# PLANT DORMANCY: A KEY TO THE PAST
## (Genesis 1:14 and Plant Dormancy)

ALBERT B. FERGUSON*

*Many plants undergo periods of dormancy, which fit in with seasonal changes of the weather. But it does not follow that dormancy is caused, in the first place, by the weather. In fact, provisions of dormancy at the right times are seen as more examples of the Creator's superb skill and foresight.*

### Introduction

On the third day of His creative work, our Lord made dry land appear and "clothed" it with a great variety of plant life, each a distinct kind, capable of reproducing a unique type (Genesis 1:9-13)

Genesis 1:14: "Then God said, Let there be lights in expanse of the heavens to separate the day from the night and let them be for signs, and for seasons, and for days and for years."

The Hebrew word *moed* is translated "seasons" in the authorized version of the Bible eight times; "congregations," 149 times; "solemn feast," nine times; "appointed," nine; "feast," six; "set time," six; and "set feast," five times. It seems to me that *moed* is a time or place where important events take place. I believe that in Genesis 1:14 *moed* refers to the importance of the set seasonal climatic changes that take place.

Most forms of organic life go through periodical cycles: annual, monthly or shorter. In many cases these are controlled by annual climatic changes. In temperate and arctic areas, plant, reptile, fish, insect, and mammalan life cycles are built around seasonal climatic variations necessary to their existence in many cases.

It is quite evident that the Lord God placed the earth on its tilted axis when He created it and put it in orbit around the sun. Because of this tilted axis and yearly rotation, there are varying photoperiods and temperature variances to which organic life in the cooler parts of the earth is adapted.

Most temperate and arctic area plants require a cool period of weeks or months for certain biochemical changes to take place before normal regrowth can take place. I believe that freezing temperatures are never beneficial and that in the beginning, many had a built-in tolerance to freezing, which probably wasn't needed prior to the post-deluge era. Thus the tolerance cannot have evolved.

Prior to the flood, a vapor canopy may have prevented extremes of heat and cold throughout the earth. There are strong evidences that freezing temperatures were unknown at that time. There were many types of organic life prevalent in large numbers that are unknown today apart from fossil remains; of which a few are still preserved by quick freezing and are in their frozen state. Siberia and Alaska abounded with fossil plant and animal species that were intolerant to cold.

### Information on Dormancy

In an excellent article on "Seed Stratification" by Dr. Harold Pellett, Department of Horticultural Science, University of Minnesota, St. Paul, Minnesota, seed dormancy is covered quite thoroughly.[1] And another article by Dr. Thomas O. Perry of the School of Forest Resources, North Carolina State University, Raleigh, N. C., "Dormancy of Trees in Winter," is an excellent summary of most of the known phenomena of tree dormancy.[2]

Woody plants of temperate areas flush with rapid terminal growth as warm night and extended day length arrives in the spring. Most plants with pronounced annual growth rings have a very short period of terminal growth which, in many cases, is pre-formed in late summer of the preceding year. Pine and red oak are prime examples. These trees set terminal buds immediately after the early growth elongates and will not renew terminal growth until the following spring unless it is pruned severely or defoliated or receives some other unusual treatment. (A long, hot, moist summer may be enough.)

Plants like birch, maple and apple with indistinct annual growth rings continue to elongate in spite of shortened days. Temperature and water supply seem to determine time of cessation of twig tip elongation and bud set. An extended chilling period is necessary before normal new growth can take place. Trees like juniper may not have a true dormancy requirement.

Cambial expansion is continual throughout summer months as long as there is adequate water and warm temperatures. Some observers think that the cambium has no true dormancy but others disagree. It is generally agreed that the roots of woody plants do not have a dormancy requirement.

Spring flowering bulbs such as tulips, narcissus and hyacinths require a chilling period before normal growth can take place. Spring flowering plants set their flower buds in July and August shortly after the spring flush of new growth.

Dormancy can be classified into early dormancy, mid-dormancy and late dormancy. The first stage of dormancy begins in mid-summer but cambial meristem continues activity. Cellulose in the first formed cells in reduced and lignin formation is accelerated. Fats and starches are stored in the wood tissues, buds are formed containing the leaf primordia in preparation for the next spring growth flush.

As cool weather and short days arrive, cambial action ceases. This is what plant men call the hardening off period. At this time there is an increase of some types of enzymes including abscisic acid. These enzymes are involved in leaf abscission and the transition from early to mid-dormancy.

In reality, as long as the temperature is above freezing, there is no true dormancy. Buds grow in size, and in quantity and types of enzymes. There is a reduction in polphenolozidase and phenols and an in-

*(Continued on page 127)*

*Albert B. Ferguson receives mail at Caixa Postal 699, 50.000 Recife, Pe., Brazil.

# PANORAMA OF SCIENCE

### Comets Recent—Surely Solar System Likewise

There are many attempts to evade the plain evidence for a young universe provided by comets. For comets are observed to "wear out" relatively quickly; they simply could not have formed part of the Solar System for billions of years. A popular way of avoiding the obvious conclusion has been to appeal to the idea, due evidently to Oort, of a "reservoir," out beyond the orbit of Pluto, containing huge numbers of comets in "cold storage," from which one is now and then perturbed into action. Now a paper has appeared which should finally lay this notion of the reservoir of comets to rest.[1]

The paper cited contains so much information that only a few points can be mentioned. It is shown that all the alleged evidence for the shell of comets is, in fact, a misinterpretation of evidence. The author describes the shell of comets as "mythical"; and remarks that part of the reason why it has been accepted so generally is that ". . . others . . . took its existence for granted . . ."

