas varies inversely as the volume, may fail at quite high pressures or low temperatures. But then some more far-reaching law takes over, of which Boyle's law was a special case, applicable under certain conditions. Again, under many conditions objects fall with a certain acceleration, about 32 feet per second per second. But if they do not, that is taken to mean that some force other than gravity, e.g. air resistance, is acting; and when it is taken into account some law still describes the situation.

One must distinguish, of course, between laws of nature, which are statements of observed regularities; and civil or criminal laws, which are enactments promulgated by some authority. Yet there is a connection. One can think of the laws of nature as enacted by the Creator. On the other hand, a visitor to Britain, by observing regularities, might conclude that there the law is that one drive on the left. And what the old philosophers called the natural law occupies a middle position. This is a moral or ethical law; but it was enacted by the Creator, and promulgated by being implanted into everyone's conscience.

There seems to be no reason, within the material universe itself, why it should be law-abiding. But it is; i.e., ordinarily the regularities apply. (The error of uniformitarianism, incidentally, is to substitute "always" for "ordinarily".) Scientists must admit that "laws exist" but we do not know why they exist. Laws are an attempt by man to abstract what he finds exists in the universe. The fact that there is a consistency is universally accepted, but the fact that there is consis-

cy implies the question: "why is there consistency?" i.e., what causes the consistency?

The second assumption that science universally follows is that this order is knowable to man, i.e., man is able to abstract this order into laws. If he could not, there would be no point in scientific research. If one could not discover the law of gravity, there would be no point in trying. These two assumptions have been so successful that the sciences of physics and chemistry, for example, are called "exact" sciences because man is often able to measure and account for all the factors and with an extremely high degree of reliability predict results, given awareness of all the important factors.

The behavioral sciences, likewise, are endeavoring to apply these two axioms in their research, i.e., there is order in behavior, this order is knowable to man, and if one knows all the relevant contingencies the behavior will be fully predictable.¹⁰ The problem, of course, with human behavior is that there are a number of contingencies, many of which are difficult to delineate, and many are probably unknowable, at least in retrospect. With extensive study, though, many of the behavioral sciences have been able to abstract laws which have a fairly high degree of predictability, especially in dealing with animal behavior or human behavior in situations where most of the important variables can be controlled. The assumption is that if one can fully understand both the genetic and environmental influences, behavior can be predicted.

People behave the way they do for a reason, and this assumption has underlined not only psychology since its inception in the 1800's, but man's view of man throughout history. When someone does something we do not readily understand, we invariably respond with, "Why did you do that?" on the implicit assumption that there is a reason. This is implied in speaking of a responsible person. That there is a reason for all behaviors assumes, again, a cause, the word reason and cause being somewhat synonymous. Hunger, e.g., was the reason for my behavior and likewise caused my behavior. The supposition that all behavior is caused, again leads us back to the concept of a causer.

The cause may take the form of a negation: "the cause of the accident was that the vehicle had no brakes"; or an inanimate thing: "the brakes failed because of a crack in the master cylinder". Even such cases can commonly be traced back to a thinking, animate, cause: e.g.: "the man inspecting the cylinders was careless that day, having been up late the previous night".

The point that all behavior is caused is brought out in the proverb which states, "bring up a boy according to the way for him, even when he grows old he will not depart from it." (Proverbs 22:6) If a child is properly trained he will be a responsible citizen (assuming there are no genetic factors present which affect normality). Likewise, working backwards, if an adult is a concerned citizen, works hard, and is respected in his community, etc., we say he is such because of his "good upbringing". This is not to dispute the existence of free will, only to say that when we examine behavior we look for a cause whether that cause be our training, the fact that we are hungry, the influence of others, or our own inter-

nal motivations. All of these are different causes but still causes.

Everyone Looks for Causes

The need for a reason for an occurrence or existence has led to the development of many of the beliefs and myths which historians constantly come across. The observation that "it thundered" required an answer to the question "what causes thunder?" Knowing something caused it, the early Greeks postulated the god "Zeus" (the thunder god) as an explanation.¹¹ This satisfied the need for an explanation. Additional research has eliminated this nebulous explanation and replaced it with a set of physical laws which essentially accomplish the same thing—satisfy the need to know what caused, in this case, thunder.¹² The very fact though, that all past societies sought an explanation (and thus had *some* type of explanation for most events which repeat themselves with some regularity so that they became aware of them) for the physical occurrences around them supports both the contention that man has an innate need to know the cause of the main events he sees occurring around him, and the supposition that man instinctively recognizes that all events have a cause. Further, the fact that many societies sought an explanation, and not being able to find a physical one, created gods or metaphysical explanations, indicates the antiquity of the belief that all events require a causative factor, and thus that this need is part of man's mental make-up.

This innate perception that all events have a causer can be seen not only throughout history and among all cultures but also among very young children. Among the first words that a child learns is "why" and this word, as any mother or father knows, is generously exercised during most of the child's early years, supporting the contention that this need to verbalize a causer for all that exists is innate.

Induction and Statistics

Theoretically the above two axioms of science cannot be confirmed until every single example has been researched or tried. To demonstrate the law of gravity it would be necessary (from one viewpoint) to release every single object that exists (or has ever existed) within a given distance away from the earth to see whether or not the law always holds, which is obviously an impossibility. The science of statistics, however, enables us to drop a certain number of objects (a sample) and from the sample generalize to the entire universe, or at least the earth. This science has enabled man to test a limited number of examples, and with a high degree of accuracy generalize the resultant findings. Even the laws of statistics are based on certain assumptions which experience has proven, to the degree necessary, to be valid. Before the science of statistics, inductive reasoning was used to produce conclusions based on a sample. Actually, statistics is a highly developed system of inductive reasoning.

Men have likely always reasoned inductively, i.e., by going from a set of facts to a general conclusion, so as to summarize the cases observed; and theoretical discus-

sions of the process go back at least to Aristotle's *Posterior Analytics*. The problem is usually that of getting a representative, and sufficiently large, sample. Here statistics can help, as mentioned; but even without statistics one can often arrive at, maybe not theoretical, but practical certainty.

An assumption of research is that *all* events have at least a hypothesized cause. For those events which the cause is not obvious we believe that a cause exists, but must be found. So researchers try to find the cause. The field of parapsychology, e.g., is concerned with exploring many (alleged) events which do not *seem* to have an understandable cause, but the very existence of this science (and some debate of whether it is a science) and the effort to apply the scientific method to so-called mystical occurrences with faith that in time the reason, mover or causative factors will be found, again supports the belief that all events have a cause. Events currently classified as "unexplainable" are believed to be explainable with further research, even if this requires the formation of new psychological and biological laws. These laws, after scientific verification, will, many researchers are confident, take their place among presently existing psychological and biological laws.

Can Events Occur Without Causes?

At times, it is maintained by some that certain events occur without a cause. For example, the attraction of matter, the forces which hold the atom together, the disintegration of radioactive elements, etc., some hold do not have a cause, they only "occur". A number of events, though, in the past have been reputed to be "without cause" usually described as "the nature of things". Further research, though, in most cases, has found a very specific cause. As this has so often been in the past, likewise with many events occurring today where a cause is not presently known, it seems inevitable that a cause will be found. At any rate it is one thing to say that a cause is not known, and quite another to say that a cause does not exist. Even if one is never found, this does not demonstrate a cause does not exist. The basic axioms of science rule out the possibility that events occur without causes. Because of sensory limitations, we may not be able to delineate a cause, but the most we can state is that a cause is not yet known. Assuming the possibility that something could occur without a cause, the most we could state is that we do not know. We cannot state that a cause does not exist for a certain phenomenon.

Mathematicians, logicians, philosophers and others have debated, discussed, researched and debated the difficulty in demonstrating a specific effect is the result of a certain cause, but rarely have they questioned the axiom that for a given effect a cause, somewhere, exists.

Problems About First Causes

This concept of the necessity of a cause is so much a part of our thinking that it is difficult if not impossible for us to perceive reality without postulating a cause. Even understanding a law is facilitated by knowing what caused the law. That laws "just exist" or "have always existed" is not a satisfying answer. It could, perhaps, be stated that, e.g., natural forces cause the

physical and chemical laws. It then could be asked, what causes the natural forces? If the explanation is given, for example, that a tremendous explosion in the universe caused the natural forces, we then must hypothesize yet another cause for the "big bang". If we answer "natural forces" caused the "big bang" at this point it can be seen that we are beginning to reason in circles. The finite mind evidently cannot fathom an event that does not have a cause and thus has difficulty whether God or any of the proposed natural explanations is given to explain the existence of the universe.

This is getting around to the question which children—and some adults—sometimes ask: "Who created the Creator?" Of course, the same thing might be asked about a naturalistic cause; if, e.g., there was a big bang, what preceded it?

It may be replied that a being may, in a sense, be the cause of its own continuing existence, although not of its coming to being. An animal, e.g., is the cause of its own continuing existence, to the extent that it directs (not necessarily consciously) its own vital processes.

The material universe, everyone agrees, could not have existed as it is forever; hence it must have some cause, external to it. But a being such as men believe God to be could exist eternally; logically, some entities, such as time, may be considered always to have existed. So God can be His own cause; and there is no need to ask who made Him.

Attempts to Avoid the Need of a Causer

The realization that the existence of a creation requires a Creator (or at least a process which accounts for the existence of a creation) requires those who do not believe in a Creator, and yet question the validity of the theory of evolution, to hypothesize some other means to account for our universe's existence and that of living beings. One theory, which was in vogue for a short time, especially because of such works as Von Däniken's *Chariots of the Gods*, (although it is older) is the idea that life came from another planet, in essence was dropped off here from some type of space craft. This idea, though, still does not solve the problem, but only transfers it somewhere else and to another time. We still have to ask *why* or *how* life was created on the place life supposedly came from. Also, it says nothing about the inorganic universe.

Some, though, reason that if it could be demonstrated that the creation came about by itself, i.e., does not need an outside force or mover, there would be no need for God and thus no reason to believe in Him. The theory most often postulated to demonstrate that the universe and all that is in it came about by "itself" (and thus by chance) is some form of spontaneous generation, especially of living things.

This theory, believed for centuries, taught essentially that life was, in some cases, generated by itself from dead material from some natural and normal process; although it was generally believed that only some animals, primarily insects, could be spontaneously generated. Limited spontaneous generation was held by such notable figures of history as Plato, Socrates, Epicurus, Democritus, Harvey, Thales, Newton, Goethe, Copernicus, Galileo, Bacon, Hegel and Schell-

ing, even though most of these men were, in many ways, creationists.¹³ It was, for example, believed that geese rose from barnacles, mice from dirty undergarments, bees from dead calves, fruit flies from banana peels, and maggots from manure. These common observations are very logical and credible conclusions from the data available at the times concerned. A banana peel left by itself invariably yields, in a day or so, fruit flies (called such because of the belief that these insects came from fruit). But looking beyond the surface, scientists found that the first conclusion was not valid. Rather for every event there is a cause, in this case a parent.

Redi, Spallanzani and Pasteur are well known for their various experiments to check the validity of this hypothesis. They exposed meat to the air in a jar and then sealed another jar which contained sterilized meat so as air could not get at the meat. As expected, the organic matter exposed to the air seemingly generated life, but the meat sealed from the air, and heated to destroy life within the air of the jar, did not generate new life. After many similar experiments, the theory of spontaneous generation has now been discredited.

Then how do those who believe in pure evolution feel life originated? In essence it is believed that life originated through spontaneous generation—only under conditions that *no longer exist today*—thus spontaneous generation is not possible *today*, but *was* in the past—“it must have been possible; life is here, we are here, so it must have happened,” proceeds the logic of this belief. To make the theory of spontaneous generation more acceptable, it was believed that life was not spontaneously generated from “nothing”. Inanimate matter did not change into fully developed creatures, such as flies; but “pre-life” was spontaneously generated at one time in the form of very *simple* amino acids; then they changed eventually into very simple life forms, and eventually into forms such as viruses; and with more eons, into bacteria, and on (after many more eons) to man. It would be plainly absurd to say this happened suddenly; but it is alleged to become reasonable if stretched out over an incredibly long lapse of time. In essence, what is hypothesized is a type of “multiple spontaneous generation”.

Evolutionists usually ascribe this alleged process to mutations. But it is hard to see that mutations would be helpful, or even meaningful, at the early stages. Evolutionists ignore these early difficulties, and hide the others under the screen of vast ages of time. But even they agree that the time available is finite. And the probabilities of the required events are so small that even in the greatest amount of time which is proposed, the probability of the spontaneous generation is so small that the process may as well be said to be impossible.

Many Disenchanted with Evolution

To the minds of many people—and an increasingly larger number—the evolutionary explanation, which is, in essence, spontaneous generation, even if modified, is untenable. Not only is evolution unacceptable to Christians, but the population in general has doubts about the theory. A recent survey of upper level college students found that out of 242 students polled, 90.9% felt that either creation or *both* evolution and creation

should be taught in the schools and only 6.2% felt *only* evolution should be taught.¹⁴ Out of the 242 students (many of whom were college seniors), 95 or 39.3% were “pure creationists” and only 9.9% were “pure evolutionists”. 48.3% felt that God, in varying degrees, used some type of evolution to bring about man’s existence. This group is what is known as “limited creationists”. A significant number, close to half, were “pure creationists” but a very insignificant number—about 10% (15.1% of the males and 8.5% of the females) were “pure evolutionists”. These results are similar to national surveys among the population as a whole.

Thus the belief that the majority of people (and especially the majority of college students) are evolutionists is not the case. It is further assumed that all “eminent scientists accept evolution. But this is not the case. A number of eminent scientists are clearly to some degree creationists, including many top scientists both living and dead. True, many scientists *do* accept evolution’s validity often without having much background specifically in evolutionary theories. Even as for Darwin himself, although famous, we could question to what degree and why he was “eminent”. Acknowledging his important contributions in biology, we should realize that he looked at evolution primarily as a hypothesis to be explored. That he did not express nearly the degree of faith in his theory that many of his followers did helps us to put the theory in its proper perspective.

Summary

In the way of summary, we can see that the existence of a creation requires a Creator or some means of bringing about a creation (if something happened there must be causal factors). Consideration of these matters belongs to the science called the Study of Origins, also called “Originology” or “Cosmogony”. Research of origins comes down to two alternatives: a creation by a Creator and a creation by some means of spontaneous generation, i.e., a creation without a Creator. To some extent, at first sight, saying that the creation was created by the Creator results in the same problem as saying that creation created itself, i.e., who created the Creator? But this question—and many others—a Christian meets with faith; and a Christian philosopher considered unnecessary. For he *does have a tremendous amount of evidence for his belief*; and where there are gaps in evidence, he has faith that some day they will be filled in. Evolutionists, too, have many so-called “missing links”—but they feel that the evidence is good enough and faith can make up for the missing links—“they must be there, I know they are there, we just haven’t found them yet.” All beliefs are based on probabilities, and acknowledging this fact helps us work from high level probabilities to low level probabilities, a road all researchers must travel to find answers, a road which requires filling gaps in knowledge no matter what branch we select.

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¹The Minnesota Technologist, October 1957.

²Newton, Sir Isaac. Mathematical principles of natural philosophy: Optics. (in) Great Books of the Western World, vol. 34, p. 369. William Benton, Chicago. (Encyclopedia Britannica, Inc.) 1952.

³What this "breath of life" consists of is another question; but many researchers, like ordinary people, have felt that there is something beyond inanimate matter which causes life. Of course, to call it a vital principle, or something of the sort, may be merely to substitute one name for another; at best, it is an attempt to label an admittedly elusive concept.

⁴Szent-Gyorgyi, Albert, 1977. Drive in living matter to perfect itself. *Synthesis* 1 (1):18.

⁵*Ibid.*, p. 17.

⁶Sprague, Elmer, 1967. Paley, William. (In) *The Encyclopedia of Philosophy*. Collier MacMillan Co., New York. Vol. 6, pp. 19-20.

⁷Paley, William, about 1800. *Natural Theology*. The work was issued (Vol. 1) by Harper and Brothers, New York, 1839. and has recently been reprinted by St. Thomas' Press, Houston.

⁸Osborn, Henry Fairfield, 1925. *The earth speaks to Bryan*. Chas. Scribner's Sons, New York, pp. 64, 65.

⁹*Ibid.*, p. 65.

¹⁰Hunt, Elgin F., 1966. *Social science*. The MacMillan Co., New York. (Third edition).

¹¹The *Encyclopedia Britannica*, edition of 1945, under "Zeus".

¹²This "drive to know" may be as strong as a hunger or sex drive. It has been remarked on many times, e.g., in the opening words of Aristotle's *Metaphysics*: "All men by nature desire to know".

¹³Wysong, Randy L. D.V.M., 1976. The creation-evolution controversy. Inquiry Press, East Lansing, Michigan, p. 180.

¹⁴Bergman, Jerry, 1977. The attitudes of college students in teacher training programs toward the teaching of evolution and creation. *Journal of the North American Creation Movement*, 22 (6):1-4.

NO HOPE FOR THE PHALAROPE

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When Adam's rib became women's lib, the phalarope failed to cope. For it is poor papa who pays, as he has had to assume all the housewifely chores of nest building, incubation and family feeding. He is also a rather wan Don Juan, as he was even denied the plume and pride of a *petit-maitre*; for instead of a lady's man, he is but a hen-pecked pawn. It's a clear-cut case of lady's choice and his only consolation comes when the girls vie for his Valentine. Yes, whether Miss, Mrs. or Ms., it is the female of this fouled-up fowl that wears the baroque plumage of the coxcomb and does the courting. Could this be the beginning of a natural transexual?

While science frowns upon the anthropomorphism implied by this sex scandal, is it any more facetious than evolution's sacred saga of "Mother Nature?" At least the phalarope family is for real, even if their parental profile is somewhat of a paradox.

While the allusion to women's lib may be rather tenuous, a more pertinent question arises regarding natural selection and survival. As the phalarope's reversal of the parental role seems to be the only radical sexual deviation in avian behavior patterns, it is only logical (abstruse maybe?) to speculate on the explanation of this devious conduct.

Only two options are available: Either this juggling of the genders existed from the beginning, or "Mother Nature" had to experiment with some bizarre transitional match-making. Since the latter would involve homosexuality, and would do little to perpetuate the race, attention must be focused on the former.

But now the problem broadens, as it involves not only the phalarope, but the sexual relationships of all species. If a beginning is postulated, when did it begin, and how did the two sexes diverge? According to evolution it had to be a long slow process over millions of years. "Hominoid" fossils have been discovered around the world, but apparently with only a very sparse population; probably about the same census statistics as Big Foot and Sasquatch. This means that many would have to survive and slowly select the necessary genital equipment in isolation, separated by mountains and ocean barriers.

But natural selection cannot operate without the ability to reproduce, and the ability to reproduce is supposed to come from selection and survival. But selection cannot be exercised except en masse. And even *en masse* (witness the infinite millions of experiments with *Drosophila*) has failed to produce any radical sexual changes or improvements.

It would be a gross exercise in futility to even speculate on fertility and the reproductive processes employed before the male and female characteristics were developed. Suppose one side of the world produced only females and the other side only males; or one evolved a million years before the other (or even a million days?); or one was sterile; or one or both failed to exhibit a mating instinct; or there was a slight ripple on the gene pool and the chromosomes clashed. Absurd? Only if rationality is ruled out and random chance called the shots.

Perhaps it would be best to go back to the beginning and start over again. Before any pattern of gender or genetics can be inherited, it must first be formed, be it phalarope or filial. And that formation demands precise planning in both expertise and exactness.

Friend phalarope's domestic dilemma may have been a *faux pas*, but the solution of its source can be solved only in the divine decree of creation and its pattern of purpose.



Male phalarope *Steganopus tricolor* at nest.

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CREATIONIST SCIENCE: A CHALLENGE FROM PROFESSOR YOUNG

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*The recent book, **Creation and Flood**,¹ by Dr. Davis A. Young, may be considered an example of a position which many have adopted: that of trying to have Christianity and science each autonomous in its own realm. However, such an attempt, when examined closely, shows many weaknesses in respect to both theology and science. Some aspects of the matter are discussed here.*

It will be understood that this article is not intended as an attack on Dr. Young, nor on his book. Rather, it is a critical investigation of a notion which has been around for some time, but of which Young's book is one of the latest expositions.

Introduction

There are three ways of handling the present controversy between modern naturalistic science and the Bible. One way is to fit both science and theology under the naturalistic presupposition; this method is by far the majority opinion in the intellectual world today. Another way is to fit both science and theology under the supernaturalistic presupposition; this is the method of present creationism. A third way is to place theology under the supernaturalistic presupposition but leave science under the naturalistic presupposition; this approach has had many proponents within evangelicalism and is followed, in spite of denials, by Dr. Davis A. Young in his new book, *Creation and the Flood: An Alternative to Flood Geology and Theistic Evolution*.¹

Dr. Young is an associate professor of geology at the University of North Carolina at Wilmington. Not only is Dr. Young competent in geological matters, but he shows good theological training as the son of the late renowned Old Testament Reformed scholar Professor E. J. Young of Westminster Seminary, Philadelphia. Because Dr. Young's new book has necessarily raised complex inter-disciplinary questions involving both theology and science, the present reviewers believe that their comments ought to be more comprehensive than the usual book review.

This review begins by surveying the three-fold set of solutions to the Bible-science controversy. Then the discussion proceeds to an analysis of Young's basic position in the light of the three-fold nature of the debate. Finally, to support the present analysis of his basic position the review notes details in Young's Biblical exegesis and geological stance.

The Three-Fold Debate

All thought has a starting point. It is the Christian position that the thinker must begin with God or with man. If one begins with God, then the Bible as His Word necessarily stands prior to all intellectual pursuits whether such activity occurs in arts, music, science, or theology. To properly interpret the trees in the Garden of Eden, for example, man had to be supernaturally informed not just with respect to their ultimate cause but also with respect to their specific qualities (Gen.

2:15-17). In the Biblical position there has never been a "prehistoric" era devoid of special revelation from God (Isa. 40:21), and this constantly available special revelation has necessarily been inseparably linked to historical, observable events in the physical world (Deut. 4:32-35). Man thus has no escape and no excuse. God's very words have again and again been confirmed in physical happenings to the point that Jesus insisted that his words regarding physical, observable events on earth had to be true in order not to invalidate his words regarding heavenly, unobservable phenomena (John 3:12).

This point does not mean that the Bible offers theoretical constructions for the historian and scientist directly. God told Adam to investigate ("name") the animals for himself and come to his own conclusions without direct special revelation on each detail (Gen. 2:19). Observation and construction of an edifice of knowledge about general revelation is a central part of man's dominion work on earth. Nevertheless, as creationists have pointed out, God's Word, special revelation, does speak *at some points* about the *details* of general revelation as well as ultimate causes and purposes. Two trees in the Garden were unique. Man was created from dust. Death was not present before the fall. Antediluvian mankind (some of them, at least) did live longer than present humanity. There was a global flood. The Bible, then, while not providing theoretical constructions, does provide valuable "eye-witness" observations about past historic events, observations which *must* be taken into account at the beginning of any theorizing.

No scholar in any area of intellectual endeavor, therefore, is left with Biblical pronouncements merely in the domain of ultimate causes. He faces additional Biblical statements in his own academic backyard. The anthropologist, for example, encounters Biblical materials which should be incorporated into his data base. It will not do for him to put forward a theory independently of these materials and then at the last minute baptize it with the pronouncement "God did it."

For this reason the Christian position must be intellectually separate in every scholarly field from the non-Christian humanist. The Christian scholar must, if he is to remain faithful to his Lord, always listen to the Word of God at every point in his investigations. He knows his finite and sinful limitations; he realizes God's omniscience and objectivity. The Christian scholar must ground his very view of truth in the Word of God, and then he must incorporate anything God has said in-

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to his pursuits. Not to do so is to leave great areas of thought autonomous from God.

The non-Christian humanist, on the other hand, must start with man in every area. Every statement and every theory must pass man's test. Like Eve in the Garden, the humanist must check God's Word even if he must disobey it to do so. In theology, for example, the humanist begins first with what he judges to be "civilized concepts of morality" and then judges the Old Testament by his self-erected standard. Thus the humanist creationist critic Dr. Preston Cloud objects to "the mass drowning" of the flood of Noah and "the brutal revenge" of the Passover.² The only *acceptable* theological scholarship on the humanist base is one that submits to man's naturalistic presupposition.