The conclusion reached is that ". . . the great majority of comets must be fairly recent acquisitions by the Solar System." And so they are (although the author does not make this point), because the Solar System is fairly recent. The comets, in fact, provide good evidence of the youth of the Solar System.

### Dogma vs. Fact in Vitamin Research

Most readers know about the controversy about vitamin C, in which Pauling, especially, has been engaged. Some investigations reported recently[2] may be worthy of notice, however.

Experiments, carried out on guinea pigs, showed that while it is true that certain amounts of the vitamin are sufficient to prevent scurvy more or less completely, it is not true that amounts greater than those are useless. In fact, amounts up to 20 to 40 times the common dose showed good effects, in terms of general growth, speed of healing of wounds, etc.

The author of the article in which the work is described complains about the ". . . crippling but time-honored assumptions . . . (that) . . . ascorbic acid functions merely to prevent scurvy, and secondly, that within a species a narrow range of needs must of necessity exist . . ." Those who are concerned with vitamins are asked to ". . . ascertain the actual facts, in contrast to those which fit most gracefully into preconceived ideas and dogmas . . ."

Although this work has to do with vitamin C, it is asked, very reasonably" . . . can there not be comparable uncertainty with respect to other vitamins . . ."

Does this not sound familiar? What more crippling assumption could there be than that of uniformitarianism? Does Darwinism not provide a preconceived dogma, so that facts which fit gracefully into it, if there be any such, are chosen? It is admitted that there is uncertainty about the origin of e.g. birds. It is not likely that, as far as evolution goes, there is comparable uncertainty about all origins?

Here, as in many other fields of science, the stultifying effects of prejudice, of making up one's mind before the facts are in, are becoming apparent. The same effects are evident in the closed state of mind of evolutionists.

### Do Index Fossils Need Re-Indexing?

A person who has not previously studied geology is usually amazed to find that the ages of rocks are not determined by fossils of dinosaurs, mammoths, etc., but supposedly by fossils of tiny sea-creatures such as the foraminifers.

Of course, it would be desirable to correlate the presence or absence of several kinds of fossil; and that is often done. Sometimes, it would appear, the results are fairly satisfactory; sometimes they are not.

It is concerning matters of this sort that a controversy has been manifested in the journal *Nature*.[3, 4] As the summary of the matter said, the discoveries ". . . seemed to invalidate the timing of what was thought to be one of paleontology's most reliable datum planes—the first appearance of the planktonic foraminifer, *Globorotalia truncatulinoides*. This plane had always been taken to mark the onset of the Pleistocene about 1.8 million years ago."

The controversy continues. Whatever the outcome, one might be delineation that many of the geological ages are based on rather flimsy evidence.

### Can Racemization Indicate Ages?

The process of racemization seems to be taking a place along with the decay of carbon 14 and other radioactive isotopes as a way of attempting to determine the ages of remains. Racemization applies especially to bones.

Certain of the organic materials in living things can exist in both the right-hand and the left-hand form. However, in actual living things, only the left-hand form is found. (This fact is itself an argument against uniformitarianism, as has been noted before.)

When some living being dies, however, the materials start to turn into the right-hand form, at least partly; and the end result is a mixture of the two forms. It is possible, by suitable analysis, to find the proportion of the two kinds, and thus, the rate being supposed known, to calculate how long ago the living thing died. Similarity to the studies with carbon 14 is apparent.[5]

The rate of the racemization, a chemical process, is known to depend strongly on the temperature, as do most chemical rates. Thus a letter,[6] in commenting on the method, has maintained that the method cannot yet be considered reliable, because of the possible effects of temperature, and maybe other things, too.

It might be remarked, in addition, that surely the possible presence of catalysts should be considered under "other things." The way in which a catalyst, present maybe in a very small amount, can speed up a reaction, is well known. Possibly something similar could be involved in racemization.

### Another Anomalous Proportion of Isotopes

Something ususual has been found in uranium in a deposit at Oklo, in Gabon, Africa. Ordinarily, the uranium consists mainly of the isotope 238. Generally, there is also a certain small amount of the isotope 235, which might be called the explosive one. The uranium

at Oklo does contain some type 235, but in some samples not much more than half of what is commonly found is present.[7]

It appears, then, that under certain circumstances, arising naturally, the proportions of radioactive isotopes can differ rather widely from what is expected.

It is common, as is well known, to try to determine the ages of rocks from the amounts of various isotopes present. Had any such attempt been made at Oklo with the uranium, the results would plainly have been meaningless. This can be another piece of evidence to show that alleged ages, obtained by such methods, should be viewed with much reservation.

### Uniformitarian Theorists Cannot Explain the Moon

The Moon, as well as inspiring song-writers and poets, continues to provide stumbling-blocks for evolutionists regarding the origin of the Earth.

It is hard to believe, in any uniformitarian theory, that the Earth and the Moon formed simultaneously, in more or less the relation in which they are now. So it is usually supposed that either one body broke apart to form the two ("fission"); or else that the Moon, having been formed separately, was acquired by the Earth some time later ("capture").

The author of an article on the subject has pointed out that either of these concepts involves difficulties.[8] As for *fission,* it is hard to believe that the Earth once spun rapidly enough to throw off the Moon. Moreover, if that had happened, why is the Moon's orbit inclined to the Earth's axis?