Resolution of the Bible-science debate becomes a three-fold affair: only three broad positions are possible. First, starting from man, one may follow the humanist methodology. Lip-service may be given to God about being the ultimate cause, but under no conditions will Biblical materials bearing upon science's data base be taken seriously. Since all talk of God, ultimate causes, and morality occurs *only* because it is tolerated by the prior framework of man's naturalistic presupposition, such talk cannot be identified as truly Christian or Biblical. The first position in the Bible-science debate is clearly humanist in both theological and scientific matters.

The second position is that of modern creationism. In this position God's Word is taken as the starting point in *both* theology and science. Something is true because God said it. The Christian biologist or geologist not only submits to God's ultimate sovereignty in creation and history, but he also submits to God's scattered comments on past historical events. Like his humanist colleague he, too, is occupied with theory construction and with trying to give an account of the processes of nature. Unlike his humanist colleague, however, he has a "head start" in the search for truth: he knows truth exists, and he knows some facts which have to be dealt with on the way before truth is attained. Contrary to popular criticism, he does not have to use miracles to avoid every hard problem that seems for a time to defy explanation.³

The third position appears to be a combination of the first two. It seems to let God's Word be the final reference point in theological matters, but it refuses to let God's Word rule science. Science in this position must be allowed to develop autonomously by itself. If the Christian scientist has special revelation about the data of past history in this view, he must passively sit on the sidelines with this material until such data is discovered and verified on some other basis than being part of God's Word. The Christian scientist, in this view, is not called upon to reform science or to act as salt (cf. Matt. 5:13). Moreover, in this view the Christian must constantly strive to reinterpret the Bible to fit the latest scientific model because verification of the "correct" interpretation always awaits the verdict of scientific pronouncements. Unfortunately, at bottom, this third position is like the first: the non-Christian concept of autonomous science is accepted; and the Word

of God, no longer sovereign over every area, is no longer sovereign at all.

Young's Basic Position

Which of the above three positions is Dr. Young's? At first glance one would think Young follows the second position in line with the creationist movement. He strongly affirms that "Genesis 1 is *history*"⁴ and that "the *Christian* scientific investigator ought first, last, and always be led into the truth not by his theories or his feelings or his practical difficulties, but by the infallible Word of God."⁵ Young distinguishes between scientific verification and truth and thereby seems to limit science to something less than a truth-attaining discipline.⁶

Moreover, Young insists that the Christian investigator follow the Word of God not only in matters of ultimate causes and purposes but also in matters of historical details. Facing the Genesis account of man's special creation, for example, Young strongly holds that Genesis provides authoritative, detailed special revelation about biological matters. He writes of the conflict between Genesis facts and evolutionary theory:

The conflict over the origin of man is real. It cannot be removed by reinterpreting the Bible for the total Biblical data do not permit the latitude in interpretation . . . There is no point in Christians' retreating on this question simply to gain favor with the scientific community. Biblical Christianity must challenge science on this point.⁷

Nevertheless, when one reads Young's remarks on the nature of science itself, he sadly discovers that, after all, Young drifts into the third position discussed above. Although he does challenge biological science when it intrudes into the area of man's origin, Young for the most part wants science to proceed without Scriptural interference. He concludes his book with this statement: "We recognize science for what it is and allow it to develop in a natural way without forcing discovery into a preconceived mold."⁸

What is the place of science for Young and how in his view does it "develop in a natural way?" Young sees science in the same way it is conceived in the modern community of scientific orthodoxy today as a limited field of inquiry within which all explanations are given in "natural, *mechanistic* terms."⁹ [Emphasis original] Young acknowledges that such science depends upon "the assumption of the invariability through time of the 'laws of nature.'"¹⁰ On this basis, of course, supernatural acts are excluded from the domain of science.

This view of science would be all right for the Christian, if it were constantly remembered that uniformity of natural laws on the level of ordinary physical and chemical reactions is merely an approximate "working rule." Since man is a religious being made in God's image, however, he is never content to leave uniformity approximate: man demands *absolute* uniformity at some level of reality. The Christian obtains his needed absolute uniformity in the immutability of the Creator, while the non-Christian obtains his in a legislated false absolute uniformity in the creation. The non-Christian scientist is thus driven in a religious quest to worship "Nature" and to ground himself in Nature's supposed

absolute uniformity.¹¹ The present writers question the wisdom of leaving unqualified the usual definition of science as the study of uniform laws and processes in nature. How does Young's view of science keep science from drifting into idolatry?

This question becomes more important when one turns from what Jones has called "neo-science" (study dealing with presently observed processes) to "paleoscience" (study of past events and their causes).¹² In paleoscience one faces the awesome task of trying to explain the final state of affairs without direct observations of the initial conditions or of the processes acting in the interval between the initial conditions and the final state. With a quantitative data-base of at most a few centuries' duration, how confidently can one extrapolate geo-physical processes backward over intervals up to 10⁹ times longer than the data-base?¹³ Either one blindly clings to a legislated uniformity, or he searches for eye-witness data about the initial conditions and intervening events. If he finds such observational data which report events unexplicable in terms of known present processes, he must weight the relative validity of uniformity and of observer credibility. How can the paleoscientist judge the relative merits of each if he is bound by Young's view of science?

Consider, for example, the flood of Noah. On one hand, according to present knowledge (given the uniformity of natural law) a year-long flood of such a degree that it forever changed the earth-atmospheric system (II Pet. 3:5-7) is practically an impossibility.¹⁴ On the other hand, eye-witness data of highly credible observers (including God) says it happened. A paleoscientist, when faced with such data, must appropriately weight the opposing views. He can do one of three things: (1) he can insist upon absolute uniformity in nature at the level of known processes and wholly discredit the Biblical and extra-biblical data; (2) he can insist upon absolute uniformity in nature at a higher level, the present processes being but specific instances of a more general law, and use the Biblical and extra-biblical flood data to find this higher natural law; or (3) he can insist that absolute uniformity is found in God alone and concentrate upon describing as accurately as possible *what* happened before trying to explain *how* it happened in terms of natural law or divine miracle. How does Young's definition of science help him decide upon (3) instead of (1) or (2)?

When Young then takes this ineffective view of science and says he wants to see such science "develop in a natural way," what can he mean except that the Christian scholar is to let his field develop unchallenged from the Scripture? Can a Christian scholar in another field such as ancient history let things develop autonomously without reference to Scriptural data on the Exodus and Conquest? Or must such a person passively stand by and let ancient chronology become entangled in hopeless dilemmas when the truth lies resting in his hands? Is this behavior being "salt of the earth"?

Young's basic position, then, in practice leads to the third position discussed in the first section above. God's Word does not rule science; instead science through its primary verification rules what the Scripture say. In-

evitably the process of deriving Scriptural interpretations from scientific activity leads to a Bible which is confined to speaking about merely ultimate causes (which lie safely beyond whatever happens to be the self-declared domain of modern science). It remains to justify this interpretation of Young by reference to his Biblical exegesis and to his geological interpretation.

Young's Biblical Exegesis

Despite his high view of Scripture, Young concludes his work with a Bible that has been interpreted through the grid of what present-day science deems possible. And in the process of such interpretation Young has emasculated the text of any significant statement about past earth history. The Bible is left speaking in general terms only about creation and providence. The following remark shows Young's overall view of Biblical exegesis of Genesis 1-11:

Until an interpretation of Genesis 1 can be developed that is accurate and trustworthy as, say, the Westminster Confession's doctrine of God or election or the person of Christ, we make a grave mistake in insisting on full agreement between Scripture and science, for the Christian community is not sure what exactly that agreement should be.¹⁵

Besides omitting mention of the fact that the Westminster Confession explicitly mentions the six days of creation (IV,i), Young seems confused about the issues which have been raised in the past 300 years of discussion on the topic of Genesis 1-11 and paleoscience. The subsequent paragraphs point out this confusion.

What Young does not seem to appreciate is that Bible interpretation generally is decided by the coherence of the Scriptures themselves, not by reference to outside general revelation. The very example of Matthew 1 which he cites is proof of this statement. The genealogy of Matthew 1 is broadly understood only by comparison with other Scripture, not with extra-Biblical materials. Extra-biblical materials will often cause the interpreter to appreciate more deeply the text, but it does not help in deciding basic interpretative questions.¹⁶ For this reason Whitcomb and Morris devoted four of the seven chapters in *The Genesis Flood* to exegetical matters, drawing heavily upon the lessons of the past 300 years' discussion. For this reason, too, Professor Hoeksema enlisted the argument from perspicuity or clarity of the Scriptures in his defense of the strict creationist interpretation, a defense Young too hastily dismisses.¹⁷

By changing this basic perspective and making the final decision in interpreting Genesis 1-11 contingent upon paleoscience, Young dooms any Scriptural rule over paleoscience. Scriptural eye-witness observations of past earth history are thus rendered insignificant in paleoscientific theory-making. The flood is a prime example. Young insists that present-day geological evidence as currently interpreted cannot allow for a global, earth-changing flood. Prompted by this geological pressure, he goes to the text of Genesis 6-8 to reexamine it and to see if another more compatible interpretation is possible. Although he agrees the text teaches a universal flood, he concludes: "the flood

was . . . not a major geological event, certainly not an event which reshaped the globe."¹⁸ What Young omits, however, is the careful procedure of comparing Scripture with Scripture, in particular, comparing Genesis 6-8 with II Peter 3:5-7. Because II Peter 3:5-7 has figured prominently in the on-going debate since at least 1681,¹⁹ Young has simply not interpreted Genesis 6-8 carefully.

Further evidence of Young's confused approach toward interpretation of Genesis 1-11 in his strategy of making the literal days of Genesis 1 the *crux*. He assures his readers:

Virtually any other areas of significant conflict between the Bible and earth history can be removed once it is seen that the Bible by no means unequivocally teaches a 144-hour, purely miraculous creation which took place only a few thousand years ago. Other conflicts are really pseudo-conflicts . . .²⁰

If one studies the past three centuries of debate, however, one finds that the *crux* is not the Genesis 1 days but the flood in Genesis 6-8. Again, to the credit of Whitcomb and Morris they did not entitle their work *The Genesis Creation* because they correctly saw where the central issue lay. If the Bible teaches a cataclysmic flood a few centuries before Abraham, and if geological interpretation refuses to permit such a flood, then immediately a major conflict has been generated irrespective of what one does with the Genesis 1 days. At precisely this point the classical "gap theory" strategy of placing the geological ages before Genesis 1:2 failed because once the strata had been assigned to the creation period, there was no strata left to confirm the flood. Other details could be cited to show that the flood, not creation itself, has become the *crux*.

Young's insistence upon requiring confirmation of Genesis 1-11 interpretation from outside of the text leads him to reverse the implication of Genesis' abbreviated nature. On the whole Young downplays geologically significant events recorded in Genesis 1-11 because "the main concern of Scripture is with sin and grace, judgment and salvation, rather than with geology."²¹ Of course! But how is man informed in the matter of correctly interpreting general revelation and of avoiding false idolatry and fear of nature? How does man learn about God's sovereignty over nature forces?

Does Genesis 1-11 not cite precisely the most awesome and foreboding features in nature in order to assure man that God controls all things after His counsel? Thus the curse upon nature is all-encompassing but under God's control (Gen. 8:21) and scheduled for elimination in the new universe (Rev. 22:3). The flood figured deeply in man's theology of nature (Job 22:15-16; Isa. 54:9-10). It was selected by Christ as the single most appropriate event to describe the coming holocaust in nature on the Day of the Lord (Matt. 24:37; cf. II Pet. 3:5-7). Is it logical to assume that God would select a minor geological event to reveal His sovereign judgmental control over nature to a civilization which was deeply aware of other catastrophic geological phenomena (e.g., Judges 5:4-5, 20-21; Job 9:5-7; 14:18-19; Ps. 68:7-9; Hab. 3:3-16; Zech. 14:5)? The curse and the flood are cited in Genesis

1-11 precisely because they *were* the most stupendous occurrences in nature and Jehovah was king over even them!²²

Young's Biblical exegesis, then, operates with the wrong perspective. Inclusion of anything in the highly abbreviated Genesis 1-11 text makes it a major event. By Young's approach the Bible is divorced from any serious impact on geological science with the result that God's assurances to men that He controls even the most awesome of nature judgments evaporates.

Young's Geological Interpretations

Young's geological interpretations follow consistently from his view of science and the Bible. In an amazing statement he says:

Science cannot be forced to agree with Genesis all at once, even if Genesis had given us an exhaustive technical description of creative events. To insist that science should agree with Genesis 1 is to misunderstand the nature of science . . . [Science] changes as new facts are continuously discovered. But the facts are not discovered in such a way as to lead linearly ever closer to the truth. Science is always based upon partial evidence. Sometimes the facts that are discovered may temporarily lead in the wrong direction or give a false impression until a new group of facts is discovered. If we insist that science at all points agree with Genesis, we forget that only some of the facts are presently available to science.²³ [Emphasis original]

No creationist known to the writers has ever insisted that science immediately come into perfect conformity with Genesis. What creationists have more modestly required is that science consider the eye-witness data given in Genesis at the start of theory-making, as part of the data-base in the foundation of paleoscience. Young, in contrast, insists that the Genesis data should not play an active role in scientific progress. His statement above shows how he thinks science should be left alone to discover facts "naturally."

A basic fault with creationism according to Dr. Young is its failure to provide the field geologist with an adequate criterion to distinguish created rocks from post-creation rocks.²⁴ Created rocks are only descriptably whereas post-creation rocks are both descriptable and explainable. Created rocks have apparent age; post-creation rocks do not. How, asks Young, is the geologist supposed to distinguish the two kinds? How did the master of the feast in John 2 distinguish between the two kinds of wine—the created wine and the "post-creation" wine? Obviously, he could distinguish between them only by listening to the Creator! This feature of being *forced* to listen to the Word of God in detail is the main motivator behind the tremendous assault upon the thesis of "apparent age" put forward by Whitcomb and Morris. Young and all other critics have never answered how creation can take place without apparent age. Young would like to push the problem back to the fields of chemistry and physics and get it out of geology.²⁵ But this move doesn't solve the problem; it only changes its location.

Against classical creationism Young advances five geological objections. The implication implicit in these

five objections is that modern geology has attained a degree of certainty in its basic outline of earth history that makes any radical modification incredible. First, Young believes that the flood would probably have rearranged only relatively small amounts of unconsolidated surface debris. This objection recalls the similar argument made nearly 30 years ago by Dr. J. Lawrence Kulp when he claimed that unconsolidated surface debris would never be sufficient to explain the thicknesses of sedimentary rock on earth.²⁶ The answer, of course, is that this objection presumes the initial condition prior to the flood of the earth's surface had the present proportion of consolidated/unconsolidated materials. Genesis evidence suggests, however, that the antediluvian earth surface was different in many respects from postdiluvian terrain.²⁷

Young next looks to the issue of heat flow in igneous rocks.²⁸ He believes that strict creationism requires formations like the Palisades sill in New Jersey to have cooled down some 1200 degrees Celsius in a year or less, clearly to Young a mathematical impossibility given the existing equations of heat flow. It is important to point out that many variables exist in the process of heat flow. A rock's chemical composition is probably most important. From both field evidence and laboratory work the temperatures of most types of igneous rock have been determined with some certainty. This fact suggests the assumed initial temperature of magmatic intrusion. Many anomalies, however, exist in the field evidence. How can supposed "hot" rocks intrude sediments with little or no apparent chill zones and leave no evidence of contact alteration of the country rock? This sort of evidence shows the lack of complete understanding by geologists of this process.

Rate of heat flow is determined from assumed initial temperature and thickness of the igneous body. It depends not so much on the depth of intrusion but more on the dimensions (surface area/volume) of the intrusive body and the outward temperature gradient. Another very important variable in igneous melts is the volatile components. They greatly control the temperature of crystallization. If they are released rapidly (usually under low pressure environments) the effect on the melt raises crystallization temperature precipitating quick crystallization of the minerals.²⁹ It is well known that water plays a part in igneous melts and that much water associated with this process appears at the surface as juvenile water. It seems possible that pre-Flood melts may have contained higher percentages of juvenile water and upon their ascent released this water. Not only would crystallization rates have exceeded present uniformitarian ideals, but much water would have been released for the flood. The effect may act to diminish by orders of magnitude crystallization rates.

How does one evaluate heat flow? Is this but another uniformitarian process which may have occurred at rates beyond those we presently observe? How many plutons have been observed cooling? The point here is that Young is too optimistic that modern geology can essentially account for all the possible variables. Creationism does not have to posit a direct miraculous exception to known laws because the known laws are not

that well known! In fact, if vigorously pursued, Biblical observations of past events might lead to some amazing discoveries about natural processes.³⁰

Young's third major objection is the contradiction of creationist age estimates with those given by modern chronometry.³¹ It is interesting that in actual field situations most chronometrists require the age of the rock formation from which the sample was extracted. This datum is needed as a check so they can be "in the ballpark" with their determination. Anomalous results from the assumed age are always considered to be the contaminated specimens. Especially considered to be anomalous are those results which might support a young earth.

Moreover, the many variables existing in radiochronometry, which creationists have discussed time and again, cannot all be determined with certainty. The Rb-Sr method which Young exalts is no different. If one assumes that all the conditions are met and a straight line relationship is plotted, one still is forced to deal with apparent age. In addition, all samples from the same rock may be tested on a relative basis but not on an absolute one. In both of Young's examples, the Beemerville nepheline syenite and the Palisades sill complex, the associated radiometric dates merely fit the assumed time of rock formation. This agreement in no way compels belief in long ages. The geometric relationships of the rocks are the same in spite of the usage of "absolute" rock ages.

Young's fourth major objection is that metamorphic rocks require long periods of time to form.³² In the laboratory, however, simple rock metamorphism is reproduced. Such work usually consists of less than four phases and occurs under extreme conditions. All of these laboratory metamorphisms must proceed at rates which can be observed by man. The literature shows the great complexity of metamorphic rock suites.³³ To take the little which is known about such rock suites and associations of mineral phases and extrapolate observations into great lengths of time is not true science.

As Young has pointed out, all the phase changes for minerals have been more or less defined for various ranges of pressure and temperature but not for time. Time is merely an inferred variable. The conditions observed in the laboratory define the natural conditions which are thought to cause metamorphism. These extremes of heat and pressure may easily have existed during and after the flood. The rate of metamorphism would have been the same. As will be shown below, the processes of strain in the crust have continued until the present. These strains would continue the metamorphism of such rock suites as the Franciscan Formation from the flood debris. The Bible reports catastrophic events in nature continuing throughout Old Testament history.³⁴

The last major criticism of Young is that plate tectonics and continental drift invalidate creationism.³⁵ Although some creationists oppose this process of earth history, other creationists believe that it fits well with late and post-flood activities.³⁶ The earth would have been vibrating like an oscillating tuning fork and would have required some time to unwind. The existence of geological evidence for continental drift in no way

limits time rates involved in the process. Young is correct in saying these evidences of continental drift show global tectonism, but rather than damaging strict creationist earth history, it merely enforces the idea of rapid catastrophism.

Tectonism is what one would expect from a worldwide flood. Some even think Genesis 10:25 refers to tectonism. The culmination of geophysical stresses on the earth's thin, fragile crust would occur when God's wind blows over the face of the earth at the end of the flood (Gen. 8:1). In fact this action may have been the very mechanism that set the crustal plates in motion. Flood geologists, then, may well have a mechanism for the beginnings of continental drifting—a key problem for uniformitarianism which currently lacks an acceptable trigger for tectonics.

Young's geological interpretations, then, illustrate how he has become enmeshed in the mental framework of autonomous science. Science, especially a paleoscience like historical geology, left to itself to develop naturally will develop in a false idolatrous direction like every other activity of fallen man.

Conclusion

Dr. Young's book, *Creation and the Flood*, tries to keep theology under the supernatural presupposition but allows science to develop under the naturalistic presupposition. The book does this in two ways. First, it subjects Bible interpretation to verification from study in general revelation. The resulting situation is that the Bible is stripped of any counsel regarding the broad outlines of earth history and thus of any strong assurance that the greatest cataclysms of nature were under God's sovereign control. Second, the book implicitly proclaims the essential correctness of present paleoscience, that no radical Copernican revolutions are possible with new future data. Christians are thus told that they cannot understand the plain text of Genesis without the intermediate priesthood of modern geologists.

Creationists can profit from Dr. Young's work because it presents a very common kind of reasoning encountered in evangelical science circles. For that reason the above comprehensive review was believed to be necessary.

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- ²Cloud, Preston. 1977. Evolution theory and creation mythology, *The Humanist*, 37(6):55. Related articles appeared previously in *The Humanist*, 37(1).
- ³See next section for discussion concerning how creation science is open to both secondary natural causes and divine miracle.
- ⁴Young, *Op. cit.*, p. 41.
- ⁵*Ibid.*, p. 79.
- ⁶*Ibid.*, p. 145.
- ⁷*Ibid.*, p. 144.
- ⁸*Ibid.*, p. 213.
- ⁹*Ibid.*, p. 144.
- ¹⁰*Ibid.*, p. 53.
- ¹¹The non-Christian thinker uses the following syllogism but fails to appreciate his unconscious bias shown in how he reads the term *uniformity*.
If truth exists, there must be uniformity.
Uniformity is denied by catastrophism and miracles.
- Therefore truth cannot exist with catastrophism and miracles. The major premise is correct but as stated it does not specify what level of uniformity is to exist. Uniformity could exist on higher levels—relative uniformity in broad general laws like the First and Second Laws of Thermodynamics and absolute uniformity in the Creator (cf. 1 Pet. 1:23-25).
- ¹²Jones, Arthur. 1971. The Nature of evolutionary thought, *Creation Research Society Quarterly* 8(1):44-49. This excellent discussion by a working biologist as well as other key articles in *CRSQ* over the past 13 years was omitted in Young's work.
- ¹³See mathematical development of the error term in such extrapolation in Rodabaugh, David J. 1975. The Queen of sciences examines the king of fools, *Creation Research Society Quarterly* 12(1):15.
- ¹⁴Discussion below notes how Young omits any consideration of the classical passage of II Peter 3:5-7 and holds to the old idea of the Tranquil Flood theory discussed in Whitcomb and Morris. 1961. The Genesis flood. Presbyterian and Reformed Pub. Co., pp. 97-106.
- ¹⁵Young, *Op. cit.*, p. 133.
- ¹⁶Young refers to archeological insights into Israel's history such as Meredith Kline's work on suzerainty-vassal treaties for supporting his idea of the determining role of extra-Biblical general revelation in Bible interpretation. None of these examples, however, have ever altered in a major way Old Testament interpretations developed prior to their discovery. Such extra-Biblical materials have merely confirmed and increased appreciation for the time-honored conservative interpretation of the text.
- ¹⁷*Ibid.*, pp. 46-48. The doctrine of perspicuity of the Scriptures protects the believer against any priesthood intervening between himself and God's Word. Hoeksema simply called attention to the implication of saying that Genesis 1-11 has never been understood properly until modern geologists produced their nineteenth and twentieth century models of earth history. Young does not appear to appreciate that his same reasoning applied to, say, modern psychology would argue that personality traits mentioned in the Bible have never been properly understood until present behaviorist and/or existentialist models were developed.
- ¹⁸*Ibid.*, p. 212.
- ¹⁹Note discussion in: Haber, Francis C. 1959. The Age of the world: Moses to Darwin. Johns Hopkins Press, Baltimore, pp. 71-83; Rupke, N. A. 1967. Prolegomena to a study of cataclysmal sedimentation, Why not creation?, ed. Walter Lammerts. Presbyterian and Reformed Publishing Co., Nutley, NJ, pp. 141-51; and Clough, Charles A. 1969. Eight years after: the effect of the *Genesis flood*, *Creation Research Society Quarterly*, 6(2):81-84.
- ²⁰Young, *Op. cit.*, p. 144. Such a position leads Young to resurrect the old Day-Age theory without any extensive interaction with creationist works criticizing the theory. Moreover, he mentions Meredith Kline's "framework" hypothesis (1955,58) which was related to Bernard Ramm's earlier "revelatory days" hypothesis (1955) without noting that one impetus behind these hypotheses was the problem of trying to come to grips with the *literalness* of the Genesis 1 days. Young ignores this work and returns to the Day-Age view, modifying it so there is no essential correspondence between each day's work and progressive development of the earth and its biosphere. Note: Ramm, Bernard. 1955. The Christian view of science and scripture. William B. Eerdmans Pub. Co., Grand Rapids, pp. 218-29; and Kline, M. G. 1958. Because it had not rained. *Westminster Theological Journal*, 20:146-57.
- ²¹*Ibid.*, p. 173.
- ²²The flood was a major component in the Old Testament apologetic against chaotic nature. For insight into the Ancient Near Eastern dilemma over chaos in nature see Waltke, Bruce K. 1974. Creation and chaos. Western Conservative Baptist Seminary, Portland, Oregon. For this reason, too, Young's cavalier treatment of the curse in Genesis 3 is deficient. On page 162 he tries to use Keil to support his idea that the fall did not lead to the sudden introduction of death in the animal world when Keil's point in the passage cited explicitly asserts the contrary!
- ²³Young, *Op. cit.*, pp. 133-4. This statement seems to imply that the Genesis data are not defined as facts.
- ²⁴*Ibid.*, pp. 53-4; 76-8.
- ²⁵Young's objections against apparent age in geological matters fall with equal force upon the chemist or physicist who might ask amid radiochronometric studies how do I distinguish created molecules from post-creation molecules?
- ²⁶Kulp, J. Lawrence. 1950. Deluge geology. *Journal of the American Scientific Affiliation*, 2:1-15.

(Continued on page 35)

ASSUMPTIONS AND HUMAN NATURE

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In scientific work, even as in everyday life, one proceeds on the basis, not only of established facts, but also of unproven assumptions. This is inevitable, and by no means blameworthy. What is blameworthy is to refuse occasionally to examine the assumptions, or worse still to try to prevent those who would examine them from getting a hearing. The evolutionary dogma, in particular, depends on many unproven assumptions; and there has too often been a reluctance on the part of those who propound the view to examine the underlying assumptions critically.

It is human nature to assume that certain inclusive statements represent the whole truth, although not proved to be entirely true. An example is the diffuse feeling of some persons that growth equals evolution and that either word is a synonym for creation. Assumption, however, does have a standing in that it is a starting point for work or research. The unproved parts of the assumption are taken to be no hindrance in the contemplated work. But if the foundation ideas are based upon wishful thinking or skewed observation they are inadequate or misleading. In time a false assumption may even pass as a law.

Since assumptions are often made, both in science and in ordinary life, it is well to look into the meaning and validity of the process. The Random House Dictionary lists the following related words: taken for granted, postulated, fictitious, suppose, presuppose. The first synonym listed is probably the best, for an assumption usually resembles the experience or thought of a group of people rather than the vagary of an individual. It often represents the thoughtless acceptance of the views of the majority, whether true or not.

A number of ideas which rest upon no better foundation than assumption are recognized, for instance, "Progress is innate; it comes about of itself." "Evolution is another word for growth or creation." "The degree of likeness between two organisms indicates their degree of kinship." Actually this likeness is only one of the criteria of kinship. Another assumption is that a fossil is supposed to have lived where it is found, thus ruling out severe floods or cataclysms in the history of the earth.

For at least 80 years evolutionists have been making the following assumption which, as you can see, is based not upon observation but on the faith that evolution is necessarily true: "The (rock) formations of different regions are arranged in their true order by the *law of included organisms*; i.e., formations, however widely separated, which contain a similar assemblage of fossils are equivalent and belong to the same division of geological time."¹

Actually there are many data to indicate God made new types of living things, while now he is maintaining those types. The mutations which we see are not new types but subtractions from the old types; they do not give the (improved) morphology, like vertebrae, feathers, seeds in ovaries, or improved coordination, which evolution calls for.

A young man once asked the author, "Would it not be easier to believe that animals in the beginning arose just as they do now?"

"Why, that would be impossible," I replied; "young animals at present come from parents; in the beginning there were no parents."

A Need for Assumption

One could go on with the mention of ideas which are accepted without serious thought, with the admonition to give more observation and reflection. But we must recognize that while assumption is not proof, there actually is a place for it. About the first of May in this latitude a farmer decides that the weather will be favorable for him to plant corn. He cannot prove that there will be no more frost; indeed corn at times has been frozen; but in order to have time for the crop to ripen he had better assume that there will be no more frost until fall, and plant the seed; as he usually does.

Before we start any work or research we make certain assumptions as to the given facts although we may not be conscious of our thoughts. The person who cannot come to a decision loses time or may do nothing at all. In ordinary work we usually rely upon *valid* basic assumptions, but in our ideas of the nature of the world and of human nature, wishful thinking and the ideas of others play a big part. "All study of the natural sciences involves some assumptions; hence it is highly important that all our assumptions be rigidly sound."²

Here we are dealing in philosophy, a very simple and basic branch of that study. We are seeking the function of assumption; and it essentially is this: it saves us from the stultifying result of indecision and gives the faith which brings action in study and work. Does this show that it is always true? By no means!

The Usual Trend

An assumption usually is accepted by a majority of the people; but what about the minority, which may include some active thinkers and researchers? They are an irritating problem for the majority, but in time may become the majority. The majority party prolongs its rule of thought because it accepts as truth that which the thoughtless ones *want* to believe; e.g., they do not want to obey the Bible, therefore they say it is only a fabrication.

Observation and experiment often are hard to perform; for instance no one has observed the beginning of the Earth; experiments in genetics are slow and sometimes costly. Then there is a temptation for scholars to rely upon the theory which they like and say that all informed persons agree. Of the persons who disagree they

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can say they are uninformed; but it is hard to convince the world that holders of advanced degrees in science are uninformed.³

Truth is not the product of time or place, and does not change like fashions in clothing. There was a time when a majority of Europeans thought that lead could be turned to gold and that the Sun revolved around the Earth. When the author was in high school, physicists said that light is of the nature of vibrations, not particles as they used to teach; they had solved the problem. But now they recognize that in some research it seems that light consists of particles after all. We cannot rest content that the latest ideas always are the most trustworthy; there still may be changes in which a part of the past will claim its own.

The more we believe in our assumptions, the less we say about their true nature. To be sure, they still are there; but we tend to pass them off as hard facts. In the text *General Zoology* by G. B. Moment the word *Assumption* is not found in the Contents, Index, or anywhere else as I have found; but concerning the origin of birds the author categorically states, "Birds have evolved from reptiles."⁴ Like many other scientists he does not recognize facts which make this decision debatable; that all birds, and birds alone, have feathers, and no animal has feathers which are partly scales. Such teaching resembles indoctrination rather than science.

Another example, an historical one, of the silent acceptance of an assumption is the supposed inheritance of acquired characters. "In the discussion of Lamarck's concrete cases nothing was said about the supposition that the stretching of the parent giraffe's neck would affect the offspring, making its neck slightly longer. In other words, nothing was said about the assumption that changes of body in parents, however slight, are transmitted to the offspring; for example, that big muscles gained by a parent through exercise are passed on as bigger muscles to their children or that the neck-stretching of a parent giraffe's neck would produce by inheritance a longer neck in its offspring."⁵ Now the inheritance of acquired characters has been ruled out of genetics because nobody has found clear cases of such results; indeed, the evidence seems to be against it.

The philosopher, H. H. Titus, adds his conclusion: "Since science is often said to be based on observation and experimentation, it is well to emphasize again that scientific knowledge depends also on assumption and postulates, and that these in turn rest essentially on faith."⁶ Quite true: science, as well as belief in creation, makes much use of faith in finding the significance of observed facts.

Now let us look at the United States school system. Our nation, which recognized God in the Declaration of Independence, prayed in the Constitutional Convention and in Congress, puts God's name on our coins,

nevertheless objects to mentioning God in textbooks. This ruling represents a body in unstable equilibrium, which, as you know, must fall. The only question is, How soon?

Call Them What They Are

G. A. Kerkut lists the following assumptions as a basis for believing in evolution:

"1. The first assumption is that non-living things gave rise to living ones, i.e., spontaneous generation occurred.

"2. The second assumption is that spontaneous generation occurred only once.

"3. The third assumption is that viruses, bacteria, plants, and animals are all related.

"4. The fourth assumption is that Protozoa gave rise to the Metazoa.

"5. The fifth assumption is that the various invertebrate phyla are interrelated.

"6. The sixth assumption is that the invertebrates gave rise to the vertebrates.

"7. The seventh assumption is that within the vertebrates the fish gave rise to the amphibia, the amphibia to the reptiles, and the reptiles to the birds and mammals. Sometimes this is expressed on other words, that the modern amphibia and reptiles had a common ancestral stock, and so on."

"The first point I should like to make is that these seven assumptions by their nature are not capable of experimental verification."⁷

On a later page this English scientist says: "In effect, much of the evolution of the major groups of animals has to be taken on trust. There is a certain amount of circumstantial evidence but much of it can be argued either way."⁸

Kerkut, unlike the average text writer, makes it plain that this listing is made not to test out hypotheses, but as basic principles of the living world as the evolutionists want to teach it; conclusions to the contrary are not permitted by the teachers. We creationists present both the evolutionary and creation models and ask the student to make up his mind. In many places, parents are pleased with such a change.

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AGAINST CATASTROPHIC RATIONALISM: GRAVITATIONAL ATTITUDE DEFLECTIONS OF THE EARTH'S AXIS†

JAMES N. HANSON*

The postulated very large angular deflections of the earth's axis due to gravitational encounters, say with Venus or Mars, as espoused by many rationalistic catastrophism, most eminently by Velikovsky, are analyzed and found wanting. Useful analytic expressions are derived and are also applied against the alleged accuracy of astronomical dating and Copernicanism. Large Angular deflections seem to be possible only if a large body were to be captured for a considerable period of time.

It will be understood that this article is concerned only with possible changes in the direction of the earth's axis. Possible changes in the orbit, as some catastrophists have proposed for the earth or for other bodies, are not investigated here.

Problem and Procedure

The Euler rigid body equations for the angular displacement of the earth due to (1) an interstellar of cometary flyby, (2) asteroidal or planetary encounters, and (3) Keplerian capture of a massive body, are solved to yield simple analytical approximations. In order to obtain simple solutions the notion of an equivalent dumbbell for the earth is derived. Analytical error analysis as well as numerical integration of the exact equations is performed in order to demonstrate the accuracy, at least for the purposes of this paper, of the approximate solutions. The equivalent dumbbell approximate model is a planar one which errs in the favor of rationalistic catastrophism.

In order to estimate this error, the interstellar flyby case is solved in three dimensions. This three-dimensional solution then, also provides a theoretical model for questioning the alleged accuracy of astronomical dating in that the singular or accumulated effect of asteroidal encounters could have produced very large errors in the geographical position and time of ancient eclipses. Lastly, some consequences against Copernicanism are conjectured, especially concerning Joshua's long day.

Plan of this Article

The problem is discussed qualitatively in the Introduction, and then in the light of conclusions which have been reached, in the sections: Consequences on Astronomical Dating, Note on Geocentricity, Joshua's Long Day and Geocentricity, and the Conclusion. These parts may be read first, and will show what has been accomplished. The mathematical details are mostly contained in the sections: The Equivalent Dumbbell, The Equation of Motion of a Dumbbell, Dumbbell Rotation Due to a Mass Moving Rectilinearly from Infinity to Infinity, Numerical Evaluation of Rectilinear Case, Dumbbell Rotation Due to a Mass Moving in a Circular Orbit About the Sun, Dumbbell Rotation Due to a Mass Moving in a Keplerian Orbit, Numerical Evaluation of

the Keplerian Case, Verification by Numerical Integration, and The Orientation of a Rotating Ellipsoid Due to Arbitrary Rectilinear Motion.

Introduction

Rationalistic catastrophism is not indigenous to this time. Many ancients held such views, for example see Johnson's chapter on the pre-Copernical conceptions of the universe.¹ In more recent times "Wicked Will" Whiston (1667-1752), known for his translation of Josephus's "Antiquities," was tried for blasphemy by the Anglican Church for his enthusiastic use of the New Newtonian Cosmology in rationalizing the Noahic Flood by a near cometary collision.² Peterson³ ingeniously has a double-nucleus comet staying electromagnetically suspended above the earth in order to explain Joshua's long day, the two luminous nuclei being the sun and the moon. And even more fanciful theories are promoted by Patten^{4,5} who requires and earth ice canopy and planetary encounter.

Whiston, Petersen, and Patten have many interesting things to say, and they argue from the Bible, and correctly on some points; however they have hopelessly rationalized Scriptural catastrophic miracles to such an extent that God's intervention is not recognized. In fact it is not clear that He is even needed. It is indeed, hard to reconcile the Bible as the Book that makes the simple wise (Ps. 119:130) and the "wise" simple (Ps. 19:7) in the light of these arbitrary scientological interpolations. A fine expression is, "just because you can say it is so does not make it so." So it is with the afore-mentioned and with Velikovsky and his followers. I have not seen the slightest mathematical substantiation that these things (planetary encounters with the earth, etc.) have taken place or could take place. The best work defending rationalistic catastrophism seems to be the defense of Velikovsky in the defunct journal *Penseé*⁶ and its successor journal, *Kronos*.⁷

It will be shown in this paper, that if a planet, say Venus, could become captured into a Keplerian orbit by the earth for a sufficiently long per of time (i.e., a sizeable fraction of the captured body's orbital period, a large angular displacement of the earth's axis would occur (only capture will give this result for the other cases analyzed give quite small displacements). Hence the central question facing Velikovsky and his allies is, *was* Venus ever captured by the earth (as will be seen, even a close encounter will not help Velikovsky). We may even weaken the question by asking, *could* Venus

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ever have been captured by the earth.

The scientific establishment has thrown these questions out of court in much the same manner as it does questions concerning scientific creationism. However, Bass, writing in *Pensee* in two excellent papers⁸ has discussed these two questions (especially the second), but has not answered them. Bass is a competent mathematician who clearly knows the area of classical and modern celestial mechanics and its bearing on the Velikovskian thesis. The present writer is familiar with Bass's fine work on nonlinear differential equations and hence regards his opinions highly.

Bass's arguments are qualitative not quantitative, for he correctly notes that due to the vagueries of numerical integration of such problems, it would not be possible to demonstrate the Venusian encounters postulated by Velikovsky. Hence he argues qualitatively including analogy. The analogy used is the path of the comet Oterma III. I find this analogy unconvincing in that it is insufficiently well observed to draw the definite conclusions Velikovsky requires and that the comet only supplies a weak analogy to a very specific and unusual conjectured orbit of Venus. Furthermore, though the mass of Oterma III is probably mathematically "irrelevant" (8, p. 9), the mass of Venus is not.

Most importantly, Bass's answer to the question, as to whether it is possible that Venus in orbit between Mars and Jupiter could then proceed to an extremely close approach to the earth and then into its present very nearly circular orbit, is that such a possibility does not appear to be ruled out. That is, the present development of the mathematics concerning such problems does not permit the question to be answered with assurity. Even if it did, the mathematical definition of the problem would be very restrictive when compared to actual many-body problem for non-point masses in the presence of non-gravitational forces.

This answer is not an answer at all. Even if the answer to the *could* question were affirmative, it would still be necessary to demonstrate that such *did* happen. Bass speaks of such a demonstration as hunting for a needle in a haystack. The specific question Bass addresses may not even be relevant, for the rational catastrophic explanation of the many miraculous Bible events (the Flood, Joshua's long day, Hezekiah's extra hours, etc.) requires vastly more celestial mechanical gymnastics of Venus or Mars than he considered.

For anyone wishing to appraise the matter and read a fine chastisement of establishment astronomy, Bass's papers are must reading. For example, Bass forcefully points out that the stability of the solar system is not the usually parroted 10^{11} or so years as required by megaevolution but more on the order of a few 10^2 years. Such short term stability is clearly compatible with the time scale of God's administration of His Creation which is of the order of 1000's of years,⁹ if not precisely 7000 years (2 Pet. 3:8).

In the paper I have not discussed the magnitude of the energies associated with the pertinent motions. Merely citing certain energy values,¹⁰ as is done frequently by followers of Velikovsky, and then drawing conclusions based on some unstated energy balance principle, is of little use. Great absurdities arise from this procedure in

which the kinetic and/or potential energy of one body is assumed somehow to transfer to another. Of course energy methods such as Lagrangian or Hamiltonian mechanics do provide in principle total information, for they do lead to the development and solution of the pertinent equations of motion from which one might compute the actual motions of massive bodies. It is these motions that are required and which are approximated in this paper.

Only gravitational forces are considered. Despite unsubstantiated claims to the contrary by many who entertain Velikovsky's notions, I must conclude, with Keister,¹⁰ that possible electromagnetic forces would be smaller in effect than gravitational ones. The Roche limit for the gravitational distortion of a body is used in a nonessential way. Roche's limit properly applies only to a liquid body satisfying certain conditions.^{11,12}

The analysis included in the next several sections is presented in fair detail so as to render it as provable as possible to the reader. It is my hope that this paper serves to caution against the uncritical adoption of Velikovsky's or Patten's or other such theses within the Bible-Science community. This type of thesis is based on wishful thinking and not on cautious logic, and especially not on the Bible. Velikovsky himself, while he makes much use of the Bible, seems to disclaim any strong doctrine of inspiration; and some secular catastrophists seem to be actually antagonistic to the Bible and Christianity. I must remind the reader that "could be" is not to be equated with "is"; and in the case of the alleged motion of Venus the "could be" is not even substantiated.

I should add that, while I have to disagree with Velikovsky on points of celestial mechanics, I believe that he may be on much stronger ground in his attempt to reconstruct ancient history and chronology.

The Idea of the Dumbbell

The reason that another body, e.g. Venus or an asteroid, would exert a torque, a turning action, as well as just a force, on the earth, is as follows. Consider Figure 2. The earth is a spheroid—it bulges at the equator. The nearby object, shown at μ , attracts all the parts of the earth; but, since the attraction is stronger the closer together the things concerned are, there is a stronger pull on the left side of the spheroid than on the right. Hence the effect is to turn the spheroid counter-clockwise.

Since the bulge is what matters, it seems natural to try to approximate the spheroid by something which is a bulge and nothing else—the dumbbell. It consists of two parts, each of mass $M/2$, imagined mounted a distance $2D$ apart on a light rod.

In the following parts, the appropriate dimensions, to make the dumbbell really equivalent, are estimated. Then the amount by which the dumbbell might be turned in various situations is calculated.

If one considers a rotating earth, there is another effect. Just as a spinning top resists falling over due to gravity, so a spinning earth would resist, to some extent, having its axis turned to a new direction. This consideration is taken up in the section: The Orientation of

a Rotating Ellipsoid Due to Arbitrary Rectilinear Motion.

Because of this, and for other reasons too, the analysis of the dumbbell gives an upper limit on the amount by which the axis might be changed.

The Equivalent Dumbbell

In order to simplify the analysis of the rotational motion of the earth (an oblate spheroid) due to gravitational torques arising from an inverse-square force field, it will be convenient to investigate to what extent the earth may be replaced by an equivalent dumbbell. It will be found that a dumbbell is gravitationally equivalent to an oblate spheroid to a high degree of approximation and that this equivalency is independent of the location of the attracting body with respect to the position and orientation of the dumbbell. The gravitational torque due to an inverse-square field of strength μ on an arbitrary rigid body V , will be computed. The case for an oblate spheroid will be evaluated and equated to the torque on the equivalent dumbbell in order to determine the dimensions of the equivalent dumbbell. The field strength is given by $\mu = GM$ where $G = 6.7 \cdot 10^{-8} \text{cm}^3 \cdot \text{gm}^{-1} \cdot \text{sec}^{-2}$ and M is the attracting mass. In Figure 1 the center of mass of rigid body V is at $\mathbf{R} = (X, Y, Z)^T$ with respect to a Cartesian coordinate system whose origin is at mass M . The superscript T on a vector or matrix indicates its transpose. An elemental mass, dm , of V is located at displacement, $\mathbf{r}$, from $\mathbf{R}$, and is measured with respect to a Cartesian coordinate system indicated by unit vectors $\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3$ fixed in rigid body V .

The elemental force due to mass M on elemental mass dm within is

$$- \frac{\mu}{|\mathbf{R} + \mathbf{r}|^2} \frac{(\mathbf{R} + \mathbf{r})}{|\mathbf{R} + \mathbf{r}|} dm \quad (1)$$

Hence the total gravitational torque, $\mathbf{T}$, is the integral over the volume of V of the cross-product of $\mathbf{r}$ with the elemental force.

$$\mathbf{T} = - \int_V \mu \mathbf{r} \times \frac{(\mathbf{R} + \mathbf{r})}{|\mathbf{R} + \mathbf{r}|^3} = - \mu \int_V \frac{(\mathbf{r} \times \mathbf{R})}{|\mathbf{R} + \mathbf{r}|^3} dm \quad (2)$$

The absolute value of a vector indicates its length and will be denoted as $|\mathbf{V}| = V$. Assume $r \ll R$ and apply the binomial theorem to obtain

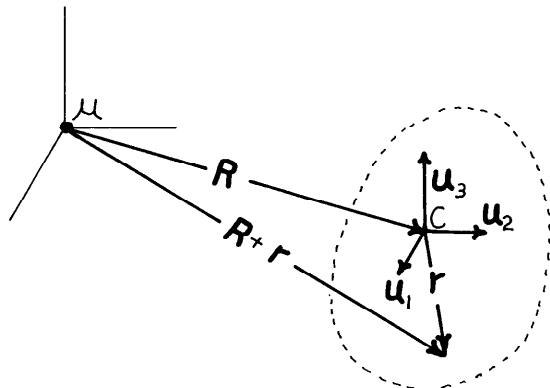


Figure 1. This shows the arrangement for computing the torque $\mathbf{T}$ on the rigid body V (shown by broken lines) due to the mass M , shown at $\mu (= GM)$. The center of mass of the body is at c.m.

$$\begin{aligned} \frac{1}{|\mathbf{R} + \mathbf{r}|^3} &= \frac{1}{\{(\mathbf{R} + \mathbf{r}) \cdot (\mathbf{R} + \mathbf{r})\}^{3/2}} = \frac{1}{(R^2 + 2\mathbf{R} \cdot \mathbf{r} + r^2)^{3/2}} \\ &= \frac{1}{R^3(1 + \frac{2\mathbf{R} \cdot \mathbf{r}}{R^2} + \frac{r^2}{R^2})^{3/2}} \approx \frac{1}{R^3} (1 - \frac{3\mathbf{R} \cdot \mathbf{r}}{R^2}) \end{aligned} \quad (3)$$

where terms on the order of $r^2 R^{-5}$ and smaller are ignored. The dot indicates the vector dot-product. Thus the gravitational torque is approximated by

$$\mathbf{T} = - \frac{\mu}{R^3} \int_V (\mathbf{r} \times \mathbf{R}) (1 - \frac{3\mathbf{r} \cdot \mathbf{R}}{R^2}) dm \quad (4)$$

Since $\mathbf{r}$ is referred to the center of mass of V ,

$$\int_V (\mathbf{r} \times \mathbf{R}) dm = (\int_V \mathbf{r} dm) \times \mathbf{R} = \mathbf{0} \times \mathbf{R} = \mathbf{0} \quad (5)$$

and therefore using a well known matrix identity

$$\begin{aligned} \mathbf{T} &= - \frac{3\mu}{R^5} \int_V (\mathbf{r} \times \mathbf{R}) (\mathbf{r} \cdot \mathbf{R}) dm \\ &= - \left[\frac{3\mu}{R^5} \int_V (\mathbf{r} \mathbf{r}^T) dm \right] \times \mathbf{R} \end{aligned} \quad (6)$$

where matrix multiplication is intended except where a dot or cross product is indicated. Consider the following identity where $\mathbf{U}$ is the unit matrix,

$$\begin{aligned} [(\int_V \mathbf{r}^2 \mathbf{U} dm) \mathbf{R}] \times \mathbf{R} &= [(\int_V \mathbf{r}^2 dm) \mathbf{U} \mathbf{R}] \times \mathbf{R} \\ &= (\int_V \mathbf{r}^2 dm) \mathbf{R} \times \mathbf{R} = \mathbf{0} \end{aligned} \quad (7)$$