It is not clear, on the other hand, that a planet can capture a satellite. As the author wrote: "Capturing a satellite, as it turns out, is most difficult." An attempted capture would give something with an orbit still around the Sun; as, indeed, has happened to the comets "captured" by Jupiter.[9]

The conclusion is, that as far as uniformitarian ideas of the origin of the Moon go, all models ". . . fall considerably short of a satisfactory explanation . . .".

The Creation of the Moon, on the other hand, as set forth in the Biblical record, offers no real difficulty to anyone who does not let prejudice keep him from admitting the possibility of Creation.

### Planetary Orbits Prove Nothing About Origins

One result of the continuing controversy about Velikovsky's suggestions is that some questions, which were considered to be closed, have been re-opened. One of these concerns some points of celestial mechanics. Perhaps it would be better to say that the results, long largely neglected, of a previous re-opening are now receiving some study.

The motion of a single planet around a Sun, considered as a problem in mechanics, is fairly simple. If there are several planets, however, they exert gravitational forces on one another. The problem of calculating the motion then becomes impossible, except by a series of approximations. Astronomers call these effects of the other planets "perturbations."

Newton believed that these perturbations might eventually make the Solar System unstable in some way, unless God should intervene to set it right again. Laplace, Poisson, and others, in the eighteenth and nineteenth centuries, believed that they had shown that the perturbations remain limited in their effects, so that the orbit of a planet, for instance, would merely vary back and forth slightly about some mean orbit. This is still often stated or written as a fact.

Unfortunately, the solution is worked out in infinite series, which may not converge unless the disturbances are small. So the stability was assumed in trying to prove it; the question was begged. This has been known since the end of the last century.[10, 11]

The possible instability of orbits is perhaps not so directly concerned with Creation. What is of interest is the fact that if some unusual event should occur in the Solar System, the planets, because of mutual interaction, would afterwards settle into a configuration something like the present one; described, to note only one feature, by Bode's law.

The point of this is that, even just according to the mechanics, the present configuration of the Solar System might have come from any one of a very great number of earlier configurations. It is something as if billiard balls had been "broken" violently; one could not calculate back, after they had come to rest, to find how they were moving shortly after the "break."

Thus, any attempt to determine from the present configuration of the Solar System the nature of a nebula, or swarm of "protoplanets," or something of the sort, whence it would be alleged to have originated, is bound to be inconclusive.

### Astronomy and Chronology

Not only is astronomy a science of import, but also it has a related interest to those who believe the Bible. This is because of applications, legitimate or otherwise, of astronomy to chronology. Some information which may have a bearing on such applications is available.

In two more articles, a researcher has continued to point out places in which, it is argued, the data given in Ptolemy's Almagest were fudged.[12, 13] It is not likely that those particular data will be used in chronology. But other data from Ptolemy might be; and when some data are found to have been fudged one is inclined to look very carefully at other data.

Whatever anyone may think about Velikovsky's views on astronomy it must be admitted that he has studied ancient records very carefully. So his views on chronology deserve at least a hearing. He has maintained that many of the astronomical methods, and in particular the "Sothic" method, by which the dates of events in ancient Egypt were established supposedly, are worthless. Indeed, they serve to perpetuate a chronology which had been set up, apparently by conjecture, before the hieroglyphics had been deciphered.[14]

Much the same must be said, it has been claimed, about many—but not all—of the attempts to establish ancient dates from remarks about eclipses.[15]

Indeed, there is evidence to show that the term "eclipse" may not necessarily have meant in ancient times as restricted a range of phenomena as it does now. For instance, Luke in chapter 23, verse 45, stated literally, in the Greek, that the Sun was eclipsed at the time of the Crucifixion. There was, indeed, darkness. But it could not have been an eclipse in the astronomical sense. The time was the Passover—

the full Moon. The Moon was on the wrong side of the Earth to cause an eclipse of the Sun. Evidently "eclipse" just meant a darkening or hiding, whatever the cause.

Again, some authors wanted to interpret certain ancient inscriptions as referring to an eclipse of the Moon on the 25th of the month, or of the Sun on the 26th. But there can be no eclipses on those days of a lunar month; eclipses of the Sun can come only about the beginning or the end of the month, those of the Moon about the 14th or 15th.

### More Evidence of a Catastrophe?

Another example has been found of a "hiatus" in the deposits on the floor of the ocean. This particular hiatus involves the time of the early Oligocene (according to the conventional geological names), and was found in the north-eastern Indian Ocean. The writers suggest, however, that it might be world-wide.[16]

It is worth while for creationists to make note of findings of this sort; for they may be useful in working out a more detailed account of what happened during the Flood.

### Are Footprints Becoming Scientifically Respectable?

Footprints will be familiar to many readers, from the well known film, *Footprints in Stone,* and from other reports. However, reports of such findings can be seen in other scientific journals.

Editors of *Nature* have published the photograph of a footprint, which, according to the report,[17] was found in volcanic ash near Demirköprü, Turkey, in 1970. The print is now in the Museum of National History, Stockholm. It is said that the print seemed to have been made by one running toward the River Gediz. The estimated age is said to be 250,000 years.

The similarity of some to the circumstances to those connected with the prints found near Glen Rose, such as the appearance of haste, and the association with a river, is striking. Incidentally, this print does not appear nearly so convincing as some of those from the Paluxy River.

### A Distinction Needed

It has been common, in these pages and elsewhere, to distinguish between micro-evolution, which is what happens in e.g. plant breeding within kind, and macro-evolution, which is what evolutionsists usually claim e.g. change over time *across* kinds. The distinction, of course, is not new, having been made, for instance, in *Science Is a Sacred Cow* by Standen.