Therefore $\mathbf{T}$ may be written as

$$\begin{aligned} \mathbf{T} &= - \left[\frac{3\mu}{R^5} \int_V \mathbf{r}^2 \mathbf{U} - \mathbf{r} \mathbf{r}^T dm \right] \times \mathbf{R} \\ &= - \frac{3\mu}{R^5} (\mathbf{R}^T \mathbf{Q})^T \times \mathbf{R} \end{aligned} \quad (8)$$

in terms of the inertia matrix

$$\mathbf{Q} = \int_V (\mathbf{r}^2 \mathbf{U} - \mathbf{r} \mathbf{r}^T) dm = \begin{bmatrix} I_1 & 0 & 0 \\ 0 & I_2 & 0 \\ 0 & 0 & I_3 \end{bmatrix} \quad (9)$$

$\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3$, axes are principle axes of inertia at the center of mass. Hence expanding $\mathbf{T}$ gives,

$$\mathbf{T} = - \frac{3\mu}{R^5} [(I_2 - I_3) YZ, (I_3 - I_1) XZ, (I_1 - I_2) XY] \quad (10)$$

If V is an oblate spheroid with polar moment I_3 and equatorial moment of inertia $I_1 = I_2$ then

$$\mathbf{T} = - \frac{3\mu}{R^5} (I_3 - I_1) XZ \mathbf{u}_2 \quad (11)$$

where, due to the rotational symmetry about the $\mathbf{u}_3$ -axis, no generality is lost by assigning $Y = 0$. Let $X = x$, $Z = l$ and eliminate l , by incorporating the mechanical ellipticity $\epsilon = (I_3 - I_1)/I_3$, from which

$$\mathbf{T} = - \frac{3\mu \epsilon I_3 \ell x}{(x^2 + \ell^2)^{5/2}} \mathbf{u}_2 \quad (12)$$

Since the earth is very nearly spherical with radially varying density then $I_3 = M_e k^2$ where M_e is the mass of the earth and k , the radius of gyration around the polar axis. Therefore finally, the torque on a spheroid is

$$\mathbf{T}_{sp} = - \frac{3\mu \epsilon M_e k^2 \ell x}{(x^2 + \ell^2)^{5/2}} \mathbf{u}_2 \quad (13)$$

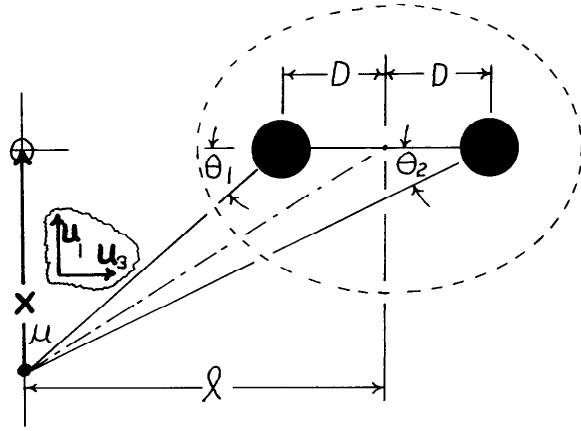


Figure 2. The equivalent dumbbell, consisting of two parts, each of mass $M/2$, mounted a distance $2D$ apart, i.e., each D from the center. The torque on it, due to the mass M , is equal to that on the ellipsoid (broken curve) which the earth actually is. The specifications of the dumbbell will be the same in subsequent Figures. The tip of the "x" vector may be taken as $x = 0$; and the "u" vectors are shown in the inset, u_3 being vertically out of the plane of the drawing.

Figure 2 shows the equivalent dumbbell of mass $M_e/2 + M_e/2$ and length $2D$ where the dumbbell axis is perpendicular to the measurement x which will be taken negatively in the downward direction in order to accord with subsequent derivations and preserve sign. The torque on this dumbbell about its center of mass, assuming $l \gg D$, is given by the couple

$$T_m = \frac{\mu M_e}{2} \left[\frac{D \sin \theta_1}{x^2 + (\ell - D)^2} - \frac{D \sin \theta_2}{x^2 + (\ell + D)^2} \right] U_2 \quad (14)$$

where

$$\sin \theta_1 = \frac{x}{\{x^2 + (\ell - D)^2\}^{1/2}}, \quad \sin \theta_2 = \frac{x}{x^2 + (\ell + D)^2\}^{1/2} \quad (15)$$

Combining gives

$$T_m = \frac{\mu D M_e x}{2} \left[\frac{1}{\{x^2 + (\ell - D)^2\}^{3/2}} - \frac{1}{\{x^2 + (\ell + D)^2\}^{3/2}} \right] u_2 \quad (16)$$

$$\approx - \frac{3\mu D^2 M_e \ell x}{(x^2 + \ell^2)^{5/2}} u_2$$

where the approximation uses $df(u) = -3(c^2 + u^2)^{-5/2} u du$ for $f(u) = (c^2 + u^2)^{-3/2}$. In this case $u = \ell$, $c = x$ and $du = 2D$.

Equating T_{sp} with T_{db} gives the equivalent dumbbell dimension as $D = \epsilon^{1/2} R_e$. The mechanical ellipticity is about $1/300$ and the radius of gyration, $0.577 r_e$ where r_e is the earth's radius¹³. Hence $D \approx .033 r_e \approx 133$ mi. This clearly justified the assumption that $\ell \gg D$ since the largest possible value for ℓ would be r_e . It should be noted that D is a constant, to within the approximations used, and does not depend on x or ℓ . Hence the use of the equivalent dumbbell in subsequent analyses is well justified. However, it yet remains to qualify the assumption that $r \ll R$ in the derivation of T_{sp} . If the $r^2 R^{-5}$ term had been retained, the resulting T_{sp} would not have changed sensible for the purposes of these analyses, even for ℓ equal to two earth radii. In fact the

accuracy of this formula for values of ℓ only slightly in excess of r_e is attested by the fact that the nodal precision of close artificial satellites is in very close agreement to that which can be derived from the expression for T_{sp} .

The Equation of Motion of the Dumbbell

The equation of motion of a dumbbell about its center of mass, assumed fixed at the origin, follows from Figure 3. The dumbbell axis is displaced by the angle θ due to the motion of mass M along a path given by the polar coordinates $(\psi, r(\psi))$ where $\psi = \psi(t)$ is a known function of time. The motion in θ is given by

$$M_e D^2 \ddot{\theta} = \frac{M_e M G}{2} \left(\frac{D \sin \theta_1}{D_1^2} - \frac{D \sin \theta_2}{D_2^2} \right) \quad (17)$$

Eliminating D_1 , D_2 , θ_1 , and θ_2 gives

$$\ddot{\theta} = \frac{M G r \sin(\psi - \theta)}{2D} \left[\frac{1}{\{r^2 + D^2 - 2rD \cos(\psi - \theta)\}^{3/2}} - \frac{1}{\{r^2 + D^2 + 2rD \cos(\psi - \theta)\}^{3/2}} \right] \quad (18)$$

Next eliminate t in order to obtain a differential equation for θ in ψ ,

$$\begin{aligned} \theta &= \theta(\psi), \quad \psi = \psi(t) \\ \dot{\theta} &= \frac{d\theta}{d\psi} \frac{d\psi}{dt} = \theta' \dot{\psi} \\ \ddot{\theta} &= \frac{d\theta'}{d\psi} \frac{d\psi}{dt} \dot{\psi} + \theta' \frac{d\dot{\psi}}{dt} = \theta' \ddot{\psi} + \theta'' \dot{\psi}^2 \end{aligned} \quad (19)$$

Hence the final general form of the equation of motion is

$$\dot{\psi}^2 \theta'' + \psi \ddot{\theta} = \frac{M G r \sin(\psi - \theta)}{2D} \left[\frac{1}{\{r^2 + D^2 - 2rD \cos(\psi - \theta)\}^{3/2}} - \frac{1}{\{r^2 + D^2 + 2rD \cos(\psi - \theta)\}^{3/2}} \right] \quad (20)$$

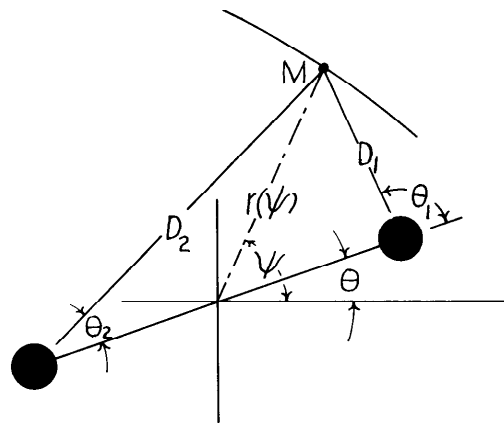


Figure 3. This shows the information necessary for calculating the torque, about its center of mass, on the dumbbell, due to a mass M . The mass M may be considered moving in the plane of the drawing, its coordinates ψ and r being functions of time.

This equation clearly has no general solution but solutions or their approximations can be readily obtained for the case $|\theta| \ll 1$ for various simple paths for mass M for which cases the equation becomes separable. Uniform motion parallel to the y -axis, uniform circular motion about a point on the x -axis, and the Keplerian orbit about mass M_e at the origin will be analyzed.

Dumbbell Rotation Due to a Mass Moving Rectilinearly From Infinity to Infinity

The motion of a dumbbell about its center of mass due to a mass, M , moving from minus infinity to plus infinity perpendicular to the dumbbell's axis will be developed. In reference to Figure 4, θ is the angular displacement of the dumbbell axis from the z -axis. It will be assumed that $\ell \gg D$ (in fact the last section showed $\ell \geq 30 D$) and $|\theta| \ll 1$. From these assumptions and the previously computed torque expression, Euler's equation for the angular motion is

$$M_e D^2 \ddot{\theta} = \frac{D \mu M_e x}{2} \left[\frac{1}{\{x^2 + (\ell - D)^2\}^{3/2}} - \frac{1}{\{x^2 + (\ell + D)^2\}^{3/2}} \right] \quad (21)$$

Let mass M move uniformly upward with velocity v starting from $x = -\infty$ at time $t_o = -\infty$ so that $x(o) = 0$ when $t = 0$, i.e., $x = x(t) = vt$, $dx = v dt$, $dt = v^{-1} dx$. Also choose initial condition, $\theta(t_o) = \dot{\theta}(t_o) = 0$. Therefore,

$$d\dot{\theta} = \frac{\mu x}{2 D v} \left[\frac{1}{\{x^2 + (\ell - D)^2\}^{3/2}} - \frac{1}{\{x^2 + (\ell + D)^2\}^{3/2}} \right] dx \quad (22)$$

which upon integrating twice from $x = -\infty$ to x gives

$$\begin{aligned} \dot{\theta}(t) &= -\frac{\mu}{2 D v} \left[\frac{1}{\{x^2 + (\ell - D)^2\}^{1/2}} - \frac{1}{\{x^2 + (\ell + D)^2\}^{1/2}} \right] \\ \theta(t) &= -\frac{\mu}{2 D v^2} \left[\ln \{x + [x^2 + (\ell - D)^2]^{1/2}\} - \right. \\ &\quad \left. \ln \{x + [x^2 + (\ell + D)^2]^{1/2}\} \right]_{-\infty}^x \quad (23) \end{aligned}$$

The lower limit will be evaluated by the use of the binomial expansion, which leads to

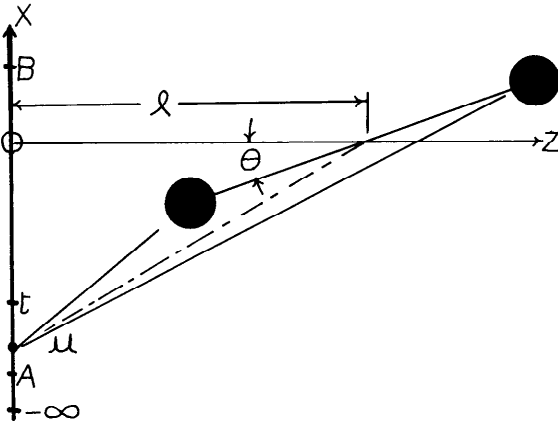


Figure 4. Here the torque on the dumbbell is being calculated due to a mass moving uniformly along the straight line AB. The zero position indicates its location at time zero; the place "t" at time t, etc.. In the very remote past, x was infinite in the negative direction, and θ and its derivative zero.

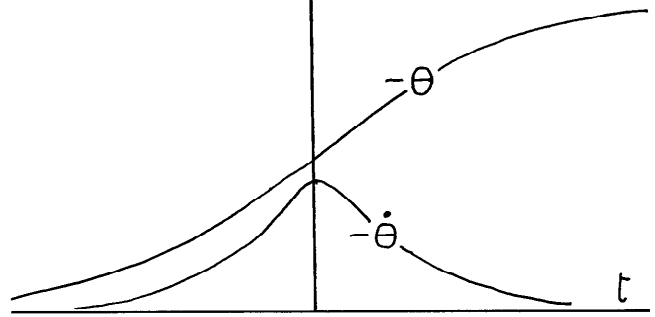


Figure 5. This shows, qualitatively, the motion, i.e., rotation, of the dumbbell due to the uniform rectilinear motion of the mass M from minus to plus infinity. Note that θ changes altogether by $-2\mu/\ell v^2$, and the greatest magnitude of its derivative is $-\mu/\ell^2 v$.

$$\lim_{x \rightarrow -\infty} \ln \left[\frac{x + \{x^2 + (\ell + D)^2\}^{1/2}}{x + \{x^2 + (\ell - D)^2\}^{1/2}} \right] = \ln \left(\frac{\ell + D}{\ell - D} \right) \quad (24)$$

So eventually

$$\theta(t) = \frac{\mu}{2 D v^2} \ln \left[\frac{\ell - D}{\ell + D} \frac{x + \{x^2 + (\ell + D)^2\}^{1/2}}{x + \{x^2 + (\ell - D)^2\}^{1/2}} \right] \quad (25)$$

This permits the computation of the net displacement, $\theta(+\infty)$, and the displacement $\theta(o)$ when the mass M crosses the z -axis.

$$\theta(+\infty) = -\frac{\mu}{D v^2} \ln \frac{\ell + D}{\ell - D} \approx -\frac{2\mu}{\ell^2 v^2}, \ell \gg D \quad (26)$$

where the logarithmic term has been replaced by the first two terms of its Taylor expansion. Similarly $\theta(o) = -\mu v^{-2} \ell^{-1}$; also $\theta(o) = -\mu v^{-1} (\ell^2 - D^2)^{-1}$. Figure 5 summarizes these computations. The dumbbell is at first accelerated downward attaining its maximum velocity as mass M reaches $x = 0$. As M continues moving from $x = 0$ to $x = \infty$ the dumbbell is increasing deflected until its velocity becomes, once again, zero at $x = \infty$. The θ curve in Figure 5 is actually very close to a step function in that almost the total of the net deflection is accomplished at $x \approx 0$.

Numerical Evaluation of the Rectilinear Case

The net displacement of the dumbbell, or equivalently the earth, is

$$\theta_{\max} = |\theta(\infty)| = \frac{2\mu}{\ell^2 v^2} = \frac{0.13 M'}{\ell'^2 v'^2} \quad (27)$$

where M' , v' and ℓ' are M , v and ℓ measured in units of the earth's mass, earth's velocity and the earth's radius, r_e , i.e., $M' = M/M_e$, $v' = v/v_e$, $\ell' = \ell/r_e$. Let the minimum value of v' be 1, for this would be the minimum for a member of the solar system passing near the earth; and let the minimum ℓ' be 1.3 r_e as given by the Roche limit. Hence $\theta_{\max} < 1.8 M'$.

It only remains to compute the largest mass, assumed to be spherical, that has radius $0.3 r_e$. This would constitute a grazing encounter. Let the specific density of mass M be $\rho = 6$ (the maximum planetary density is 6.03 for Mercury) and that of the earth is $\rho_e = 5$; then the maximum M' is

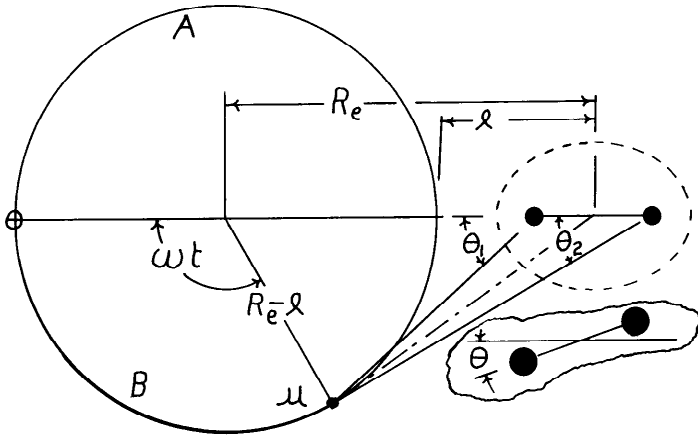


Figure 6. This shows the angles, etc., involved in calculating the torque on the dumbbell (shown also in the inset) due to the motion of a mass M ($\mu \pm GM$) with constant velocity around the circle AB. It is assumed that at time zero the mass is at the extreme left; and that then θ and its derivative are both zero.

$$M' < \frac{\frac{1}{3} \pi (0.3r_e)^3 \rho}{\frac{1}{3} \pi r_e^3 \rho_e} = \frac{.027 \rho}{\rho_e} \approx 0.03 \quad (28)$$

Hence an upper bound on θ_{MAX} might be $\theta_{MAX} < 1.8$ $(0.03) = .054$ rad. $\approx 2^\circ$. Even a two degree tilt of the earth's axis is far too small to be useful in the rationalistic catastrophism of Velikovsky, Patten, and others. Finally, this justifies the initial assumption that $|\theta| \ll 1$ which gave rise to a second order separable differential equation, linear in θ and easily integrated. A physical realization of this model would be a fly-by of an interstellar object or of a very long period comet. However, a grazing encounter with Venus ($\ell' = 1 + .96$, $M' = .81$, $v' = 1$) gives $\theta_{max} = 3^\circ.1$.

Dumbbell Rotation Due to a Mass Moving in a Circular Orbit About the Sun

In this section similar computations will be performed but for a mass, M , moving around the sun with relative angular rate, ω , with respect to the dumbbell, in an orbit of radius $R_e - \ell$ where R_e is the distance between the sun and the dumbbell. In reference to Figure 6 the couple acting on the dumbbell is

$$T = \frac{\mu M_e D}{2} \left(\frac{\sin \theta_1}{D_1^2} - \frac{\sin \theta_2}{D_2^2} \right) \quad (29)$$

where, again, it is assumed that $|\theta| \ll 1$ and where

$$\begin{aligned} D_1^2 &= a_1 + b_1 \cos \omega t & D_2^2 &= a_2 + b_2 \cos \omega t \\ a_1 &= (R_e - \ell)^2 + (R_e - D)^2 & a_2 &= (R_e - \ell)^2 + (R_e + D)^2 \\ b_1 &= 2(R_e - \ell)(R_e - D) & b_2 &= 2(R_e - \ell)(R_e + D) \\ \sin \theta_1 &= \frac{R_e - \ell}{D_1} \sin(\pi - \omega t) & \sin \theta_2 &= \frac{R_e - \ell}{D_2} \sin(\pi - \omega t) \end{aligned} \quad (30)$$

whereupon Euler's equation yields

$$M_e D^2 \ddot{\theta} = T = \frac{\mu M_e D \sin \omega t}{2} \left(\frac{1}{D_1^3} - \frac{1}{D_2^3} \right) \quad (31)$$

$$\text{or } \ddot{\theta} = \left[k \sin \omega t \right] \left[\frac{1}{(a_1 + b_1 \cos \omega t)^{3/2}} - \frac{1}{(a_2 + b_2 \cos \omega t)^{3/2}} \right] \quad (32)$$

In this $k = (1/2) \mu D^{-1} (R_e - \ell)$; and integrating with $\dot{\theta}(0) = 0$ gives

Table 1. This gives the p 's and q 's which are coefficients in the series used in Equation 38.

p_0	1.38629	436112	q_0	0.5
p_1	0.09666	344259	q_1	.12498 593597
p_2	.03590	092363	q_2	.06880 248576
p_3	.03742	563713	q_3	.03328 355346
p_4	.01451	196212	q_4	.00441 787012

$$\dot{\theta}(t) = k' + \frac{2k}{\omega} \left[\frac{1}{b_1(a_1 + b_1 \cos \omega t)^{1/2}} - \frac{1}{b_2(a_2 + b_2 \cos \omega t)^{1/2}} \right] \quad (33)$$

where

$$k' = -\frac{2k}{\omega} (\sigma_1 - \sigma_2) \quad (34)$$

$$\sigma_i = \frac{1}{b_i(a_i + b_i)^{1/2}}, \quad i = 1, 2.$$

Use $\cos \omega t = 1 - 2 \sin^2(\omega t/2)$, note that $a_i > b_i$, and set $\theta(0) = 0$; then

$$\theta(t) = k't + \frac{4k}{\omega^2} \left[\alpha_1 F\left(\frac{\omega t}{2}, \beta_1\right) - \alpha_2 F\left(\frac{\omega t}{2}, \beta_2\right) \right], \quad 0 \leq \omega t \leq \pi \quad (35)$$

where

$$\begin{aligned} \int_0^t \frac{dt}{(a + b \cos \omega t)^{1/2}} &= \frac{2}{\omega(a + b)^{1/2}} \int_0^{\omega t/2} \frac{d(\omega t/2)}{\{1 - \beta^2 \sin^2(\omega t/2)\}^{1/2}} \\ &= \frac{2}{\omega(a + b)^{1/2}} F\left(\frac{\omega t}{2}, \beta\right), \quad 0 \leq \omega t \leq \pi \end{aligned} \quad (36)$$

F is the complete elliptic integral of the first kind with parameter $\beta = (2b(a + b)^{-1})^{1/2} = 2^{1/2} b^{3/2} \alpha$. The change in θ per half revolution is obtained by setting $\omega t = \pi$,

$$\theta\left(\frac{\pi}{\omega}\right) = \frac{k'\pi}{\omega} + \frac{4k}{\omega} \left[\sigma_1 K(\beta_1) - \sigma_2 K(\beta_2) \right] \quad (37)$$

where $K(\beta)$ is approximated by¹⁴

$$K(\beta) = (p_0 + p_1 \delta + \dots + p_4 \delta^4) + (q_0 + q_1 \delta + \dots + q_4 \delta^4) \ln(\delta^{-1}) \quad (38)$$

$\delta = 1 - \beta$, and the p 's and q 's are given in Table 1.

to at least 8 places for $\theta < \beta < 1$. Hence the change in θ due to n revolutions of mass M is

$$\Delta \theta = 2n \theta\left(\frac{\pi}{\omega}\right) = -\frac{2nk}{\omega^2} \left[\pi(\sigma_1 - \sigma_2) - 2\{\sigma_1 K(\beta_1) - \sigma_2 K(\beta_2)\} \right] \quad (39)$$

This follows from the symmetry of $\dot{\theta}(t)$. For $\ell \ll R_e$, $\Delta \theta$ becomes

$$\Delta \theta \approx -\frac{3n\mu}{\omega^2 R_e^3} \left[1 - \frac{1}{12} \left(\frac{R_e}{D} \right) \ln \left(\frac{\ell - D}{\ell + D} \right) \right] \quad (40)$$

or using the first term of the Taylor expansion of the logarithmic term

$$\Delta \theta = -\frac{n\mu}{4\ell \omega^2 R_e^2} \quad (41)$$

A comparison of this result with that of the rectilinear case shows that the motion of the dumbbell is very slight, until mass M approaches the dumbbell along nearly a straight line. In fact, the second, logarithmic, term is $(1/4)n\omega^{-2}R_e^{-3}$ times the net deflection for the rectilinear case where in the latter, circular motion prescribes $v^2 = \mu R_e^{-1}$. The rectilinear component of the motion effectively contributes an impulse to the motion at every flyby past the dumbbell.