There are those who say that the "micro-" process should not be called "evolution" at all; and certainly they have a point. But others present evidence for the "micro-" changes, which, indeed, nobody denies, and then talk as if this were also evidence for the "macro-" process. So it is worth while, now and then, to remind readers that a distinction must be made.

The present purpose here, however, is to suggest the need of another distinction. It is proposed, in fact, that those who talk about evolution should distinguish between "one-shot" and "continuing" evolution. (To propose this distinction is not to admit that either occurred. But it is always possible to say to an oponent: "I do not agree with you in any event; but at least you might try to argue logically." And, in fact, since distinctions are ways of getting at the truth, and since the truth is on the creationist side in the controversy about origins, creationists can expect that ultimately any *true* distinctions will be advantageous to creationism.)

To be specific: In talking about the "origin of species," evolutionists make much of the uniformity of things; they try to hold that supposed causes which brought about the diversity of living things are still active. If that were so, then evolution should still be going on. So that would be "continuing" evolution.

On the other hand, some talk, usually rather loosely, about the "evolution" of "life," i.e. of living things, or even of the universe. Nobody, presumably, would maintain that such events are happening now just as they are alleged to have happened in the past. So if the origin of living things, or of the universe, be called evolution, then such events would have been cases of "one-shot" evolution.

The reason for making the distinction between "continuing" and "one-shot" is the same as that for the distinction between "micro-" and "macro-." If the distinction is not made, some people will present, what is claimed to occur, as something in support of "continuing" evolution, e.g. something about white and black moths. Then it will be assumed tacitly that the same thing serves as evidence for some "one-shot" evolution. But, of course, nothing could be farther from the truth. It is conccivable that the universe and a few kinds of living beings might have originated by special Creation, and the diversity of living things come about by variation and selection.

Indeed, Darwin, at times, suggested something of the sort. On the other hand, if the universe, and some living things could have come about by what might be called "evolution," it would still be possible that further kinds of living things could have been created directly. Indeed, some creationists hold a view somewhat akin to this: that after the Flood, God intervened directly to increase the diversity of living things. Certainly such a thing could have happened, but it is beyond the present purpose to discuss the idea further.

The point to be made now, however, is clear: anyone who wants to hold both "continuing" and "one-shot" evolution needs to substantiate both concepts, separately. And that, creationists maintain, is what cannot be done.

### Analogy Casts Doubt Upon Natural Selection

For Darwinism, whether of the "neo" or the "paleo" variety, two things have to be supposed: changes in living things, and some way of maintaining at least some of the changes. The second item is by no means unimportant; anyone who has ever been in a "tug of war" knows that holding what has been gained is as important as gaining.

It is for the purpose of "holding," of course, that natural selection is invoked. Someone has said that it is a "rachet" to hold what has been gained. The analogy is to the ratchet in a ratchet-type automobile jack, for instance. The ratchet holds the automobile at the fraction of an inch by which it has been lifted, while the lever may be lifted some more.

The analogy is clever, but is it truthful? First of all, the motion of the lever, which would correspond to variations in living things, is certainly not a random thing. No, the lever is moved up and down in purposeful strokes of the right length; to rattle it up and down at random would not accomplish desired results.

There is another analogy which may be more to the point. Consider the arrangement of electrical parts, shown, in the conventional way, in Figure 1.

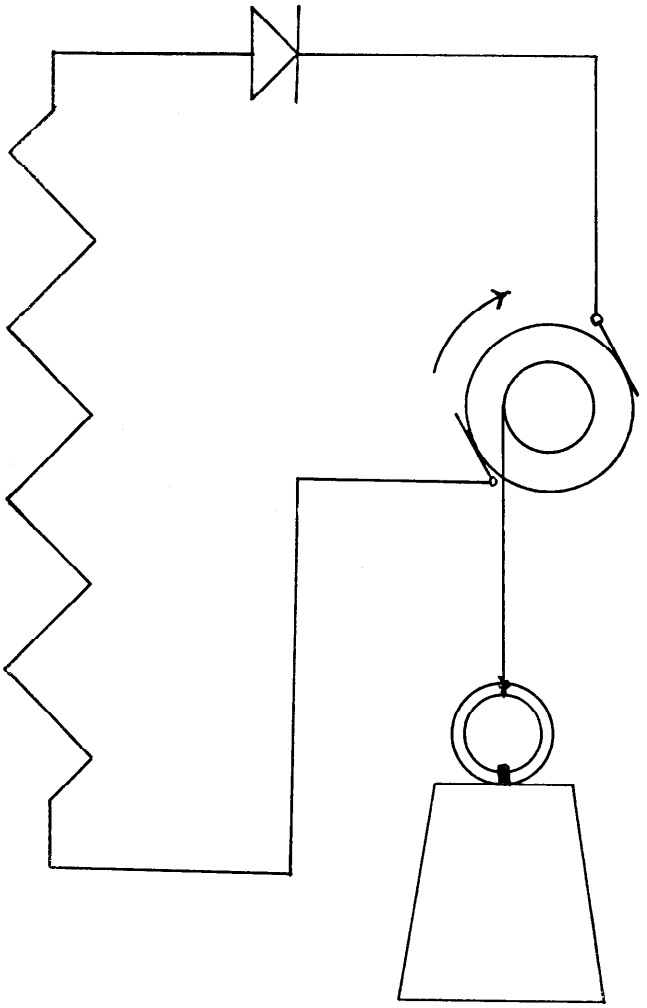

**Figure 1. As electrical noise cannot lift the weight, so "genetic noise" cannot lift the level of complexity of organisms.**

The resistor, shown by the zig-zag, has electrical "noise"; electrical current tends to flow back and forth in it in a random way. This electrical noise would show up as noise in a radio receiver, for instance, hence the name; in a television set it would appear as "snow."