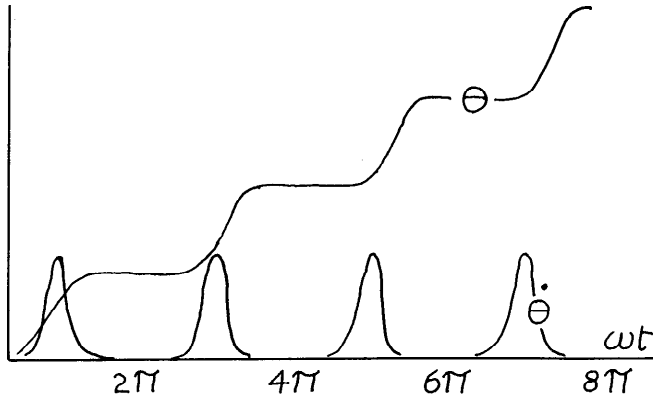


Figure 7. This shows qualitatively the rotation of the dumbbell due to the circular motion of the mass M , as discussed. Note that θ increases by steps, the magnitude of one step being about $0.017M'/\ell'^2$.

Numerical Evaluation of the Circular Case

It will be instructive to analyze the resulting motion for one complete revolution of mass, M , i.e., from $t = 0$ to $t = 2\pi/\omega$. This motion is periodic in θ as shown in Figure 7. After some manipulation it can be shown that

$$\dot{\theta}\left(\frac{\pi}{\omega}\right) \approx \frac{\mu(R_e - \ell)}{\omega \ell^2 R_e^2} \left[1 - \left(\frac{D}{\ell}\right)^2\right] \quad (42)$$

Furthermore $\dot{\theta}$ has period, $2\pi/\omega$, and maxima at $t = (2n - 1)(\pi/\omega)$, ($n = 1, 2, \dots$). The value at $t = \pi/(2\omega)$ is approximated by

$$\dot{\theta}\left(\frac{\pi}{2\omega}\right) = \frac{11\mu}{4\omega R_e^4} (R_e - \ell) \quad (43)$$

and

$$\frac{\dot{\theta}(\pi/2\omega)}{\dot{\theta}(\pi/\omega)} \approx \frac{11}{4} \left(\frac{\ell}{R_e}\right)^2 \quad (44)$$

Recall that $D = 0.033r_e$ and that if $R_e = 2.2 \times 10^4 r_e = 1 \text{ A.U.}$ and then this ratio becomes $5.5 \times 10^{-9} \ell'^2$ which for ℓ' of interest is on the order of 10^{-5} to 10^{-7} . Hence the plot for θ would seem to be a periodic sequence of sharp spikes on the $t\omega$ -axis located at $t = (2n - 1)(\pi/\omega)$ as has already been suggested by the last section.

For mass M moving at a radius of about 1 Astronomical Unit, $R_e = 1.5 \times 10^{13} \text{ cm}$, and hence the period of rotation is 1 year $= 3.1 \times 10^7$ second, therefore $\omega = 2\pi/(3.1 \times 10^7)$ and $\Delta\theta \approx 0.017 M' \ell'^{-2} n$. Once again using the limit given by Roche's limit and a grazing encounter gives

$$\Delta\theta < \frac{0.017 (0.03)n}{1.3^2} = 3.0 \times 10^{-4} n \quad (45)$$

Hence the maximum possible deflection per 100 encounters is $\theta_{\text{MAX}} = 0.03 \text{ century}^{-1} = 1^\circ.7 \text{ century}^{-1}$. This motion of the dumbbell can be pictured as a succession of impulses applied as the mass M passes by the dumbbell. The dumbbell is deflected downward, attaining a maximum angular velocity at $\omega t = \pi$. As mass M travels from $\omega t = \pi$ to $\omega t = 2\pi$, θ continues to increase symmetrically until $\dot{\theta} = 0$ at $\omega t = 2\pi$. The plot for θ is nearly a step function. A realization of this case would be an asteroid at about 1 Astronomical Unit from the sun whose orbital plane is perpendicular to the ecliptic plane.

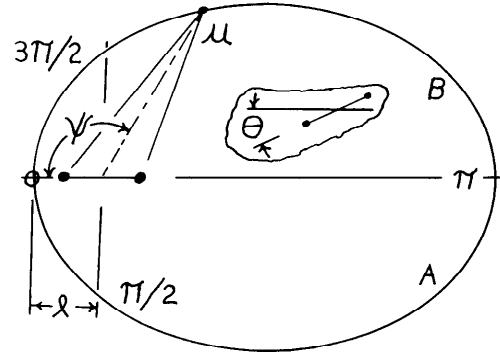


Figure 8. This concerns the torque on the dumbbell due to the motion of a mass along a Keplerian ellipse AB , the center of attraction (which is a focus of the ellipse) being the earth. The dumbbell is shown also in the inset. The angles 0 (at the extreme left), $\pi/2$, π , $3\pi/2$, etc., are the angles ψ which, along with the radial distance, serve as coordinates to specify the position. The distance $\ell = p/(1 + e)$.

Dumbbell Rotation Due to a Mass Moving in a Keplerian Orbit

For the circular case, the center of attraction for mass M was a distance from the dumbbell. In the elliptical case the center of attraction shall be the dumbbell itself. In Figure 8 the mass M moves along the Keplerian ellipse AB with its focus at the center of the dumbbell.

$$r = \frac{p}{1 + e \cos \psi} \quad (46)$$

where $p = \ell(1 + e)$ and e is the eccentricity. Approximating the moment arm of the couple by $D \sin \psi$ and dropping the D^4 terms gives

$$\ddot{\theta} = \frac{\mu \sin \psi}{2D} \left(\frac{1}{D_1^2} - \frac{1}{D_2^2} \right) \approx - \frac{\mu \sin 2\psi}{r^3 \{1 - 2\left(\frac{D}{r}\right)^2 \cos 2\psi\}} \quad (47)$$

$$\approx - \frac{\mu \sin 2\psi}{r^3} \left[1 + 2\left(\frac{D}{r}\right)^2 \cos 2\psi \right]$$

Let $\theta = \theta(\psi)$ and adopt $\theta(0) = \dot{\theta}(0) = 0$. Using the Keplerian identity, where h is the constant angular momentum, $\psi = hr^{-2}$, and $dt = h^{-1} r^2 d\psi$, gives

$$d\dot{\theta} = - \frac{\mu \sin 2\psi}{hr} \left[1 + 2\left(\frac{D}{r}\right)^2 \cos 2\psi \right] \quad (48)$$

This expression can be expanded into powers of $\cos \psi$ and integrated to give

$$\dot{\theta} = K \left[J_1 + 2\left(\frac{D}{p}\right)^2 J_2 \right] \Big|_0^\psi \quad (49)$$

where

$$K = \frac{2\mu}{hp}, \quad h^2 = G(M + M_e)a(1 - e^2), \quad a = \frac{2p}{1 - e^2}$$

$$J_1(\psi) = - \cos^2 \psi \left[\frac{1}{2} + \frac{e}{3} \cos \psi \right] \quad (50)$$

$$J_2(\psi) = \cos^2 \psi \left[-\frac{1}{2} - e \cos \psi + \frac{1}{4} (2 - 3e^2) \cos^2 \psi + \frac{1}{5} (6e - e^3) \cos^3 \psi + e^2 \cos^4 \psi + \frac{2}{7} e^3 \cos^5 \psi \right]$$

Again, eliminating dt , and integrating gives

$$\theta = K' \left[J_1' + \left(\frac{D}{p} \right)^2 J_2' \right] \psi \quad (51)$$

where

$$\begin{aligned} K' &= \frac{Kp^2}{h} = \dots = \frac{2M'}{1+M'} \\ J_1' &= \frac{\psi}{D} \frac{J_1 - J_1(0)}{(1 + e \cos \psi)^2} \\ J_2' &= \frac{\psi}{D} \frac{J_2 - J_2(0)}{(1 + e \cos \psi)^2} \end{aligned} \quad (52)$$

The expressions for J_1' and J_2' have been integrated by expanding the denominator term by the binomial expansion out to e^3 terms. This results in the following expression for the net angular displacement of the dumbbell,

$$\begin{aligned} \Delta\theta &= 2n [\theta(\pi) - \theta(0)] \\ &= -\frac{2\pi n M'}{1+M'} \left[1 + \frac{2}{3}e - \frac{3}{2}e^2 + \frac{1}{4} \left(\frac{D}{e} \right)^2 \frac{1}{(1+e)^2} \right] \end{aligned} \quad (53)$$

Figure 9 shows a qualitative plot of this motion. Note that $\Delta\theta$ increases with increasing e but is quite insensitive to D/ℓ .

Numerical Evaluation of the Keplerian Case

Since the dependency on e and D/ℓ is slight,

$$\Delta\theta \approx -\frac{\pi M' n}{1+M'} \quad (54)$$

which for small M' yields a small $\Delta\theta$ as was assumed at the outset. However, for large M' the result seems qualitatively correct even though a large $\Delta\theta$ is produced in violation to the initial assumption that permitted explicit solution. This may be summarized as,

$$\begin{aligned} \Delta\theta &\approx -2\pi M' n, M' < 1 \\ \Delta\theta &\approx -\pi n, M' \sim \frac{1}{2} \\ \Delta\theta &\approx -2\pi n, M' > 1 \end{aligned} \quad (55)$$

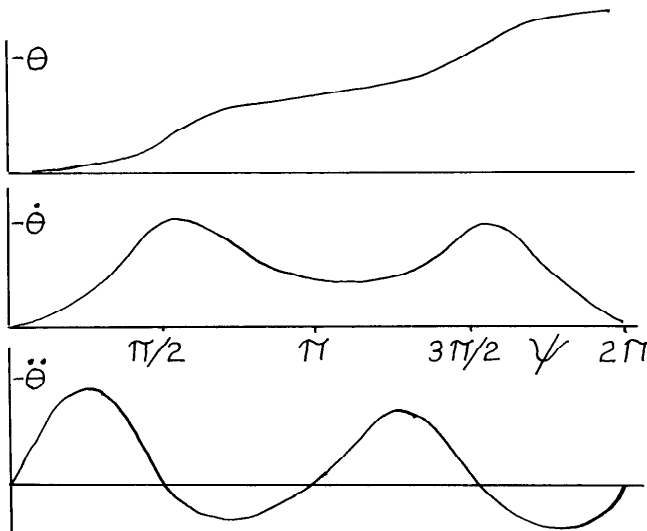


Figure 9. This shows qualitatively the rotation of the dumbbell due to the Keplerian motion around it. The total change of θ shown is of magnitude about $\pi M'/(1 + (2e/3))$.

For example, if the largest asteroid, Ceres, with a mass of $M' \approx 10^{-4}$ were to be captured in orbit perpendicular to the earth's equator then $|\Delta\theta| \approx 0.036 \text{ rev}^{-1}$. However, for a captured mass the size of Venus ($M' = 0.81$) it would seem that very large rotations are possible. For such an event to happen Venus would have to be captured for a sizeable part of one revolution and in an orbit nearly perpendicular to its present orbit. As has been previously discussed that Venus or Mars could have been captured and then released by the Earth has not been demonstrated. Furthermore, it must be realized that in all cases a zero angular displacement results for motion in the earth's equatorial plane and that, as it will be shown, a very small nutation angle would occur if the earth's spin is considered.

The result that $\Delta\theta$ essentially only depends on the mass M at first seems paradoxical in that $\Delta\theta$ depends only slightly on ℓ and that the limit of $\Delta\theta$ as ℓ becomes large is non-zero. This apparent difficulty is reconciled when one considers the time needed for one revolution of the captured mass M . The period of M in a Keplerian orbit is

$$P = \frac{2\pi}{\{G(M+M_e)\}^{1/2}} \left\{ \frac{\ell}{(1-e)} \right\}^{3/2} \quad (56)$$

and the average angular motion of the dumbbell is

$$\dot{\theta}_{ave} = \frac{\theta(2\pi)}{P} = -\frac{2.2 \times 10^6 M'}{(1+M')^{1/2}} \left(\frac{1-e}{\ell'} \right)^{3/2} \quad (57)$$

Hence only if mass M comes close to the earth could it then exhibit the short-term effects that the catastrophic rationalist requires. For comparison, a body in circular orbit around the earth at one solar distance gives $\dot{\theta}_{AVE} = 0.62 M'(1+M')^{-1/2} \text{ deg-yr}^{-1}$.

Verification by Numerical Integration

In order to check or verify the accuracy of the formulas derived, the exact equations of motion have been numerically integrated. For example consider the exact differential equation for the Keplerian circular case where $\psi = \omega t$ and hence

$$\begin{aligned} \frac{d^2 \theta}{d\psi^2} &= \frac{r^4 M \sin(\psi - \theta)}{2D(M+M_e)} \left[\frac{1}{\{r^2 + D^2 - 2rD\cos(\psi - \theta)\}^{3/2}} \right. \\ &\quad \left. - \frac{1}{\{r^2 + D^2 + 2rD\cos(\psi - \theta)\}^{3/2}} \right] \end{aligned} \quad (58)$$

Table 2. This shows the results of numerical integration of the exact equation of motion for a circular Keplerian orbit about the dumbbell, the initial conditions being that θ and its derivative are zero at the beginning. The entries M' and r' are the mass and radius in units of the earth's mass and radius. The right-hand column gives the derived theoretical result: $\theta(2\pi) = 2\pi M'/(1+M')$.

M'	$r' 2$	5	20	200	Theor.
10	6.308	6.306	6.306	6.306	6.283
1	6.637	6.638	6.638	6.638	3.142
0.1	0.5022	0.5021	0.5021	0.5021	0.5712
.01	.04709	.04708	.04708	.04708	.06221
.001	.004680	.004679	.004678	.004678	.006277

using Kepler's period Law, $\omega = r^{3/2}[G(M + M_e)]^{1/2}$ and initial conditions of $\theta(0) = \theta'(0) = 0$.

Table 2 shows the results of a Runge-Kutta integration for various M' and $r' = r/R_e$ compared with the derived theoretical result. It is readily seen that the theoretical approximation is of sufficient accuracy for the purpose of this paper. The very slight dependence on orbit size is verified. The Keplerian case has been displayed since the approximations used were seemingly most crude in that instance. The major source of error is the replacement of the angular argument $\psi - \theta$ by ψ in the general expression introduced earlier.

The Orientation of a Rotating Ellipsoid Due to Arbitrary Rectilinear Motion

In this section the rotational motion of a rotating ellipsoid due to an arbitrary uniform rectilinear motion of mass M will be approximated in order to correct or compare, at least in the uniform rectilinear case, the formula derived herein for the planar motion of an equivalent dumbbell.

In Figure 10 let the earth occupy the origin with its axis of symmetry along the Z -axis and let mass M move uniformly with velocity v along a straight line perpendicular to the X -axis and crossing it at a distance ℓ from the origin at time $t = 0$. The displacement vector $\mathbf{R} = (X, Y, Z)$ for M is

$$\mathbf{R} = \mathbf{a} + \mathbf{vt} = (\ell, 0, 0) + vt(0, \cos\phi, \sin\phi) \quad (59)$$

where ϕ is the angle between the path of M and the (X, Y) -plane. In the equivalent dumbbell analysis, for the case of an ellipsoid of revolution, $I_1 = I_2$, and the torque becomes

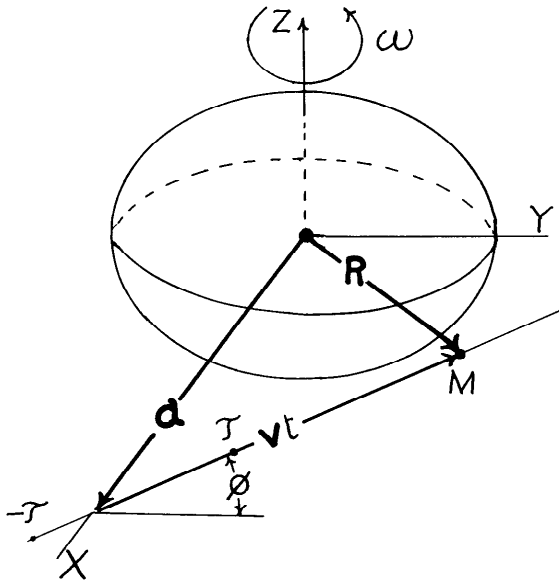


Figure 10. This shows the spinning ellipsoidal planet, and the things involved in calculating its nutation (due to the spin it is a case of nutation, not just rotation), due to the arbitrary uniform rectilinear motion of the mass M . $-\tau$ and τ show where it is at those times; at time zero it is in the equatorial plane, where the head of the vector $\mathbf{a}$ meets the tail of the vector $\mathbf{vt}$.

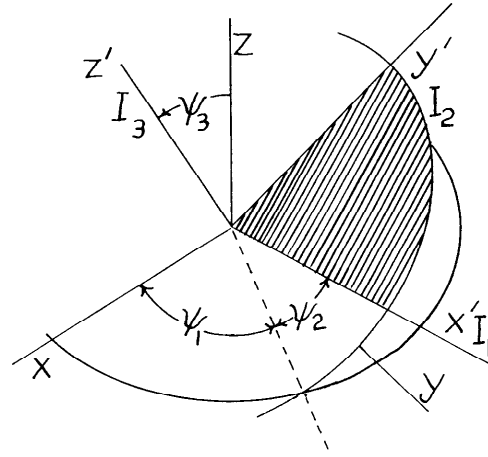


Figure 11. The Euler angles: ψ_1 (precession), ψ_2 (spin), and ψ_3 (nutation), relate the rotating primed system of coordinate axes fixed to the earth to the stationary unprimed ones fixed in space.

$$\begin{aligned} \mathbf{T} &= -\frac{3\mu}{R^5} (I_1 - I_3) (YZ, -XZ, 0) \\ &= \frac{K}{(k^2 + t^2)^{5/2}} (t^2 \cos\phi, -kt, 0) \end{aligned} \quad (60)$$

where the second expression is obtained by combining $\mathbf{R}$ and where $K = -3\mu(I_1 - I_3)v^{-3}\sin\phi$, and $k = \ell/v$. Recall that $\epsilon = (I_1 - I_3)/I_1$ is the mechanical ellipticity and define Ω to be the planetary spin rate. In reference to Figure 11 let ψ_1 , ψ_2 , and ψ_3 be the three Euler angles relating the rotated prime system to the stationary unprimed system. In the special case of an axial symmetric body (i.e., $I_1 = I_2$) there is no loss of generality if the x' -axis is fixed in the (x, y) -plane, i.e., in this case this direction remains a principle axis if ψ_2 is the spin angle measure about the z' -axis. The angle ψ_1 is the precession angle, ψ_2 the spin angle, and $\psi_3 (= \theta)$ the nutation angle. It is the nutation angle that is required due to the torque supplied by mass M in Figure 10. Let N_1 , N_2 and N_3 be the supplied torque resolved about the x' , y' , and z' axes and ω_1 , ω_2 , and ω_3 the respective instantaneous angular velocities about these axes. Then in this special case Euler's equations along with the equations for the Euler angles provide a complete set of equations for the motion,¹⁵

$$\begin{aligned} N_1 &= I_1 \dot{\omega}_1 + (I_3 - I_1) \omega_2 \omega_3 + I_1 \omega_2 \dot{\psi}_2 \\ N_2 &= I_1 \dot{\omega}_2 + (I_1 - I_3) \omega_1 \omega_3 + I_1 \omega_1 \dot{\psi}_2 \\ N_3 &= I_2 \dot{\omega}_3, \quad \omega_1 = \dot{\psi}_3, \quad \omega_2 = \dot{\psi}_1 \sin\psi_3, \quad \omega_3 = \dot{\psi}_2 + \dot{\psi}_3 \cos\psi_3 \end{aligned} \quad (61)$$

where the equations for the Euler angles follow immediately from the spherical trigonometry of Figure 11. Let $\mathbf{S}$ be the rotation matrix that transforms a point (or vector) in the unprimed system to a point (or vector) in the primed system. This is found in any standard text on mechanics to be

$$\mathbf{S} = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix} \quad (62)$$

$$\begin{aligned}
S_{11} &= \cos\psi_2 \cos\psi_3 - \cos\psi_3 \sin\psi_1 \cos\psi_2 \\
S_{22} &= -\sin\psi_2 \sin\psi_1 + \cos\psi_3 \cos\psi_1 \cos\psi_2 \\
S_{12} &= \cos\psi_2 \sin\psi_1 + \cos\psi_3 \cos\psi_1 \sin\psi_2 \\
S_{21} &= -\sin\psi_2 \cos\psi_1 - \cos\psi_3 \sin\psi_1 \cos\psi_2 \\
S_{13} &= S_{31} = \sin\psi_2 \sin\psi_3, S_{23} = -S_{32} = \cos\psi_2 \sin\psi_3, S_{33} = \cos\psi_3
\end{aligned} \quad (62)$$

Hence

$$\begin{bmatrix} N_1 \\ N_2 \\ N_3 \end{bmatrix} = S \begin{bmatrix} T_1 \\ T_2 \\ T_3 \end{bmatrix} = S \begin{bmatrix} kt^2 \cos\phi / (k^2 + t^2)^{5/2} \\ -Kkt / (k^2 + t^2)^{5/2} \\ 0 \end{bmatrix} \quad (63)$$

Note that $N_3 = 0$ and hence ω_3 is constant. Further, from the previous analysis, $|\psi_1| \ll 1$. Therefore by the equation for ω_3 let $\dot{\psi}_2 = \omega_3 = \Omega$, and $\psi_2 = \Omega t$. Again from the previous analysis $|\psi_1| \ll 1$ and $|\psi_3| \ll 1$ and if t is taken such that $k^2 \gg t^2$ then the torques in the moving primed system may be approximated by

$$\begin{aligned}
\begin{bmatrix} N_1 \\ N_2 \\ N_3 \end{bmatrix} &\approx \begin{bmatrix} \cos\Omega t & \sin\Omega t & 0 \\ -\sin\Omega t & \cos\Omega t & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \end{bmatrix} \\
&\approx \frac{K}{k^5} \begin{bmatrix} t^2 \cos\phi \cos\Omega t - k t \sin\Omega t \\ -t^2 \cos\phi \sin\Omega t - k t \cos\Omega t \\ 0 \end{bmatrix} \quad (64)
\end{aligned}$$

Now on combining the equations of motion and assuming ω_2 and ω_3 to be small gives

$$\begin{aligned}
N_1 &\approx (I_3 - I_1) \dot{\psi}_1 \sin\psi_3 (\Omega + \dot{\psi}_1 \cos\psi_3) + I_1 \Omega \dot{\psi}_1 \sin\psi_3 \\
N_2 &\approx (I_1 - I_3) \dot{\psi}_3 (\Omega + \dot{\psi}_1 \cos\psi_3) - I_1 \Omega \dot{\psi}_3
\end{aligned} \quad (65)$$

which when solved for the precession and nutation rates yield

$$\begin{aligned}
\dot{\psi}_1 &= \frac{N_1}{I_1 \Omega \sin\psi_3} \\
\dot{\psi}_3 &= \frac{N_2}{I_1 (\dot{\psi}_1 \cos\psi_3 - \Omega)} \quad (66)
\end{aligned}$$

for small ϵ and $\dot{\psi}_1$. These equations are hopelessly nonlinear and may not easily be solved for ψ_1 and ψ_3 . However the maximum value of ψ_3 may be approximated. Substituting the expressions for N_1 , N_2 and $\dot{\psi}_1$ into the identity for $\dot{\psi}_3$ gives

$$\dot{\psi}_3 = - \frac{\Omega K \sin\psi_3 (t^2 \cos\phi \sin\Omega t + k t \cos\Omega t)}{K t^2 \cos\phi \cos\psi_3 \cos\Omega t - K k t \cos\psi_3 \sin\Omega t - I_1 k^5 \Omega^2 \sin\psi_3} \quad (67)$$

Note if ψ_3 is assumed very nearly constant on the right hand side then the numerator is an odd function of t while the denominator is even. Thus the whole right hand side is odd and

$$\theta(\tau) \equiv \int_{-\tau}^{\tau} \dot{\psi}_3(t) dt = 0 \quad (68)$$

That is, the net angular displacement of a spinning ellipsoidal planet for symmetric time intervals of mass M above and below the equatorial plane is very nearly zero. The maximum displacement occurs very nearly at the time $t = 0$ when the mass M crosses the equatorial plane. Hence define

$$\psi_{3max} = \theta(0) = \int_{-\tau}^0 \dot{\psi}_3(t) dt \quad (69)$$

which after some manipulation and removing small terms becomes, for $|\Omega t| \gg 1$

$$\psi_{3max} = - \frac{K \tau \sin\Omega \tau}{I_1 \Omega^2 k^4} \quad (70)$$

or on combining constants

$$\begin{aligned}
|\psi_{3max}| &> \frac{3Mg\epsilon \tau \sin\phi}{\Omega^2 \ell^3 k} \quad (\text{rad.}) \\
&\approx \frac{1.6 \times 10^2 M' \tau \sin\phi}{\ell^3 k} \quad (\text{degree}) \quad (71)
\end{aligned}$$

Note the following values: $\tau/k = .1$, $M' = 1$, $\ell = 2$ gives $|\psi_{3max}| < 2^\circ \sin\phi$ which would surely yield an absolute bound, while $\tau/k = .1$, $M' = .01$, $\ell = 10$ giving $|\psi_{3max}| < 0^\circ.00016 \sin\phi$ seems a more sensible value. The dependence on the reciprocal cube of ℓ insures that only a very small nutation angle could occur. This analysis assumed that the spin velocity, Ω , was not small, hence in the expression for ψ_3 , Ω cannot be set to zero in order to permit a comparison with the planar dumbbell case. Therefore a correction for planetary spin cannot be specifically established. However, the factor $\sin\phi$ corrects for the oblique motion of mass M . Similarly an approximation for the precession is

$$\psi_1(\tau) \equiv \int_{-\tau}^{\tau} \dot{\psi}_1(t) dt = - \frac{6Mg\epsilon \tau \sin\phi}{k \Omega^2 \ell^3 \sin\psi_3} \left[\frac{\tau}{k} (\cos\phi \sin\Omega t + \cos\Omega t) \right] \quad (72)$$

The important result in this section is that the effect of planetary spin and the oblique path of mass M is to produce a net planetary deflection of very nearly zero even though a sensible, though small, intermediate maximum nutation does occur. These formula require $k^2 \gg \tau^2 \gg \Omega^{-2}$.

Consequences in Astronomical Dating

It is unfortunate that many Christian chronologists and historians feel compelled to gauge biblical chronology by secular events especially when they are, or seem to be, associated with astronomical events, such as an eclipse of the sun. Many arguments might be brought to bear against, giving too much weight to, astronomical dating,^{16, 17} such as the problem of the adopted calendar, the local time reckoning and the distance from the observed astronomical event from the biblical event. I only wish to address the alleged numerical precision for computing the place, date, and time of day of an ancient eclipse.

Though the computations fail to support a gravitational explanation for some of the Velokovskian conjectures, they do suggest perturbations, though small, in the earth's attitude that are large in the theory of eclipses, and in fact, sufficiently large to render such astronomical dating very suspect if not useless. This follows from the accumulated effect of the asteroids, and would be due to past variations in the near earth asteroidal flux, since the current flux (whatever may be its value) is benignly empirically included in the present eclipse theory.

Since the asteroids nearly all follow the same directional sense in the solar system, their effect on the orientation of the earth's spin axis should tend to accumulate and not cancel as would be the case if their disposition with respect to the earth were random at closest ap-

proach. In fact, of the several thousand recorded asteroids: there are several that have come very close to the earth, even near the lunar distance. Thus, such occurrences might produce changes in the precession and nutation of the earth at various times and to accumulate to such an extent as to make extrapolation backward by 2000 years or more quite uncertain. R. R. Newton's work¹⁸ in attempting to reconcile ancient chronicles and the present observed earth motion seems, at least, to permit this possibility.

From the analysis of the Keplerian capture case it might be conjectured that the nutational deflection due to a passing asteroid is $2\pi M'\lambda_n$ radians where M' is the asteroidal mass in earth mass units and $|\lambda_n|$ is a number less than one that corrects the asteroid passing obliquely to the equatorial plane, the fraction or extent to which the asteroid is captured and any other departures from the planar dumbbell approximation. It is important to recall that for the capture case, the deflection is independent of the distance to M and therefore any asteroid that is well perturbed by the earth may be said to be partially captured and thereby to produce a deflection. The precessional deflection may be argued to be $2\pi M'\lambda_n$ but where $|\lambda_n|$ need not be small, for as was seen in the expression for precession for the uniform rectilinear motion case, a nutation of ψ_3 near zero yields a large precession. The case for $\psi_3 = 0$ gives an infinite precession, but this is merely the case of pure spin.

The net effect of asteroidal partial capture encounters might be taken as

$$\sigma_n \sim \sum_i \left[\frac{0.017M'_i n_i \lambda_i}{\ell_i^2} + 2\pi M_i n_i (1 - \lambda_i) \right] \quad (73)$$

$$= 2\pi \sum_i M'_i \left[1 + \lambda_i \left(\frac{0.003}{\ell_i^2} - 1 \right) \right]$$

where the summation is over such encounters and where the first term inside the summation is the nutational deflection derived for the circular case and the second is that for the Keplerian capture case. The factors λ_i and $1 - \lambda_i$ specify the weight given to each mode of deflection as the asteroid approaches and passes the earth. The factor λ_i also may correct for the effect of the obliquity of the asteroid path with respect to the earth's equatorial plane. Taking $M'_i \approx 10^{-5}$ to be the average asteroidal mass,¹⁹ assuming the ℓ_i term to be negligible, and setting $\lambda_i = 0.99$ (i.e., during only 1% of its orbit is the asteroid captured) gives $\sigma_n \sim 6 \times 10^{-7} \sum_i n_i$. Now assume, that there has been only one such asteroid in a 1000 year period and that it is influenced by the earth, say, yearly, then $\sigma_n \sim 6 \times 10^{-4}$ rad-millennium⁻¹ = 0.°03 millenium⁻¹. The accumulated effect in precession, σ_p , would be several times this, due to the $\sin\psi_3$ in the denominator. Recall that it was argued above that nearly all the λ_i should have the same sign due to the general counterclockwise motion of the solar system. These very heuristic results translate into an error of about 10 miles in latitude and greater in longitude for an eclipse between the times of Abraham and David. Ten such asteroids would yield a very significant error (100 miles) but then, perhaps $\lambda_i \sim .999$ or larger. However, only one asteroid with a small λ_i would yield a large geographical error. Note that for a cometary

impact ℓ_i may be less than one thus causing the ℓ_i term to dominate.

Hence the effect due to deflections in the nutational and precessional Euler angles *might* be large. However, the effect on the remaining Euler angle (i.e., the spin angle, ψ_2), is even more pertinent. Recall that one of the equations of motion for the earth's disposition is $\omega_3 = \dot{\psi}_2 + \dot{\psi}_1 \cos\psi_3$, and that ω_3 is constant since $I_3\dot{\omega}_3 = N_3 = 0$. Hence approximating ω_3 by Ω , since $\dot{\psi}_1$ is small, and integrating gives

$$\dot{\psi}_2(\tau) \equiv 2\tau \left[\Omega + \Delta\psi(\tau) \right] = \int_{-\tau}^{\tau} \dot{\psi}(t) dt$$

$$= 2\Omega\tau + \frac{6\epsilon M G \tau \sin\phi \cot\psi_3}{\Omega^2 \ell^3} \left[\frac{\tau}{k} \cos\phi \sin\Omega t + \cos\Omega t \right] \quad (74)$$

$$2\tau\Delta\psi \approx \frac{5 \cdot 1 M' \tau \sin\phi \cot\psi_3}{k \ell^3} \left[\frac{\tau}{k} \cos\phi \sin\Omega t + \cos\Omega t \right]$$

From which the millennial effect on spin, for $\tau/k \sim .5$, can be roughly gauged to be $\sigma_s \sim 1 \times 10^{-4} \sin\phi \cot\psi_3$ deg-millennium⁻¹, which translates into only a fraction of a mile on the earth's surface for the geographical displacement of an ancient eclipse. This only serves to verify the relative imperturbability of the planetary spin rate. Even several large asteroids, $M' \sim .001$ coming very close, $\ell' \sim 10$ would only yield $\sigma_s \sim 0.°001$. It might be conjectured that partial capturing could increase this figure by a factor of 10.

The author showed in reference (20) that significant changes in the earth's spin rate would accompany global tectonic activity. It was shown that these changes might be of the order of $|\Delta\Omega/\Omega| \approx 10^{-4}$. Research on the effect of earthquakes in recent times²¹ suggests changes of about 10^{-8} . If such a change were persistent over a 1000 year period this would translate into an error of only about 15 miles for the location of an ancient eclipse at low latitudes. However, a change of 10^{-5} over a 100 year period would account for an error of about 1500 miles. This last figure would discredit astronomical dating, and furthermore seems quite possible in the light of biblical catastrophes such as the possible continental splitting in Peleg's time²² and the enormous global tectonic events surely persisting for decades after the Flood year.²³

Another potentially large effect on the spin angle, as well as on the nutation and precession angles, might be the past very strong geomagnetic field²⁴ and its interaction with the solar field in accordance with Maxwell's equations. Thus, surely, a vastly greater persistent torque was applied to the earth's geomagnet than at present.

In summary it is conjectured that the near earth asteroid flux might well have, in past times, produced significant errors in computing the location of an ancient eclipse and, in fact, one large asteroid becoming sufficiently partially captured by the earth would yield the same or larger effect. This effect would be manifested in nutation and precession but not spin. However earth tectonics and the past strong geomagnetic field might well have caused changes in spin that would produce very large errors in the computation of positions and time of ancient eclipses.

A final note on the capturability and frequency of near earth asteroids is in order. The asteroid Toro is an

example of an asteroid which is in resonance with the earth being in permanent partial capture by the earth and possibly, with Mars or Venus.²⁵ Hermes came within 800,000 km of the earth and several recognizable craters on the earth may well be due to impacts of large bodies.²⁶ The frequency of near earth asteroids might be adduced to have been in the thousands if not larger.²⁷ There seems to be a total of several hundred thousand asteroids of over 1 km in radius.²⁷ That very few very near asteroids have been observed attests to the extreme difficulty of discovering such objects. Their observation requires a number of fortuitous conditions, which severely limits their discovery.

Note on Geocentricity

In the preceding sections, computations have been performed based on the Newtonian model in order to estimate possible or conjectured motions in the earth's orientation from which it appears that the earth's orientation could be susceptible to significant motions, though of insignificant magnitude to please the Velikovskians. Though I have used the language of Copernican cosmology, the simple literal narrative of the Bible leads me to another cosmology, i.e., geocentricity. Specifically, I hold that these motions are not of the earth but, might be said, to have this appearance due to apparent optical motions or physical motions of the torquing body and cosmos at large. This may sound absurd, however, if one investigates the long neglected, ether-fluid cosmologies of LeSage or Helmholtz, for example, he would find constitutive physical explanations compatible with geocentricity. Even the metaphysical Einsteinian relativity permits for geocentricity (curiously, Hoyle acknowledges this).²⁸ J.D. Cassini (1625-1712), though Astronomer Royal of France, and well acquainted with the enormous success of Newton's (1642-1727) mechanics, nevertheless espoused geocentricity in an era dominated by the free-thinking of Voltaire.²⁹ Cosmologies, which happen to be favorable to geocentricity, have been neglected or suppressed, it seems to me, on evolutionary bases. For example, it was argued that the fluid (ultramundane corpuscles) of LeSage's theory would greatly heat up or, by pressure, break down the earth during geological ages. However if the requirement of geological ages is removal but instead a time span of about 6000 years invoked, then one need not on these grounds reject LeSage's theories and their kindred. The language Newton uses in his *Principia* in regard to the supposed inertial forces, the Coriolis and centripetal forces, is surprisingly like that used by Thirring in describing his geocentric gravitational model.^{30, 31} For a discussion of LeSage, Helmholtz, et. al. see Maxwell³² and his references.

As mentioned, large tectonically induced effects on the earth's spin should accompany secular, and, especially, Biblically cited catastrophes. However, the Bible seems to speak of the diurnal motion of the heavens and the yearly solar motion as being essentially constant, e.g., "the covenant of the day" and "covenant of the night" (Jer. 33:20) and the continuance of the calendar and seasons (Gen. 8:22). This may be reconciled by geocentricity for if the earth does not spin by vir-

tue of God's design it cannot be induced to do so. Hence, the very near constancy of length of the gravitational-geometrical and/or apparent-optical perturbations of the sun's motion. However, as argued above, these perturbations are, nevertheless, large in the theory of eclipse computation.

Joshua's Long Day and Geocentricity

A comment on Joshua's long day (Josh. 10:12-14) is pertinent here, for it has been these verses, possibly, more than any other that have been used to defend geocentricity from the authority of Scripture. Martin Luther's views against Copernicanism are typical, "... , for Joshua commanded the sun to stand still not the earth, Joshua 10:12".³³ The Scriptures taken literally requires that the sun's and moon's bearings remained constant with respect to the local physical horizon. If this event is to be reconciled with a deflection of the earth's instantaneous axis of rotation due to a planetary encounter, as Velikovsky postulates (and, unfortunately, as many Christians seem to favor) then it must be asked: if, indeed, there exists such a continuous movement of an earth fixed set of coordinates such that the directions of both the sun and moon are constant in the moving earth fixed system? In Figure 12 let the unprimed coordinate system be fixed and the primed system fixed in the earth and hence rotating with the earth. The origin may be placed at the center of the earth with no loss of generality. The vectors $\mathbf{v}'_s$ and $\mathbf{v}'_m$ denote the directions of the sun and moon as viewed from the rotating system and $\mathbf{v}_s$ and $\mathbf{v}_m$ are the same directions but viewed from the fixed system. The Euler angles relate to two systems as in the previous section. Hence the matrix $\mathbf{S}$ specifies this relation: $\mathbf{v}'_s = \mathbf{S}\mathbf{v}_s$, $\mathbf{v}'_m = \mathbf{S}\mathbf{v}_m$, $\mathbf{v}_m \neq \mathbf{v}_s$. But $\mathbf{v}_m$ and $\mathbf{v}_s$ are, likewise, constant in the fixed system, hence differentiating gives: $\dot{\mathbf{v}}_s = \dot{\mathbf{S}}\mathbf{v}_s + \mathbf{S}\dot{\mathbf{v}}_s = \dot{\mathbf{S}}\mathbf{v}_s = 0$; and similarly $\dot{\mathbf{S}}\mathbf{v}_m = 0$. Now this identity is also true for any vector, $\mathbf{v}$ which is a linear combination of $\mathbf{v}_s$ and $\mathbf{v}_m$ (i.e., in the plane of $\mathbf{v}_s$ and $\mathbf{v}_m$), so $0 = \dot{\mathbf{S}}\mathbf{v}_s + \dot{\mathbf{S}}\mathbf{v}_m = c_1\dot{\mathbf{S}}\mathbf{v}_s + c_2\dot{\mathbf{S}}\mathbf{v}_m = \dot{\mathbf{S}}(c_1\mathbf{v}_s + c_2\mathbf{v}_m) = \dot{\mathbf{S}}\mathbf{v}$. Therefore in order for this equality to hold for such an arbitrary $\mathbf{v}$ it is required that $\mathbf{S}$ be the zero matrix, i.e., $\mathbf{S}$ is a constant matrix. But this is the only solution and can be interpreted by having a rotating earth come to an immediate

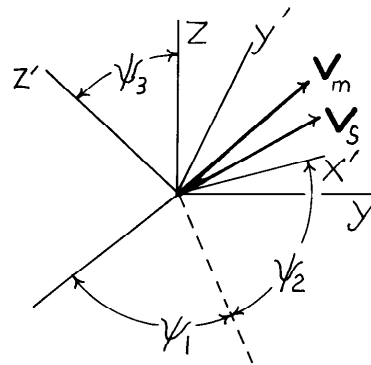


Figure 12. These are the various lines and directions involved in discussion the celestial circumstances of Joshua's long day. The vector $\mathbf{v}_m$ points to the moon, $\mathbf{v}_s$ to the sun. Only if these vectors coincided, i.e., if the sun and moon appeared together, could any possible rotation of the earth make both the sun and moon appear to stand still.

stop or that the earth was not rotating in the first place. The case $v_m = v_s$ is the one exception, for the two vectors do not form a plane and hence v may be selected such that $Sv = 0$ where S is not the zero matrix. The realization of such an event would have the earth's spin axis instantaneously shift toward the sun-moon direction so that they would be at the Beth-horon zenith, i.e., the earth's angular motion would be pure spin through an axis piercing the earth at Beth-horon. However, this case is of no interest for it is the circumstance of a total eclipse, and a total eclipse of the sun which lasted for a day would hardly help Joshua. Totten's 1890 work³⁴ on Joshua's long day and Hezekiah's 10 degrees (Isa. 38:1-22, 2 Kg. 20:12-11, 2 Ch. 24-26) assumes that Joshua's long day was a conjunction (but not an eclipse). In this case v_m and v_s would be only, at most 6.5 degrees apart. Totten also assumes ultimate precision in the theory of astronomical dating. Totten puts forth a fine devotional Bible honoring argument that deserves to be read by anyone theorizing on Joshua 10. Most importantly Totten pointedly does not speculate on the physics of the long day as he feels this is beyond the province of man, but takes the Bible (the KJV) as his inerrant authority. Unfortunately, the present available edition of Totten's work has been appended by H. B. Rand who uncritically adds a cometary flyby rationalization to Totten's God fearing study despite the fact (apparently, unbeknown to Rand) that (as has been shown herein) such an explanation is contrary to both the gravitational dynamics and to the kinematics of his proposed solution.

The problems attendant with an abrupt stop of the massive earth are similar to the problems associated with the Day-Age theory whereby one must greatly interpolate the Bible with a great number of physical occurrences which are not in the slightest to be found in the text of Scripture itself. This analysis and the simple words of Joshua 10:12-14 are easily compatible with a stationary earth about which the sun and moon travel and which the Lord permitted Joshua to stop by his command.

I regard these verses and hundreds of others, not only, to suggest geocentricity but to require it. In this regard it is revealing to note the phenomenalist and rationalist bent of *all* the modern translation as compared to the KJV. For example Ps. 104:5 in the KJV reads

Who laid the foundations of the earth, that it should not be removed for ever (KJV)
but the RSV skirts the issue by replacing "removed" by "shaken,"

Thou didst set the earth on its foundations, so that it should never be shaken (RSV)

Not only did the RSV translators pervert the meaning but, in addition, gave us an absurdity that is in contradiction with the great tectonic activity promised during the Tribulation when, indeed, the earth will be greatly shaken (Rev. 16:18).

Conclusion

The earth as an ellipsoid of revolution may be replaced by a dumbbell for the purposes of computing angular displacements due to gravitational torques arising from a mass, M , constrained to a plane containing

the ellipsoidal axis of symmetry. Using this dumbbell model, angular deflections for three pertinent cases were examined. These cases are: (1) the rectilinear case shown in Figure 4 representing a flyby of an interstellar object for which a maximum 2 degrees deflection results, (2) the circular case shown in Figure 6 representing a periodic asteroidal or cometary encounter for which a 1.7 degree/century deflection is maximal, and (3) the Keplerian case shown in Figure 8 representing a mass capture which produces a deflection of $360 M'/(1 + M')$ degrees/revolution of the captured body.

Only for the capture of a large mass can large deflections occur. It remains for catastrophic rationalists to show that such a temporary capture *could* happen and further that it, indeed, *did* happen. For small captured masses on the order of the asteroids in this case, also, produces discountable deflections. The respective approximate formulas for θ_{max} for the three cases are $0.13M'v'^{-2}\ell'^{-1}$, $0.017M'\ell'^{-2}n$ and $2\pi M'/(1 + M')n$ in radian measure where M' , v' and ℓ' are the mass of the M in earth mass units, v' is the velocity of M measured in units of the Keplerian circular velocity at one astronomical unit from the sun, ℓ' is the nearest approach of M measured in earth radii, and n is the number of revolutions of M . The accuracy of these derived formulas is verified by the accurate numerical integration of the exact differential equations of motion.

In addition, the effect of oblique motion on a spinning planet is shown to decrease these computed values, e.g., the maximum (intermediate) value of the nutational angle is reduced by at least the factor of the sine of the angle the path of M makes with the planet's equatorial plane. Thus even in the case of the captured body the effect of spin and the angle of inclination greatly reduce the derived deflection in that the net deflection is very nearly zero while the intermediate maximum deflection is thus reduced. Hence this analysis is seen to discredit Velokovskianism and catastrophic rationalism. It is further argued that these analyses tend to discredit astronomical dating and Copernicanism and favor, respectively, ultimate dating from the Biblical testimony and geocentricity. The mathematical and textual compatibility of Joshua 10:12-14 with geocentricity is noted.

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(Continued on page 72)

PANORAMA OF SCIENCE

Missing Meteorites?

It has recently been remarked on that, while there are many meteorites buried in the upper few feet or so of soil, there are few or none lower down, and in particular in the alleged geological column.¹ Surely this is a strange situation, from the uniformitarian viewpoint. A Creationist, on the other hand, will have no trouble in seeing why this is so. For the materials of the column were not lying there for ages to accumulate meteorites; they were deposited very quickly. Creationists, had they become interested in the matter, might have predicted before hand that few meteorites would be found in the column.

Creation Admitted to be Reasonable

In a recent article, the author made the following remark: "The hypothesis of special creation by divine intervention is completely logical and tenable but it is one which science, by its nature, must try to do without. That is not to say that it is wrong".²

One may agree fully with the author that Creation is a reasonable explanation of the world. But, then, why must science try to do without it? Surely it is most unscientific to refuse to consider an explanation which has been admitted to be a possible one.

It is Hard to Make Planets

In a letter to the *New Scientist*, it has been maintained that a planet like the Earth would not form, according to the current notions, around a double star.³ For the companion would disrupt the process of formation. In-

deed, even the presence of Jupiter might well disrupt the formation of a planet like the Earth.

Two things may be drawn from this. First, all of the proposed ways in which the Solar System might have originated, other than by Creation, involve difficulties. Moreover, many of the stars are double (or more); thus they may be out of the running, as for having inhabited planets. Indeed, Barnard's star, often said to have planets, might have rather a small companion. In that case planets, inhabited or not, would be unlikely.

The Tungus Explosion Again

The great explosion, which happened in Siberia in 1908, is in the news again. Two independent articles have suggested that it was a large meteorite, or small comet, composed loosely, largely of ice.^{4, 5} It would mostly have disintegrated before it hit the ground; but the heating would cause a shock in front of it, and that, in turn, a great explosion.

These suggestions are useful for three reasons. They may serve as an antidote to some of the nonsense which has been written about that explosion. The information may be useful to Creationists who believe that extraterrestrial ice has affected the Earth before, maybe at the time of the Flood. Also, the article in *Nature* has some thoughts about the possible production of carbon 14 in the shock, which may throw some light into possible vagaries of carbon 14 in general.

Young Comets and Asteroids

Creationists have often pointed out that the comets can not be very old. Now that fact seems to be more

widely admitted. It has been maintained that the comets, and asteroids too, could not be more than 6,000,000 years old.⁶ For comets gradually come apart; asteroids are gradually gathered up by the Sun.

It was proposed that they came from the breaking-up of a large planet, likely where the asteroids now are. But in the light of a recent Creation, there is no need to look for any special recent origin of these objects.

Incidentally, the common suggestion, that the comets come into the Solar System from outer space from time to time, has been investigated. The conclusion is that such an origin for comets is unlikely.⁷

Extraterrestrial Habitable Planets: Going, Going, . . . Gone?

It is sometimes taken for granted, especially in semi-popular writings, that there are multitudes of planets which are habitable, and likely inhabited. Of course, all such notions are wholly speculation, unsupported by a single piece of solid evidence.

Now it is urged, in a uniformitarian journal, that such estimates of the number of habitable planets should be reduced by a factor of about fifty.⁸

Many Creationists will say that it should be reduced more, to one: the one habitable planet which we know, and which was "made to be inhabited".