Because of the rectifier, shown by the arrow-head, electrical current will flow in one way, but not in the other. So an electric current is set flowing in the electric motor, to make it turn and, for instance, lift a weight, as represented in the illustration.

While the proposed arrangement seems plausible, engineers agree that it would not work. It is not in conflict with the conservation of energy, for the resistor would take in heat from the surroundings; but it is in conflict with the second law of thermodynamics. For one statement, or consequence, of that law is that it is impossible to have a device which, working indefinitely, will take in heat and convert the heat into mechanical work, such as that done in lifting a weight.

The "catch" seems to be that in the rectifier, and perhaps in other parts of the arrangement, there will be other electrical fluctuations which, on the average, will just counteract those in the resistor. Thus nothing would be accomplished.

Is it not likely that the natural selection, which in this analogy, might correspond to the rectifier, would fail to accomplish the alleged task of "holding" for a similar reason? Darwin, for instance, mentioned protogiraffes, which could eat off the tree-tops. But in times, or places, in which there was plenty of grass the long neck would be no advantage; it might well be a disadvantage, by making the animal clumsier, for instance.

So, just as fluctuations in the rectifier counteracted those in the resistor, fluctuations in the conditions under which animals live would counteract the variations which might have been advantageous had living conditions remained absolutely unchanging. So "variation and selection" lead nowhere, on the average.

Incidentally, "survival of the fittest," which is the same notion as selection, is denied flatly in Ecclesiastes 9:11.

—Contributed by H. L. Armstrong

### Squirrel Shopping Habits Do Not Prove Evolution

Plants like the lodgepole pine *(Pinus contorta)* now select fewer seeds and more seed protection in supposed evolutionary responses to seed predators, according to Phillip Elliot.[18]

In the last several years two theories have been proposed as to how plants react to seed predation: some workers claim that seed predators discriminate between trees on the basis of which tree will yield the highest feeding rate, thus selecting for fewer seeds per cone; while others postulate that seed predators select for smaller seed size by killing a higher percentage of the seed crop of trees with fewer but larger seeds.

Elliot maintains that evidence now seems to show that the first view above is more tenable, because seed predators have been found to choose cones from trees that have the most seed per amount of cone material.

The author claims that the pine squirrels *(Tamiasciurus hudsonicus)* discriminate between the lodgepole cones upon which they feed. The squirrels apparently select on the basis of visual stimuli, usually on the width of the cone and the shape of the cone in relation to its attachment to the branch. From these stimuli squirrels determine the number of viable seeds per cone and the ratio of total seed weight to cone weight.

Research was done in the lodgepole forests of southwestern British Columbia: three pine-squirrel territories were marked out and sample data were collected from each plot. Elliot states that the method used in measuring predation intensity, "though based on estimations and extrapolations, affords a great advantage in that it takes into account the trees' past history of experienced predation" (p. 225).

Upon the completion of sampling, computer multiple regression analysis produced a statistical model

regarding the degree of predation experienced by a given tree during its lifetime as the dependent variable, and cone and seed characteristics which dictate a squirrel's feeding preference as the independent variables. The analysis yielded five independent variables as statistically significant: cone width, number of viable seeds per cone, ratio of cone length to cone width, proportion of cone length from the widest point to the apex of the cone, and per cent of total cone weight in seeds.

Elliot concluded that these factors generally determine which trees the squirrels feed upon. Since those trees having cones characterized by the significant factors will suffer more predation than those which do not, they will not produce as many new trees over the years. Gradually, natural selection will yield lodgepole forests characterized by different factors, and Elliot reasons that those trees whose cones have more seed "protection" per seed will eventually become dominant.

Elliot must be given credit for the depth and completeness of his research despite the fact that his results did not follow his expectations. In two of the three plots, the five independent factors selected were not statistically significant. This deviation from the predicted may be the major weakness in Elliot's ideas, because his findings actually support his contentions in only one of three cases!

Elliot states it is necessary "to point out that *how* a squirrel determines seed number or the proportionate amount of seed weight in the total cone weight is not the critical point" in his research; instead, his main concern is "identifying the *effects* of . . . selection in terms of the evolution of plant reproductive characters" (p. 229). But to demonstrate evolution, one must not merely present the supposed effect, but also some specific cause.

Even if the pine squirrel *is* a selecting agent for *Pinus contorta*, despite the statistical problems the author found, evolution is not supported or even indicated. The case may be likened to that of the English peppered moth (*Biston* sp.) where no true "evolution" has taken place, but where the population balance has simply shifted.

If Elliot's proposal is correct, *true* evolution is not taking place, but over the years the phenotypic ratio is simply being changed so that there will be more lodgepole pine trees with "protected" seeds than there were before. Any evidence of "evolution" might come from a consideration of the lodgepole fossil record, something Elliot has not discussed. Elliot has no case for evolution.

—Contributed by Bart Clarke,
Los Angeles Baptist College.

**Desert Survival and Four-carbon Photosynthesis**

The highly efficient photosynthetic four-carbon plants are the subject of an article by Bjorkman and Berry, who show that these plants are adapted to conditions of high temperature, low water supply, and low carbon dioxide concentration.[19] The highest rates of production of the four-carbon plants are reached during the dry months of May through August. Some are found in arid localities such as Death Valley.