Another Effect Of Poynting-Robertson

The Poynting-Robertson effect, which sweeps the Solar System free from dust, has been discussed from time to time, and the way in which it provides for a young System.⁹ An interesting example of the efficiency of the effect has been found. It appears that it is responsible for the ring recently discovered around Uranus.¹⁰ Evidently the braking effect, due to re-radiated radiation (the radiation comes originally from the Sun, not from Uranus) acts to marshall particles, in the vicinity of the planet, into the ring. So it is quite effective even that far from the Sun.

Many Catastrophes or One?

Catastrophes seem to be becoming more respectable, even in uniformitarian science. A writer in *Nature* has proposed that the Earth has undergone several catastrophic events, involving its rotation, the magnetic field, the climate, the sea level, and possibly other things. Along with such catastrophes were great extinctions of living things.¹¹

Creationists know that there was one great catastrophe: the Flood. They may wonder whether it is not possible that there was only one, and that the appearances mentioned in the article under consideration come from counting the same catastrophe several times.

The situation may be something like that which Velikovsky^{12, 13} and Courville,¹⁴ in particular, have maintained exists in ancient history, especially that of Egypt. There, they maintain, one king, or war, has, in some cases, been counted twice. Thus the ages assigned to things have been inflated.

The Eyes Have It Once Again

The eye has always been a valuable exhibit for Creationists; for it is very hard for an evolutionist even to suggest, in any plausible way, how it could have evolved. Moreover, there are very good eyes in kinds of creatures not supposed to be closely related; thus the evolutionist may have to maintain that rather similar eyes have evolved independently several times.

It has been said that only vertebrates, molluscs, and arthropods have well-constructed image-resolving eyes. But now another kind of creature must be added to that list.¹⁵

The annelid worms, types *Torrea* and *Vanadis*, turn out to have very effective eyes. Indeed, they have a feature of their own. The eyes have two retinæ, especially sensitive to different colors.

Every case of a well-designed feature, such as this, which is found, makes it harder to believe that such design can have come about by chance.

Insects Take Counter-Measures

It was not long after radar was invented that counter-measures, such as the broadcasting of radiation to confuse the radar echos, began to be used. As for the radar, it is well known now that certain animals, such as bats, use the principle. Now it appears that there are counter-measures in nature too.¹⁶

Certain arctiid moths, which the bats evidently hunt with the help of their radar (or, rather, sonar) produce sounds, which are believed to confuse the echos which return to the bats.

Truly, there is no new thing under the Sun.

Different Levels of Design

Paley, and other natural theologians, argued strongly that the design manifest in the world and the things living in it is conclusive evidence for a Designer.

More recently it has been said, by some, that Darwin's doctrine of natural selection has removed the need to admit the existence of a Designer. In a recent article this claim is examined.¹⁷

The author points out that there are three levels of design, which must be distinguished. First of all, there is the fact that inorganic nature seems to have been designed to support life. That is true even of the elements and their properties. At that stage, there is no sense, no meaning, in talking about natural selection. So Darwin's arguments do not even touch the evidence of design in inorganic nature.

The same may be said about the second stage, what the author calls the bolts and nuts of life: proteins, enzymes, etc.. It is hard to see how any meaning could be assigned to natural selection in reference to those components; yet there is clear evidence of design.

So if at all, it is only at the third level, that of complete living creatures, that there is even any meaning in proposing natural selection. And even there, as has been pointed out in various works in the *Quarterly* and elsewhere, there is considerable evidence against natural selection.¹⁸

Also, a Creationist is entitled to wield Ockham's Razor, and to say that, since the first two levels of

design clearly require a Designer, is it not likely that He was active about the third also?

Vestigial Beauty: Evidence of Creation

The Bible plainly teaches that we are to see evidence of God in nature (Ps. 19:1, Prov. 20:12, Rom. 1:19-20). Indeed, evidences of God from design and beauty in nature are as old as science itself. In the life sciences it is an unfortunate fact that with the widespread acceptance of evolution much of what was once attributed to the Creator is now considered to have originated by mutation and natural selection (in a strict sense this is idolatry: praising that which God made instead of praising God Himself). The beauty and fragrance of flowers is no longer through to the point to a Creator, but function to attract insects to assure pollination. The music of bird songs is thought to be functional in acquiring territory, obtaining and holding mates. Even the human eye is seen as having had long evolutionary history.

There seems however, to be one kind of beauty that is non-functional. In the fall our mixed hardwood forests become a wonderland of color. From the browns of oak through the yellow of cottonwood, willow and elm to the flaming reds of dogwood, maple and gum, the woods are astonishingly beautiful. In many ways autumn color is more striking than the beauty of spring flowers. The evolutionist is hard pressed to point to an adaptive significance of fall colors. Photosynthetic processes are ending. Insects are neither attracted nor needed. Autumn colors play no role in seed dispersal and provides no obvious function for the tree—other than to declare the Glory of God. Vestigial organs were once thought to be the evidence of evolution. Could not vestigial beauty be evidence of God?

—Contributed by E. Norbert Smith

Is Tooth Attrition Good?

The concept that occlusal and interproximal wear is “nature’s rule” for an harmonious occlusion has been challenged by F. S. Seward in the *Angle Orth.* 46:162-170 Apr. 1976. The concept originally put forth by P. R. Begg of Australia was thought by many to be the answer to why man has crooked teeth today as opposed to either the aborigine or so called “Primitive Man”. The evolutionists were quick to absorb this theory since it seemed to fit their presuppositions well. Smaller jaws were the natural result of the evolutionary process of selection. Larger crania and smaller faces seem to be the trend observed in man’s upward progression. Less abrasive diets coupled with smaller jaws led to large discrepancies between tooth size and bone size. Therefore tooth abrasion that reduced tooth size mesio-distally and occlusally was the normal; it was the way “mother nature” intended. It was selectively advantageous. It is necessary, Begg said, to have attrition of teeth to have an ideal occlusion. Wear and attrition become prerequisites for good occlusion. Therefore good occlusion is never good without attrition.

As a creationist I look askance at this view since I know man does not need the II law of thermodynamics to achieve perfection. This would mean that decay is

always necessary to produce good or normal. While it may be true that wear does have beneficial results today and that attrition and breakdown are necessary to achieve a suitable working condition in fallen man; it does not prove that this was always so, nor desirable. It is one method to a workable solution. However, it is pathologic. Dr. Seward showed that tooth attrition in 155 aborigine skulls was always accompanied by a degree of flattening of the condylar eminence. Condylar eminence flattening has usually been looked upon as pathologic. He concludes by saying that if dental attrition is normal then all accompanying phenomena must be considered to be normal. If, however, TMJ disturbances are abnormal and pathologic, then it is not unreasonable to consider tooth attrition and tooth wear pathologic. I believe all tooth attrition to be abnormal but a necessary abnormality just the same as termites are that return soil nutrients from fallen trees to the ground. Those termites, unfortunately, don’t know the difference between my house and a fallen tree! For the present it is with us. We must work with the law of decay as all creation groans under its weight. I don’t believe that it is God’s plan A. It is undeniably Plan B. To say that it is necessary for normal function now is one thing, to say that it was always necessary and will always be is quite something else. The God that I know is not so limited that He must utilize a law of degeneration to make nature “work”. The world we see around us today is second best. It was not His first choice, however it was ours. That is why we have it this way.

—Contributed by John Wm. Cuozzo

Radiocarbon Calibration Anomalies

A major topic of discussion among students of radiocarbon calibration concerns short-term fluctuations of atmospheric C-14 activity in the past. There have been two schools of thought. The first is led but Suess, of the University of California, who has published a calibration curve clearly identifying short-term fluctuations with periods of the order of 50-200 years.¹⁹ Suess claims to have checked and confirmed the reality of the fluctuations by further experimental measurement. However, workers at the Universities of Pennsylvania and Arizona have carried out an extensive experimental investigation, and they have failed to confirm the details of the Suess calibration curve. This has led to a second school of thought, which is not persuaded that Suess’ results are as definitive as he claims them to be. This school has published a number of calibration curves which show minor variations depending on the statistical techniques employed. Clark²⁰ has summarized their work, and has published his own analysis of the data, which may be commended for its rigor. By including all the available data in his study, Clark has demonstrated that the quoted estimates of error are inadequate to account for the observed scatter of results. The tension between these two schools may be seen in the correspondence between Suess and Clark in the pages of *Antiquity*.²¹

This picture has been further complicated by the recent paper of Pearson et. al.,²² who report on their work with Irish Oak wood recovered from peat bogs and lake sediments. A “floating” tree-ring sequence has been

assembled, and samples of the wood have been used to obtain radiocarbon activity measurements which are claimed to have a very high accuracy. The results show a linear correlation between tree-ring age and radiocarbon age, with a comparatively low scatter (the standard deviation is about 40 years). The authors point out that their work does not confirm the existence of the short-term fluctuations reported by Suess.

The improved experimental techniques claimed by Person et al. will, no doubt, be noted by all who have an interest in the radiocarbon dating method. Since their paper implies a need for improving experimental procedures, discussion of the significance of the reported results ought to be of a tentative nature. However, the following comments would appear to be justified.

Atmospheric mixing rates are known to be very rapid; and assuming that the radiocarbon reservoirs of the earth are in a state of near-equilibrium, a uniform atmospheric C-14 activity can be expected in the Northern Hemisphere at any given time. Consequently, it is not feasible to argue that Suess' results are applicable in America, whilst Pearson's results are applicable in Europe. Despite claims for high accuracy for both sets of results, it must be insisted that one or both be questioned, because they are inconsistent with each other. In some way, experimental data have been obtained which exhibit more order and non-randomness than can actually be the case, and the mere presence of order can no longer be regarded as an indication of reliability. Normally, results which are orderly and reproducible are allowed greater weight, but in this case, where two sets of reproducible results conflict, the situation should be regarded as anomalous.

Pearson et al also comment on the Egyptian calibration curve championed by McKerrell.²³ They suggest that the Egyptian curve is erroneous, and also that the anomalous C-14 results that have been obtained may actually be indicative of inaccuracies in the Egyptian calendar. It is noteworthy that such a possibility should be raised in *Nature*, for Egyptian chronology is normally regarded as most reliable and well established.

—Contributed by David J. Tyler

Do Plant Vessels Vary with Climate? A Plumbing Problem

Water pipes in buildings such as hotels, shopping centers, and sports arenas must be located in special patterns throughout the building to meet the water needs of that particular structure. Do plants growing in different habitats have changes in their water conducting systems to equip them for life in the various climates?

The noted botanist Sherwin Carlquist of Claremont Graduate School has addressed this question through studies carried out on woody plant specimens collected while traveling in Australia.²⁴ He secured samples of wood from various species representing more than 23 different plant families.

His ultimate goal was to find out if plant vessel anatomy varied between plants of such different Australian ecological zones as Karri forest, coastal shrub, bog shrub, sand heath shrub, and desert shrub.

Plant physiologists know that in time of moisture stress, the water vessels of a plant may fill with air—decreasing the water transport within a plant and perhaps threatening its very survival. It is also known that a plant having wide water vessels and few per unit area of stem has greater difficulty in times of drought than one which has narrow vessels and many per unit stem area. As Dr. Carlquist put it:

The more numerous the vessels per sq. mm, the less the chance that disabling of a given number of vessels by air embolisms formed under water stress would seriously impair conduction in the plant.²⁵

He wanted to see if those plants subjected to high moisture stress generally had thinner and more numerous vessels than those of moister (more mesic) habitats. If they did, this would mean that the flora of particular Australian habitats is well suited for the moisture regime of that region.

As an anatomical measure he divided the mean vessel diameter for each wood specimen by the number of water vessels per square millimeter of xylem tissue and pooled data for all plants of one region. Thus if vessels were wide and few in number, this ratio would be high. If they were narrower and more numerous, this ratio would decrease. For individual plants studied, the ratio varied from 1.84 down to 0.07!

He discovered that the overall ratio for plants of dry habitats such as desert shrub was low (0.19) while ratios for the more moist environments such as the Karri forests were high (0.62). His data showed that the water tubes of plants from each ecologic zone were fit for life under those particular environmental conditions. This demonstrates that there is a good correlation between the type of climate in a given Australian region and the vessel patterns of plants growing there. Further study will be needed to show how much variation in vessel ratios would result in specimens of the same species grown in different climates. Such research might reveal how much of the variation in ratios is genetically fixed and how much is influenced by environmental conditions.

There is nothing about these data which would suggest that the plants evolved their present well-balanced tubing systems. Yet the word "evolution" was used in the title as if the research had dealt with some scientific evidence favoring that theory—"Ecological Factors In Wood Evolution: A Floristic Approach."

Such use of the word "evolution" supports Dr. John N. Moore's contention that quite often papers with the word "evolution" in their titles do not even deal with major "evolutionary" changes of kind, but simply center on minor modifications in existing plant or animal kinds (variation).²⁶

One can appreciate Dr. Carlquist's studies because they illustrate the excellent adaptation found in plant vessel systems to the moisture demands of habitats in which they grow. This is exactly what creationist botanists would have predicted!

Reproductive Links: The Birds and The Trees

Some interesting partnerships exist between birds and certain trees. The particular bird carries the seeds of the tree and that same tree in turn supplies the largest share

of food for the bird. A striking example of this is given by H. F. Howe from his careful studies in Costa Rican forests where the tree *Casearia corymbosa* supplies food to numerous species of tropical birds during January and February—a time of relative drought.²⁷

Although many birds visit this tree and feed on its fruit and fleshy seed-coats (arils), most of them drop the seeds beneath the tree. There the seeds die for various reasons and no seedlings result. But two species of tityra birds feed quickly and then carry the fruit some distance from the parent tree, dropping the seed where it has a much better chance of successful germination and establishment. Thus the tityra birds consistently depend on the *Casearia* trees for food; and likewise the tree depends on the bird for effective dispersal and survival.

Howe also points out that if the tree were to become extinct, the actual survival of these tityra birds and perhaps many other species would be threatened. By the same token, loss of the tityra birds from a given area would severely affect the long-term survival of *Casearia* trees.

Howe and many others speak of such a close relationship between diverse species as a result of "coevolution," believing that these 2 species evolved together until they came to closely depend on each other as presently evident. From the standpoint of neo-Darwinian evolution, however, it would seem unlikely that such a relationship would ever arise; because both species (bird and tree) would have to have the right mutations at the right time and in the right geographic locality to being about this choice interdependence which now exists. Natural selection would have had gradually to equip

the tree to depend on the bird and vice versa. But in truth natural selection is largely eliminative and *not creative*. A more natural and reasonable explanation in keeping with the scientific creation model would be the suggestion that the Creator formed certain trees and birds to be interdependent. Accordingly, He equipped both the tree and the bird with the genotypes necessary to bring about this close working relationship, and what at first seemed as another piece of evidence favoring the evolution model turns out to be a data item which fits best with a creation concept.

—The last two items contributed by George F. Howe

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Against Catastrophic Rationalism

(Continued from page 68)

Editor's note: May I suggest three points which, while likely implicit in this article, are not emphasized? The first two are these: any encounter sufficiently powerful to turn the Earth's axis appreciably would also cause great changes in the orbit, also enormous tides causing great flooding. It must be asked, then, whether there is any evidence of such things.

The third point is related to the second. Catastrophists sometimes point out that the rotation of the Earth could have been slowed down gradually, at Joshua's long day, e.g., so that there would have been no danger that things would have gone flying off. That is true; but there is another matter. Suppose that the Earth were slowed down gradually enough that the slowing would have caused a point on the surface to have an acceleration one thousandth that of gravity. For most purposes such a thing would have been hardly noticeable.

But the surface of a body of water, under such conditions, would take on a slope, with respect to regular sea level, of one in a thousand. That would have meant a difference of a mile or more in the level of water at the shores of oceans or seas, which again could cause great flooding.

BOOK REVIEWS

Parapsychology and the Nature of Life by John L. Randall. 1975. London: Souvenir Press. 256 pp. £ 4.00
Reviewed by John N. Moore*

By means of a three-part grouping of 16 chapters plus an Epilogue, the author formulates this book as a dialectical argumentation. He identified a "thesis" that mechanism is triumphant because "scientific knowledge has rendered materialism almost a certainty", (Part I), then an "antithesis" about those advances in knowledge which go against a purely materialistic interpretation of life (Part II), all of which leads "Towards A New Synthesis" (Part III).

Randall acknowledges in the Preface some very important developments in the last 30 years: computer technology and the study of "machine intelligence", cybernetics and information theory, molecular biology, neurophysiology, and brain chemistry. But he holds that an important challenge to these scientific advances, which have encouraged many to accept materialism, is found in "the field of parapsychology, which during the last decade has begun to occupy an increasingly prominent place among the life sciences". (p. 6)

Creationist readers will find quite useful his succinct review of the impact of Darwin in Chapter 1 ("The Descent of Man"), which contains the comment:

It seems that in science as in religion, once a belief-system has been established as a result of a period of in-fighting, there is a powerful reluctance to even think about anything which might conflict with the system. (p. 19)

Also of value is his historical assessment in Chapter 2 of molecular biology as *the* challenge to "any kind of vitalist or supernaturalist view of life", and the next chapter ("Exile of the Soul") in which Randall observes:

To anyone whose education has been largely in the physical sciences, reading the writings of the great psychological system-builders [Pavlov, Watson, Skinner, Freud, Ryle] is a strange and rather disturbing experience; for the manner in which these latter-day materialists propagate their doctrines is very much more reminiscent of a religious than of a scientific approach to knowledge. Time and again we find *facts* ignored or suppressed in obedience to *dogma*. (p. 51) (Emphasis in original) Rather than the disinterested pursuit of truth we seem to find in these men a passionate attempt to establish a new orthodoxy, to replace the dogmas of the old religions with no less dogmatic, if atheistic, religion of their own invention. (p. 52.)

I found rather interesting the major section of this book (Part III) wherein the author deals with the problems, failures, and successes of parapsychology. He moves "Across the Threshold" (Chapter 5) to "The Conflict Years" (Chapter 7) and "Critics' Reprise" (Chapter 8) before "Breaking the Species Barrier" (Chapter 10) and "The Turning Point" (Chapter 12) to state, "The continuing success of parapsychology has made a very

large crack in the fabric of the materialistic philosophy." (p. 186)

Randall indulges in "the luxury of speculating rather freely about the nature of things" in Part II which he admits in the Preface is the most speculative part of the book. He begins with a "revisit" to mechanism to get to Chapter 14 ("Genesis") in which he comments in the opening page about the "evangelists of molecular biology" (i.e., Jacques Monod), and provides the reader with the new mechanist-reductionist version of Genesis 1. (p. 201f) Creationists will find that this italicized paragraph illustrates very well how materialists have "substituted" their ideas for the unchanging and unchangeable answers of God about first origins.

This is a valuable chapter for creationists and provided this reviewer with a very valuable quotation from Sidney Fox:

Ordered matter has thus evolved through a hierarchy of stages of self-assembly. Due to repeated reproductive cycling and infrequent but multitudinous mutations, *information available at the outset* has expanded to permit a vast array of diverse types of informational macromolecules and derived systems. These systems collectively represent what we recognize as life. ("In the beginning . . . life assembled itself", *New Scientist*, February 27, 1969, pp. 459-452) (Emphasis added by Randall)

Quite accurately the author identified this statement by Fox as "the modern version of the old transformationist myth" and he states:

. . . all the properties of living matter were already present, presumably in some sort of coded form, in the very atoms from which the solar system was formed. This will seem hardly conceivable to anyone except a determined mechanist. (p. 207)

In the concluding chapters Randall continues to afford much "ammunition" against the mechanist-reductionist viewpoint of life. He holds to the importance of parapsychology. I liked these statements:

No matter how much the mechanists may try to dodge the issue by appealing to the twin goddesses of Chance and Natural Selection, there remains, both in the individual living organism and throughout the biosphere, a fantastic degree of creative organization. It would seem to be incredibly naive to suppose that all this somehow "just happened". (p. 226)

Through all the media of communication, over and over again, the message has been propagated: that life is meaningless, that death is the end of all things, and that the only sensible course of action is the pursuit of pleasure for its own sake. Yet in spite of this continuous torrent of materialist propaganda, the religious instinct remains. (p. 242)

Randall sees the reality of the Mind-Body problem but he prefers a "cosmic mind" or an impersonal "mind-at-large" as he writes about intervention by Mind, and thus stops short of accepting the Almighty God of Scripture. Disappointingly he talks about an "Experimenter-God" (p. 235)

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Because of the four chapters of Part I and all but a few concluding pages in Part III many creationist readers will find this book an excellent source of reference material.

Perception, Common Sense, and Science by James W. Cornman, 1975. Yale University Press, New Haven, Connecticut. 420 pages. Price, \$20.00

Reviewed by Jerry Bergman*

Cornman's latest book on philosophy and science deals primarily with the question "how do we know what we know?" When we react to the world around us, we generally depend heavily on our individual perceptions, accepting them somewhat at face value. Cornman examines the reality between the real world and our mind's perception of that world. According to the preface, Cornman's goal in writing the book is to determine whether a "materialistic view of . . . sensing enjoins plausibly with any of the most reasonable metaphysical theories of perception and the physical world." Thus, essentially, Cornman is tackling one aspect of the age-old mind-body problem, a problem we do not seem to be much closer to solving today than we were 4,000 years ago.

Cornman also attempts to "arrive at a plausible metaphysical view of man, the world around him, and his relationship to it when he perceives it." Cornman focuses on the process of forming "conclusions about the world around us" as an aspect of the mind-body problem, realizing that we do not directly react to the outside world, but to our perceptions of it, and that most of our reaction is, in essence, theorizing based on reasoning, an internal mental process.

The topic Cornman deals with is clearly important, especially for those interested in science-religious issues. Perception and individual reasoning are both extremely influential in arriving at religious conclusions, probably more so than in any other area. Religious conclusions are based both on the early training and background of the speculator and the religious information presented when one is receptive to religious ideas, usually from ages 8 or 9 to 15 or 16. To understand beliefs in both the religious and science areas, it is necessary to understand the process of perceiving ideas and events, and the process used in forming conclusions. Although much of Cornman's research is related directly to the field of religion, Cornman rarely mentions or applies his data and insights to religion.

There is a tendency for many to divorce so-called metaphysical reality from physical reality. This dichotomy is not only artificial, but, still worse, is forced on empirical data, resulting in *distorting man's* perception of reality. There is no reason for the universe to be divided up into physical and metaphysical spheres. The axiom in the physical sciences, "if it exists it can be measured," also applies to the so-called metaphysical sciences. Philosophy tends, more than any other science,

to integrate religion and science, helping to demonstrate that while the dichotomy of religion and science can be useful, it is artificial and can limit the progress of both religious understanding and scientific learning.

Especially have we seen this conflict surface in the current creation-evolution controversy, and in the field of originology¹ in general. Elimination of this dichotomy requires looking at the source of knowledge, demonstrating that science relies not only on knowledge from our sensory input, but the powers of reasoning, analysis, etc., all which are an important source of knowledge in the religious sphere. Especially does the resurgence of interest in the occult and the area surrounding the occult, including pyramidology, extra sensory perception, transcendental meditation, where both the scientific method, and traditional ways of knowing are used, illustrate this. Acceptance that there could be other phenomena that are "real" aside from what has been the traditional subject matter of science points to a broadening of both interest and respectability of research in the so-called metaphysical domains. I am not saying that Christians, in particular, should be involved in occult matters.

Cornman concludes that what is real is not determined by sensory impressions alone, but by our analyzation of these impressions where reason is preeminent, a process he calls "common sense." Unfortunately, the term "common sense" is never fully defined or discussed,² which is regrettable since popular understanding is somewhat different from Cornman's use of the term. The term "common sense" has created problems in communications, problems which to some degree argue against its use. For example, the term is often used to validate a conclusion in lieu of direct support. If I make a statement that someone challenges I can appeal to "it is common sense" in lieu of supporting my statement either with a scientific study, valid reasoning, or the required authorities, as though "it is common sense" is a valid justification of my statement.

Relying on a phrase "common sense" as support permits a number of incorrect statements to pass unchallenged, many of which have no foundation. Common sense is often nothing more than an expression of a belief, idea, prejudice, bias, misconception, etc. that fits into one's value belief system. Many ideas are still held by the population as "common sense" when there is no factual basis whatsoever for the generalization. For instance the gifted child, it is believed, will most likely be maladjusted, sickly and, as a whole, inferior. In this case the opposite, by and large, is true.

The fact that the book is difficult to read will prevent many who might find Cornman's material useful from pursuing his discussions. Not that the vocabulary is extremely difficult, but common words are often used in an esoteric and obtruse manner. Many terms should be defined several times to help the reader understand what Cornman is referring to in each separate use. The term common sense, for example, has a variety of meanings. It originally meant a "special faculty of the mind which came to inevitably correct conclusions regardless of what sensory data were present;" but today means many different things.²

Other concepts are used in unique ways, or applied in

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one situation when they were originally developed for other problems. For example, the principle of Occam's³ razor is often used in the physical sciences to caution against using a more complex explanation when a less complex set of reasoning will explain a phenomenon equally well. Cornman's discussion only states that this idea is "thoroughly relevant to metaphysical theories" without clearly defining his use of the concept. The concept of parsimony is not named, but is utilized in such a way that it is difficult to recognize that this concept is being referred to. Cornman tends to wrest concepts from the physical sciences into his philosophical framework without making the transition clear. In dealing with metaphysical areas, it is helpful to rely on physical concepts, indeed it is probably imperative to do so; but their use should be made clear.

A major problem with the book is that instead of thoroughly examining the data, and then arriving at a position, Cornman seems to take a position and then attempts to support or justify it. He states: "My purpose is to justify a particular metaphysical theory", and then he proceeds to try to do just that. Cornman tends to rely upon "arm chair reasoning" instead of empirical research, rarely using examples from the real world as much as might be advisable to convey his points. To increase clarity Cornman should utilize more examples, such as the illustration of a person walking into a familiar dark room (p. 348).

Empirical data are not absolutely necessary, although their support, or at least awareness of available data, should have been acknowledged. The need for a discussion of, or at least mention of, specifically biochemical data is imperative. The author speculates in areas where a very basic understanding of biochemistry and the chemical formulations of learning, memory and perception, should at least be considered. The physiology of perception may not support some of his philosophical theories; but it should have been brought more into his discussions to help the reader relate the two.

Many illustrations Cornman uses are empirical, such as his discussion of the perception that blood is red from a distance but as blood is thinned out it become clear in color because fewer and fewer erythrocytes are found within a given area (the erythrocytes give the red color to the blood). Even here, though, abstract reasoning is predominant. Although reasoning utilizes basic observations, a reliance on physiological understanding is not paramount, but only occasionally resorted to back up philosophical conclusions. Cornman's conclusions do involve mathematics, especially set theory (but knowledge of it is not essential to the reader) but postulates of such philosophers as Russell, Kant, Locke, Sellars and Berkeley are much more evident.

A common assumption of science is that so-called non-material events and phenomena are somehow less "real" than the subject matter the physical scientists have traditionally studied. Cornman's book helps us realize that the methods and logic of traditional science can be applied to the so-called metaphysical area. Cornman's research helps us realize that phenomena that cannot be directly perceived by human senses are not necessarily less real, nor are they necessarily less

testable by the scientific method. More complex procedures and a greater understanding of the universe as a whole may be required for research in this area and metaphysical reality may be less obvious, but not necessarily less real.

Creationism, in establishing itself as a valid science and a viable alternative to materialistic, evolutionary science, is supported by attempts to bridge the artificial gaps between the physical-metaphysical dichotomy. All reality is a valid subject of science; and Cornman's book helps us extend research and thought away from pure physical realities which has been the preoccupation of science for the past century.

In summary, in view of the current re-examination of the materialistic base of both our sciences and our philosophy of life in Western Society, this book is a welcome thorough examination of a number of the assumptions and problems of a materialistic science. The assumption that if it can be perceived by the senses and if the perception is consistent and repeatable, it therefore must be true, is constantly questioned throughout the book. This does not infer that groundless speculation is to be relied upon, but a firm set of ideas must be built upon each other, relying on logic, reasoning, empirical investigations, and use of the principles which result form empirical investigations.

References

¹I.e., the study of theories of origins. To distinguish here between this term and cosmogony would take too long.

²The closest to a definition which Cornman gives is that of "common sense realism". Even here he does not discuss some of the more serious problems which arise with this expression. It may be noted that in everyday use common sense means a sort of innate shrewdness; while among the older philosophers it meant a sort of synthesizing power of the mind.

³Sometimes spelled Ockham's.

The Battle for the Bible by Harold Lindsell. 1976. Zondervan, Grand Rapids, Michigan. 218 pages.

Reviewed by Paul L. Cornelius*

In its almost 2000-year history, Christianity has had to face and answer a number of challenges to its historic beliefs. The Nicene Creed was written to reaffirm the deity of Christ. Issues of the Reformation were scripture alone, Christ alone, faith alone as the way of salvation. Now in *The Battle for the Bible* author Harold Lindsell states his belief that Christianity is embroiled in the greatest crisis in its history, a crisis revolving around the question, "Is the Bible the infallible Word of God?" In the preface the author states his purpose, "I have written this book largely for evangelical lay people in the pews who may not be aware of the central issue that faces them, their denominations, and their institutions."

Concerning the importance of the issue, Lindsell says, "Little difference at a given point in history may seem to separate those who believe in an infallible Scripture from those who do not . . . What difference does this

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seemingly minor concession make? . . . One part of the answer is the deep conviction based on past history that however small the differences may appear at this point, the gap will become enormous in due season, and the differences will increase as other doctrines now believed, are tossed overboard . . . I will contend that embracing a doctrine of an errant Scripture will lead to disaster down the road. It will result in loss of missionary outreach; it will quench missionary passion; it will lull congregations to sleep and undermine their belief in the full-orbed truth of the Bible; it will produce spiritual sloth and decay; and it will lead to apostasy."

Lindsell lists several Protestant denominations in which he believes the Battle for the Bible to be already lost. In these denominations he says "there is not a single theological seminary that takes a stand in favor of biblical infallibility. And there is not a single seminary where there are not faculty members who disavow one or more of the major teachings of the Christian faith. And what is true of denominational schools is true also of . . . (Here he lists several prominent nondenominational seminaries) . . . And the writings of professors from these institutions demonstrate beyond question that multitudes have departed from the clear teachings of scripture."

Interesting insight is shown regarding faculty and students in most denominational Christian colleges. Lindsell states, "Numbers of their faculty members have taken doctoral work . . . without an awareness that what they learned in secular universities has implications for their Christian faith. Numbers of these professors teach one thing in the classroom, and believe something else on Sunday morning . . . The problem is compounded by the students . . . Exposed to non-Christian or anti-Christian teaching in the secular high schools of America, they hit the Christian college campuses (biblically) illiterate . . . They find it difficult if not impossible to accept a view of Scripture that . . . demands the submission of mind, body, and life to its world view . . . They are damaged further by attitudes that subject Scripture to the conclusions of the secular subjects rather than testing the conclusions of the secular subjects on the basis of what Scripture teaches."

It is noteworthy how frequently the question of the interpretation of the early chapters of Genesis arises. Yet the book does not deal adequately with this issue. The modern theory (or should we say myth?) of evolution, seemingly taught with a vengeance in secular schools by humanistic professors and educators (who need it to support their philosophy of life), seems to be the foundation of modern man's unbelief. Christian men and women of science, particularly those affiliated with the Creation Research Society (which the book does not mention), have published rather convincing evidence that the concepts of neo-Darwinian evolution are false (and therefore making it unnecessary and even unwise to harmonize them with Scripture). This would seem worthy of some mention in the book.

The implications of the book seem clear. Unless the main line Protestant churches can return to a Bible-believing Christianity, they can expect to reap only continued disaffection of their membership, the uncommi-

ted to ever-increasing apostasy and significant numbers of committed believers to stronger evangelical churches or fellowship groups. The book will be applauded by those who wish to see their church take a strong stand for Biblical truth. Anyone concerned with where Protestant Christianity is headed will find this book worth reading.

The Tell-Mardikh Tablets. Booklet, 16 pages, published and distributed by 20th Century Reformation Hour, Dr. Carl McIntire, Director, Collingswood, N.J. 08108. Available free and postpaid. Gift to help defray cost appreciated.

Reviewed by Miss Margaret B. Urey*

this booklet brings together in a fascinating way published reports on the discovery of the Tell-Mardikh tablets and commentary on their significance in respect to secular history of the ancient Near East and to corroboration of the early chapters of Genesis. Names and places in Scripture are verified.

The Tell-Mardikh find shows that a major Canaanite empire flourished in that part of the world between the 23rd and 26th centuries B.C. The Canaanites are usually described as "urban" and "sophisticated" and credited with developing a form of writing that became the alphabet.

There are some 20,000 cuneiform tablets found thus far. Remarkable parallels exist between the language of the tablets and the language of the ancient Hebrews. Referred to as Eblaite it appears to be a West Semitic form unlike Sumerian, Akkadian or any other ancient language known to modern science.

Excavators have found a bilingual vocabulary list of about 1,000 words in Sumerian logograms and Eblaic syllabic writing. From this it is believed scholars will be able to arrive at the meaning of all the Tell-Mardikh tablets.

Of those studied and categorized thus far many deal with economic matters, trade agreements with various city-states including a consignment of goods to "Sargon, king of Agade (Akkad)".

One large tablet deals with the details of a treaty between Ebla and Assur (Assyria).

Tablets dealing with case law show that the codes of law originated not with the Babylonian emperor Hammurabi but with some earlier lawyer.

Excavation of the large mound covering 140 acres and rising to a height of 50 feet in Northern Syria began in 1964. In 1968 a statue of the goddess Estar was uncovered with an inscription bearing the name of the lord of the city of Ebla.

Dr. David Noel Freedman, professor of Biblical studies at the University of Michigan and director of the American Schools of Oriental Research, who introduced the spectacular discovery to the United States and the western world is quoted at length. He reports that the ancient site of Ebla had a population of 260,000,

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spoke a language close to Hebrew, and its greatest king bore a name cognate with Eber, the ancestor of the Hebrews (Gen. 10:21). A God named Ya was worshipped. The identification of Ya and El raises questions concerning similarities to Yaweh and Elohim, names of God used in Genesis one and two, (and subsequently).

Hundreds of names appear, many of them corresponding to names in the Bible. Among them the name Michael is found going back to at least 2000 years before it is found in the Bible. Eber, Haran, Abraham, Esau, David, Saul are names which occur.

Names of places mentioned in the Bible are here: Hazor, Megiddo and Gaza. Most amazing is the name "urusalima," considered without doubt to be Jerusalem. This predates other mention of that city by about 1000 years. Damascus is mentioned in connection with the 5 cities of the plain.

Photographs of four of the tablets found at Ebla are shown with their size indicated. There is also a photograph of some of the tablets found in one of the two rooms in the palace at Ebla. A map shows the location of Tell-Mardikh with present-day boundaries of Mideastern nations in place. Charts showing the overlapping of names in Scripture from Adam to Isaac are of great interest.

The Ebla tablets not only destroy the evolutionary concept of the development of Israel, but in their accounts of the creation of the world and the great flood they call into question the secular theories of evolution.

Dr. Freedman believes that the finds at ancient Ebla may well be more important than the Dead Sea Scrolls to Biblical scholarship.

Dinosaurs, those Terrible Lizards by Duane T. Gish, with illustrations by Marvin Ross, 1977. Creation-Life Publishers, San Diego, California. Price, \$4.95.

Reviewed by Wilbert H. Rusch, Sr.*

I am sure that young people as well as parents in Christian homes will like this book. The young people will like it because of its excellent illustrations as well as interesting text. Parents will be interested since it will resolve their dilemma, which is what to tell their youngsters when they encounter the existence of these animals as well as what is said about them. The book is an attempt to fit dinosaurs into a creation framework, and is informative as well as interesting. It is especially suitable for young people of ages corresponding to junior and senior high school.

A minor criticism could be the use of evolutionists' sweeping statements in cases in which there is no direct evidence. For instance, there is the statement on page 19 that all dinosaurs laid eggs. Actually, there seems to be direct evidence only about Proceratops; and again Ichthyosaurs have been found with their young in their

clutches, still unborn. Again, I believe that Romer speaks of Trachodon's total of 700 teeth, instead of the 2,000 mentioned here. Finally, although it is a bit ingenious, I am uncomfortable about the extrapolation of the bombardier beetle's bad smell to possible flame-throwing proclivities on the part of Parasaurolophus. However, the extrapolation is rightly identified as such, so I suppose that it is permissible.

These minor points aside, I should repeat—parents will find this book a help, and young people will find it interesting. I should recommend it.

Mechanical Design in Organisms by S. A. Wainwright, W. D. Biggs, J. D. Currey, and J. M. Gosline. 1976. Halsted Press (John Wiley and Sons, New York) 423 + xii pages. Price \$19.50.

Reviewed by H. L. Armstrong*

The authors of this book look upon the features of organisms as examples of design, in the same way as a structure or a machine embodies design. In fact, they say that these organic "... structures can be said to be designed because they are adapted for particular functions. They are not merely appropriate for these functions, because that could happen by chance". (Page 1.)

It is somewhat disappointing that, after so clear a statement of so important a truth, the authors seem to feel compelled, now and then, to make a perfunctory nod toward natural selection. Indeed, in so doing they seem to be contradicting themselves. But the book is not blatantly evolutionary, or Darwinistic.

The authors argue strongly for "... the importance of mechanical design in all aspects of biology ...", and go on to state that "... a biologist interested in the genetics of bristle patterns on a fly's wing ought to know why the bristles are still, how bristles modify the airflow over the wing, and how such aerodynamic modifications affect the behaviour patterns of the insect". (Page v.)

The division of material is about as follows. 110 pages are devoted to strength of materials and mechanics of materials, much as engineers treat these topics. Considerations of the actual materials involved, i.e. tissues, etc., as engineering materials, occupy 130 pages. Discussion of actual structures and their uses in living beings occupy 100 pages. And about 100 pages deal with what is called "ecomchanics", i.e., ecological mechanics, the relation of mechanical design and function to the environment.

Creationists will find in this book very many examples of design which (but they will have to say it, for the book does not) undoubtedly imply a Designer. Also, anyone interested in the physical sciences for students of biology would find here many examples and things to be investigated.

*Wilbert H. Rusch, Sr., M.S., LL.D., is Academic Dean of Concordia College, Ann Arbor, Michigan 48105.

*H. L. Armstrong, M.Sc., teaches Physics at Queen's University, Kingston, Ontario, Canada.

LETTERS TO THE EDITOR

Concerning Christians' Relations
with Communist Countries

The following is in addition to comments already made^{1, 2} concerning visits of creationists to the U.S.S.R.

Christians from the West ought to fulfill Matthew 25:39-40 by asking to see their brothers and sisters in Christ who are known to be in prison for their faith. Names and addresses, and often dates and the reasons for arrest (holding prayer meetings, teaching Sunday School, distributing Christian literature, etc.) can be furnished for such Christians in many towns in the U.S.S.R. (and other Communist countries) by writing to: Jesus to the Communist World, Inc., P. O. Box 11, Glendale, California 91209.

Scientists can be particularly helpful in this regard because they are regarded by the Soviet authorities as influential in public opinion. Just as with dissident Jewish scientists, Christians in prison or danger have in many cases been released with it was discovered that they are well known in the West.

References

¹Report of the 1976 meeting of the Board of Directors. *Creation Research Society Quarterly* 13(2):124-125.

²Heinze, Thomas F. 1977. Creationist literature in Russian. *Creation Research Society Quarterly* 14(2):131.

Sincerely in Christ,
John L. Doane
P. O. Box 273
Princeton Junction,
New Jersey 08550

Received December 8, 1977

Comments on the II Law and Evolution

Evolution proposes a naturalistic, self-contained, non-purposive, irreversible, universal and continuing process by which all forms of life were evolved from simpler forms to complex ones through billions of years of changes by means of mutation, natural selection, chromosome changes, genetic recombination and reproductive isolation.

The second law of thermodynamics states that for perfectly reversible processes of the known universe, the change in the sum of the measure of disorderliness (known technically as entropy) of a system and that of the environment equals zero; and for irreversible processes, the change in entropy of the system is always greater than zero.¹ In Isaac Asimov's words, the second law is well proven and documented and it governs all aspects of our lives. He said, "As far as we know, all changes are in the direction of increasing entropy, of increasing disorder, of increasing randomness, of running down."²

It is in this scientific area that evolution is diametrically opposite to the second law of thermodynamics.

Using methods of statistical thermodynamics, possibly involving quantum physics it is possible to for-

mulate the probability functions of an increase in complexity in an irreversible process or in a non-equilibrium state. Such probabilities are tiny; but macro-evolution would need billions of such improbable steps to happen. To believe this anti-second law "principle" to have happened billions of times demands more faith than believing in special creation!

Ardent evolutionists may say that crystal formation violates the second law of thermodynamics. Physicists say that since crystal formation is a perfectly reversible process, the entropy of the crystal decreases while the entropy of the environment increases, but the sum total change in entropy is zero. The crystal increases its complexity at the expense of losing its energy to the environment. In this case, increasing complexity decreases the energy content (technically called enthalpy) of the system. Nevertheless, this process is only temporary; given right conditions, the crystal will dissolve to maximise its disorderliness. Therefore, crystal formation does not violate the II law.³

The modern theory of evolution tries to make use of natural selection, gene mutation, chromosome changes, genetic recombination and reproductive isolation. Although these processes are real, none of them has been demonstrated to violate the II law of thermodynamics. Therefore, their combinations cannot violate the II law, and therefore, they cannot account for irreversible evolution.

The II law is also testified by the Word of God. Let's see a text:

Romans 8:20-22, "for the creation was subjected to futility, not of its own will but by the will of him who subjected it in hope; because the creation itself will be set free from its bondage to decay and obtain the glorious liberty of the children of God. We know that the whole creation has been groaning in travail together until now."

Therefore, evolution is neither Biblical nor scientific.

References

¹Lee, John, and Francis Sears, 1962. Thermodynamics. Addison-Wesley.

²Asimov, Isaac, 1973. Can decreasing entropy exist in the universe? *Science Digest*. May, p. 76.

³See Williams, Emmett L., 1966. Entropy and the solid state. *Creation Research Society Quarterly* 3 (3):18-24.

Sincerely,
Christopher Chui
791 O'Connor Drive
Toronto, Ontario, Canada
Received 30 September 1977

QUOTABLE QUOTE

"... we are suffering from a plethora of surmise, conjecture, and hypothesis. The difficulty is to detach the framework of fact—of absolute, undeniable fact—from the embellishments of theorists..."

Sherlock Holmes, in the story *Silver Blaze*

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.

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$10.00 (Foreign, \$11.00 U. S.) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$10.00 (Foreign, 11.00 U. S.) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of these publications may do so at the rate of the subscription price for all issues for one year: \$13.00 (Foreign, \$14.00 U. S.).

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

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

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and 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.

Board of Directors *Biochemistry*: Duane T. Gish, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116. *Biological Sciences*: Wayne Frair, Ph.D., **Secretary**, The King's College, Briarcliff Manor, NY 10510; George F. Howe, Ph.D., **President**, Los Angeles Baptist College, Newhall, CA 91321; Lane P. Lester, Ph.D., 110 Wisteria, Orlando, FL 32806; John R. Meyer, Ph.D., University of Louisville, KY 40208; Wilbert H. Rusch, Sr., M.S., LL.D., **Membership Secretary**, Academic Dean, Concordia College, Ann Arbor, MI 48105. *Genetics*: John W. Klotz, Ph.D., Academic Dean, Concordia Seminary, St. Louis, MO 63105; Walter E. Lammerts, Ph.D., Freedom, CA 95019; William J. Tinkle, Ph.D., Timbercrest Home, North Manchester, IN 46962. *Geology*: Clifford L. Burdick, M.S., D.Sc., 924 N. 6th Avenue, Tucson, AZ 85705. *Geophysics*: Harold Slusher, M.S., D.Sc., University of Texas at El Paso, TX 79902. *Physical Sciences*: Harold Armstrong, M.S., **Publications Editor**, Queens University, Kingston, Ontario, Canada; Thomas G. Barnes, D.Sc., University of Texas at El Paso and Consultant to Globe Universal Sciences, Inc., El Paso, TX 79902; Richard G. Korthals, M.S., **Treasurer**, Dean, Concordia Teachers College, River Forest, IL 60305; Henry M. Morris, Ph.D., Institute for Creation Research, 2716 Madison Avenue, San Diego, CA 92116; George Mulfinger, M.S., Bob Jones University, Greenville, SC 29614; Emmett L. Williams, Jr., Ph.D., **Vice-President**, Bob Jones University, Greenville, SC 29614. *Science Education*: John N. Moore, M.S., Ed.D., 136 Brody Hall, Michigan State University, East Lansing, MI 48824.

ANNOUNCING SPECIAL REPRINT

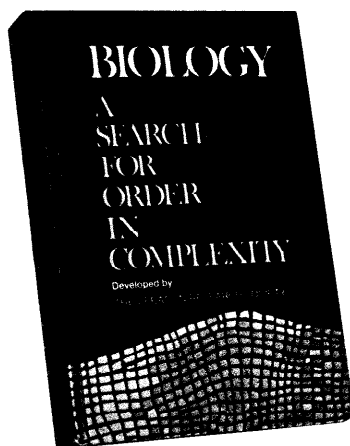
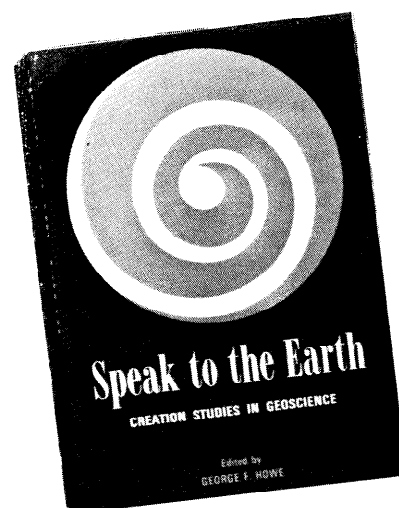
Some Christians believe that Charles Darwin, toward the close of his life, repudiated evolution and became enthusiastic for Christianity. That this did not occur has been reported by Dr. Wilbert H. Rusch, Sr., in a 1975 investigative paper on what Darwin wrote, and presumably believed, in the last two years of his life.

Now a special reprint of that paper "Darwin's Last Hours" is available for twenty-five cents (\$0.25)/postpaid per copy from the College Bookstore of Concordia College, 4090 Geddes Road, Ann Arbor, Michigan 48105. This will be a fine publication to give to those people who inquire about a possible Christian conversion of Darwin.

SPEAK TO THE EARTH (*Creation Studies in Geoscience*)

A classified anthology of articles from *Creation Research Society Quarterly* for second five-year period, 1969-1974.

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WHY NOT CREATION?

A classified anthology of articles from *Creation Research Society Quarterly* for the first five-year period, 1964-1969.

Baker Book House, Grand Rapids, Michigan and Presbyterian and Reformed Publishing Company, Nutley, New Jersey. \$7.50.

SCIENTIFIC STUDIES IN SPECIAL CREATION

Additional articles from *Creation Research Society Quarterly*, 1964-1969.

Baker Book House, Grand Rapids, Michigan and Presbyterian and Reformed Publishing Company, Nutley, New Jersey. \$6.95.

SPECIAL REPRINT AVAILABLE

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. In an article in the June, 1975 issue of the *Creation Research Society Quarterly*, Dr. Duane T. Gish published a summary report of Creationist research in the last decade.

His report was organized under these headings: Geology, General Geological Reports, Genetics, Natural Selection, General Biology, Taxonomy, Thermodynamics, and A Research Challenge.

So that members of the Creation Research Society and other interested persons might distribute this summary of a decade of Creationist research a special reprint of the Gish article has been made available. The 16-page reprint is priced at 75 cents per copy, with price reduced to 50 cents each for orders of 100 copies. Orders for the reprint may be placed through the College Bookstore of Concordia College, 4090 Geddes Road, Ann Arbor, MI 48105. Postage will be paid by the bookstore.