The four-carbon plants seem to acquire a large number of carbon dioxide molecules without losing too much water through stomates. The efficient method by which these plants maintain such a high rate of photosynthesis while experiencing a relatively low water loss is the concern of these authors.

The "secret" of the four-carbon plant is that it has two photosynthetic cycles instead of just one. In the normal photosynthetic process, carbon dioxide enters the Calvin-Benson cycle directly, forming a three-carbon molecule known as phosphoglyceraldehyde (PGAL). In the four-carbon plants, the carbon dioxide first enters a completely different cycle before reaching the Calvin-Benson sequence:

(a) The carbon dioxide reacts first in the mesophyll cells with phospho-enol-pyruvate (PEP), a three carbon compound, to form a four-carbon compound called oxaloacetic acid (OAA).

(b) The OAA forms malic and aspartic acids (also four-carbon acids) which enter the bundle-sheath cells and release a carbon dioxide molecule to the Calvin-Benson cycle.

(c) Four-carbon plants have a complex array of cells forming concentric cylinders around the fine veins of the leaf—budle sheath cells.

(d) The three carbons of an aspartic acid, which remain after the carbon dioxide is released, form a pyruvate, which again enters the first cycle.

Thus the first cycle does not yield a product as such, but is simply a device in which carbon dioxide is fixed and transferred to the Calvin-Benson cycle with great efficiency.

While the leaf of a three-carbon plant must be saturated with carbon dioxide for proper functioning, the four-carbon plant, by virtue of this process, can utilize carbon dioxide in the cell even at extremely low concentrations. As the authors point out, because of this efficient use of carbon dioxide in the four-carbon leaf the stomates are closed longer, thereby reducing water loss.

The authors point out that many agricultural crops are of the four-carbon type. They correctly suggest that agriculturalists consider the possibility of widely cultivating four-carbon domestic plants in areas that are now desolate. This is a timely subject in a world where people are looking for additional sources of food.

On page 93, Bjorkman and Berry add a new twist to the supposed "proofs" of evolution. They admit that many of the four-carbon plants are in no way related to other four-carbon plants but that each "evolved" this cycle independently of the others. Usually when one envisions evolution, he thinks of a series of links. According to these workers, however, each different type of four-carbon plant evolved independently through the millenia past.

But if it is unlikely that even one plant group would produce the enzymes and anatomical modifications involved in four-carbon photosynthesis, how probable is it that 100 plant genera from over 10 different families would undergo these complex evolutionary changes independently? It seems more logical to attribute the similarities in design to the various four-carbon plants to an Omniscient Creator.

After a moment's reflection, it seems obvious that a three-carbon plant would have to possess ALL the

essential enzymes and anatomical changes required for the four-carbon process if the cycle is to be of "value." Yet how could a three-carbon plant gradually acquire the necessary enzymes and other changes in response to drought or high temperature? Here is another instance in which well-adapted systems appear in certain plants with no links to show any supposed gradual evolutionary development.

Just as a bat's wing is of little value before it is completely functional, the four-carbon cycle would be of little or no value in conserving moisture until fully developed. Yet it is inconceivable according to present mechanisms proposed for natural selection that either a bat's wing or four-carbon photosynthetic equipment could form quickly and completely as would be required for survival value in neo-Darwinian evolution.

Unwittingly, Bjorkman and Berry present a strong argument for rapid action in Divine special creation of the four-carbon photosynthetic apparatus as a moisture conserving and highly efficient photosynthetic sequence in various "unrelated" plant groups.

—Contributed by Orville C. Murphy and George F. Howe, Los Angeles Baptist College.

### Setting the Record Straight

At least since November, 1972 editors of *Science* have periodically referred to the majority "opposition" of "evolutionary" biologists to attention by parents and others "to the teaching of evolution theory," as one author used the expression recently.[20] And in an associated "briefing" column[21] the Creation Research Society was mentioned, as if the **organization** was a part of "a nationwide campaign by fundamentalists to adulterate the teaching of evolution." (Of course determined, dedicated evolutionists are, in their way, fundamentalists too! Most evolutionists have a *prior commitment* to a particular ideology as seen in Simpson, G. G. 1964. *This View of Life.* The World of An Evolutionist. Harcourt, Brace and World, Inc.)

Thus another denial of *any* political or lobbying action by the Creation Research Society must be asserted once again. Only individual C. R. S. members have been associated at all with actions in California, Texas, Tennessee, Ohio, and other states; where parents have expressed criticisms of schools, because they felt that their children's values and beliefs were being altered undesirably.

Members of the Creation Research Society, in addition to sponsorship of publication of the *C. R. S. Quarterly,* have only tried to be of service, *as individuals.* C. R. S. members are quite active, *as individuals,* in pointing out the "bankruptcy" of terminology used by "evolutionary" writers, which is so well illustrated in various series of articles in recent months in *The American Biology Teacher,*[22] *Science,*[23] and *Scientific American.*[24]

Authors repeatedly utilize such terms as "could," "might," "suppose," "suggest," and "expected" with regard to ideas of first origins, which are absolutely untestable, and hence are outside of good, solid scientific investigation. Even the word, "scenario," is used as authors in *Science* have *imagined* aspects of origin of the moon. Since when has scenario writing, i.e., play writing, become a part of *scientific* endeavor?

This writer maintains regularly in public addresses that evolutionists include supernatural events—supra natural or beyond the natural—in their thinking about some "big bang" explosion to start the universe, spontaneous generation of first life at the sub-microscopic level or organization, movement of dry rocks in supposed mountain building and initial continental drift, plus accidental mutational changes (errors) in the appearance of humankind. None of the *imagined* changes are natural, nor repeating, and hence evolutionists do dabble in the supernatural.

In short, evolutionists have been teaching a purely **imagined** belief system about first origins in the public schools at most levels for the last three decades, if not the last 100 years. I hold that the late Julian Huxley and his sycophantish followers in the public schools, with their "evolutionary" humanistic faith, are the ones who have been violating the so-called separation of church and state. Parents rightfully criticize school systems wherein teachers of their children are guilty of selective indoctrination of the young into one belief system about origins, **at taxpayers' expense**—especially so, if that belief system is diametrically opposite to beliefs about first origins taught in the home.

—Contributed by John N. Moore

### References


[1]Lyttleton, R. A. 1974. The non-existence of the Oort cometary shell, *Astrophysics and Space Science,* 31(2):385-401.

[2]Yew, Man-Li 1973. "Recommended daily allowance" for vitamin C, *Proceedings of the National Academy of Sciences U.S.A.,* 70(4):969-972.

[3]Theyer, F. 1973. *Globorotalia truncatulinoides* datum plane: evidence for a Gauss (Pliocene) age in subantarctic cores, *Nature Physical Science,* 241(112):142-145.

[4]*G. truncatulinoides* in dispute, *Nature,* 244(5411):74. 1973.

[5]Gish, Duane T. 1975. The amino acid racemization dating method, *ICR Impact Series,* issued with the Institute for Creation Research Acts and Facts, 4(3):April.

[6]Bender, M. L. 1974. Reliability of amino racemization dating and paleotemperature analysis on bones, *Nature,* 252(5482): 378-379.

[7]Smith, Peter J. 1974. The Oklo phenomenon, *Nature,* 252 (5482):349.

[8]Hammond, Allen L. 1974. Explaining the Solar System (III): whence the Moon, *Science,* 186(4167):911-913.

[9]Compendium. *Pensée,* 3(3):22-24. 1973. See remarks about an argument in a thesis, on page 24, left.

[10]Bass, Robert W. 1974. Did worlds collide?, *Pensée,* 4(3): 8-20.

[11]Bass, Robert W. 1974. "Proofs" of the stability of the Solar System, *Pensée,* 4(3):21-26.

[12]Newton, R. R. 1975. The authenticity of Ptolemy's parallax data, Part II, *Quarterly Journal of the Royal Astronomical Society,* 15(1):7-27.

[13]Newton, R. R. 1975. The authenticity of Ptolemy's eclipse and star data, *Quarterly Journal of the Royal Astronomical Society,* 15(2):107-121.

[14]Velikovsky, Immanuel. 1973. Astronomy and chronology, *Pensée,* 3(2):38-49.

[15]Newton, R. R. 1974. Two uses of ancient astronomy, *Philosophical Transactions of the Royal Society of London. Series A,* 276(1257):99-116.

[16]Pimm, A. C., and J. G. Sclater 1974. Early Tertiary hiatuses in the north-eastern Indian Ocean, *Nature,* 252(5482):362-365.

[17]Barnaby, Wendy 1975. *Nature,* 254(5501):553.

[18]Elliot, Phillip F. 1974. Evolutionary response of plants to seed eaters: pine squirrel predation on lodgepole pine, *Evolution,* 28(2):221-231.

[19]Bjorkman, Olle, and Joseph Berry 1973. High-efficiency photosynthesis, *Scientific American,* 229(4):80-93. October.

[20]Walsh, John 1975. NSF: Congress takes a hard look at behavioral science course, *Science,* 188:426-428. (2 May)

[21]Fundamental setback for fundamentalists, *Science*, 188:428. (2 May) 1975. See further incorrect mention of Creation Research Society, as supposedly part of some "campaign": Moore, John A. 1975. On giving equal time to the teaching of evolution and creation, *Perspectives in Biology and Medicine*, pp. 405-417. Spring.

[22]Aulie, Richard P. 1974, 1975. The origin of the idea of the mammal-like reptile I, *The American Biology Teacher*, 36 (8):476-484, 511 (November); II, 36(9):545-553 (December); and III, 37(1):21-32 (January, 1975).

[23]Hammond, Allen L. 1974. Exploring the solar system: (I) An emerging new perspective, *Science*, 186:720-724 (22 November); William D. Metz. (II) Models of the origin, *Science*, 186:814-817 (29 November); and Allen L. Hammond. (III) Whence the Moon?, *Science*, 186:911-913 (6 December).

[24]Valentine, James W. and Eldridge M. Moores 1974. Plate tectonics and the history of life in the oceans, *Scientific American*, 230(4):80-89; Bishop, J. A. and Laurence M. Cook 1975. Moths, Melanism and Clean Air, *Scientific American*, 232(1): 90-99; Hallam, A. 1975. Alfred Wegener and the hypothesis of continental drift, *Scientific American*, 232(2):88-97; Bakker, Robert T. 1975. Dinosaur renaissance, *Scientific American*, 232(4):58-78. (Note: In the latter article the author proposed that dinosaurs were not obsolescent reptiles but a novel group of "warm-blooded" animals!)

# BOOK REVIEWS

*Physical Science for Christian Schools* by Emmett L. Williams and George Mulfinger. 1974. Bob Jones University Press, Greenville, South Carolina 29614. 628 + xi pages. $15.00.

Reviewed by Ron Dickey*

From the finest detail of the most easily read type to the unique sketches and outstanding illustrations and diagrams, those responsible for the production of this book have succeeded in developing a text of very superior quality.

The introduction contains excellent suggestions on how to study science. In the first unit, science is defined and placed in proper perspective in society, both the strong points and the limitations of science being stated.

Limitations, it must be said, are too often not made clear in textbooks. In this book, the authors clearly show, for instance, that, contrary to popular belief, science does not result in final or absolute answers or truth. Neither can scientists, as scientists, prove a universal negative, or make value judgments. Indeed, things like matter, energy, and gravity are not really fully understood by scientists.

Points such as these are very well explained; and I feel that they should be understood by any science student.

The importance to the scientist of facility in math and in English grammar, as well as discipline in work habits, is pointed out. Throughout the text each topic is made relevant to the present-day society; at the same time historical developments of many of the major principles of physical science are traced. Along with this, there are biographical sketches of outstanding scientists who have contributed significantly to the topic being studied.

Each topic is treated in a depth, and with a wealth of detail, found in few other present grade nine texts. The coverage is so clear, lucid, and interesting that it is easy to understand the ideas; yet as complete as one could hope for at this level. The classification of matter, the introduction to measurement, and the introductory chemistry are but three examples of the good qualities mentioned above.

Another superior feature of the book is the large number of excellent questions, problems, and student activities; plus a list of terms, found at the end of each chapter.

*Ron Dickey, B.A., is Head of the Department of Science at the Frontenac Secondary School, Kingston, Ontario, Canada.

Yet a strong point of the book might also be a weakness. The depth, quality, and quantity of material covered make the text long enough for two complete years of science, or two courses. Thus some might consider the cost prohibitive if the book were utilized in only one course. Perhaps two separate books, one ending at unit VII, the other beginning at unit VIII, might have been better, or might yet be considered.

The following topics are especially noteworthy, either because of their unique treatment, or because they are not usually found at all in a grade nine text.

1. The creationist viewpoint is presented and compared with the "evolutionary" one wherever this is applicable to the material being covered. For example, the Flood model for the origin of fossil fuels is clearly the most logical model.

2. There is an excellent treatment of the two laws of thermodynamics, which presents some of the most basic and important concepts of science. These concepts, which are often very difficult for beginning science students to understand, are presented in a lucid, interesting fashion.

3. The treatment of pollution and related questions is also very sane, clearly pointing out the pros and cons of control of pollution, and the dangers of extremes in these matters. For example, the authors point out that where a decision has to be made as to whether the production of food or keeping the environment free from certain insecticides is more important, the best decision may not necessarily be one favoring the environment. In that connection, the authors suggest that the greatest present-day pollution problem may be the pollution of the individual by drugs, alcohol, and tobacco.

In summary, this text contains one of the most comprehensive and realistic treatments of Introductry Physical Science which one could hope to find. The subject is presented in an interesting, often amusing, and always lucid fashion. Students studying from this text could hardly help but understand the process or method of science, and the dangers inherent in blindly accepting statements of supposed fact.

The authors really show the fallibility of man as they trace the "Great Ideas" or principles of science such as the periodic table from a historical perspective. They show how easily "honest mistakes" can be made, and show the importance of ever seeking for truth. They show, indeed, that only God is unchangeable

## 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 $8.00 (Foreign, $9.00 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 $8.00 (Foreign, $9.00 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: $11.00 (Foreign, $12.00 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.

---

*(Continued from page 108)*

crease in catalases and hydrolases. Growth inhibiters are reduced. Photosynthesis and respiration continue in evergreens and in the twigs of deciduous plants as long as temperatures are a little above freezing.

Temperatures of 4-5° Centigrade (35-40° F) seem most effective in satisfying mid-dormancy. Temperatures of near or below 0° or above 10° Centigrade are not effective in meeting the chilling requirement. After the chill requirement has been met, a temperature of near 25° C is needed for about two weeks or more before new growth can take place.

Generalizing from genetics studies, each type of plant species has certain variable potentials but definite limitations. Among seedlings there are variations in tolerance to heat, cold, fungi and insects, but no changes in basic types. Some plants like apple and crab *(Malus)* species cross and intergraft, but other plant families like the maples *(Acer)* are very fixed in types. Most maple species will not intercross or intergraft. There is often graft failure with different strains of the same species.

### Conclusions

The chill factor requirement of many plants in the temperate and arctic regions seems to demonstrate conclusively that these plants, from the time they were created, have had seasonal temperature changes. The continental drift idea does not seem to adequately fit with this fact.

Preservation and redistribution of plant life during and after the flood leave many unanswerable questions. There would be much free oxygen in the waters of the deluge and very few fungi spores; so seeds and plants would keep in viable condition for a long time.

Fiat creation by a super intellect could be the only explanation of this biochemical phenomena. The "evolutionary" solutions are hopeless. Those who accept the Holy Bible as the true Word of God by faith realize that He who made the physical substances has unlimited ability.

Oh, the depth of the riches and the wisdom and knowledge of God! How unsearchable are His judgments and unfathomable His ways. . . . From Him and through Him and to Him are all things. To Him be glory forever. (Romans 11:33 and 36)

### References

[1]Pellet, Harold. 1971. Seed stratification, *Proceedings of the International Plant Propagators' Society*, 23:266-275.
[2]Perry, Thomas O. 1971. Dormancy of trees in winter, *Science*, 171(3966):29-36.