

# Creation Research Society Quarterly

Haec credimus:

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

VOLUME 22

SEPTEMBER 1985

NUMBER 2



# CREATION RESEARCH SOCIETY QUARTERLY

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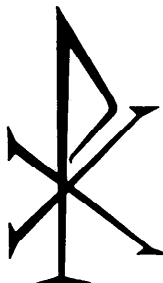
VOLUME 22

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NUMBER 2

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## COVER ILLUSTRATION

Since one of the papers discusses squirrels and the Grand Canyon, note this one enjoying his breakfast in a precarious position at the edge of the Bright Angel Trail. The "Battleship" appears slightly to his left and the trail to Plateau Point can be seen far below him to the right. A beautiful May morning in the Grand Canyon as viewed by the Editor.

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2. All basic types of living things, including man, were made by direct creative acts of God during Creation Week as described in Genesis. Whatever biological changes have occurred since Creation have accomplished only changes within the original created kinds.
3. The great Flood described in Genesis, commonly referred to as the Noachian Deluge, was an historical event, worldwide in its extent and effect.
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## TRIBUTE TO AN OUTSTANDING CREATIONIST: PROFESSOR HAROLD LEWIS ARMSTRONG (1921 - 1985)

Professor Harold L. Armstrong died on February 14, 1985 at the age of 63 after a brief and sudden illness. He had served for many years as a faithful member of the Creation Research Society (CRS) Board of Directors. He initiated one of the most readable and informative sections of the Quarterly—"Panorama of Science." From June 1974 until March 1984 he volunteered for the most demanding post in CRS—editor—serving longer than any other person in the history of the Society.

At Board meetings and in correspondence Professor Armstrong manifested brilliance and creativity coupled with humility, kindness, and consideration for others. The breadth of his research interests can be appreciated by studying his many articles in CRSQ and most of the undesignated passages in "Panorama" since its inception.

He was born in Picton, Ontario, Canada. He served with the Canadian Army overseas in the United Kingdom, central Mediterranean area, and continental Europe between the years of 1941 and 1945. He conducted a large part of his high school education by correspondence while in the military and finished high school upon discharge from the army.

He attended the Queen's University, Kingston, Ontario where he graduated with the Bachelor of Science degree in engineering physics in 1950. His outstanding performance as an undergraduate was marked by the award of the Medal in Physics and the Governor General's Medal of the Faculty of Applied Science. His studies in physics at Queen's continued under the supervision of Professor J. V. Hughes and resulted in the award of the Master of Science degree in 1951.

While working on the Master's program, Harold met his wife, Barbara, who was an undergraduate student at Queen's. They were married in June of 1952. They have two daughters (both born in the United States), a son (born in Kingston), and two grandchildren. Harold is survived as well by two sisters, three brothers, and his mother who is 90 years old and lives in Picton, Ontario.

Professor Armstrong worked at the National Research Council in Ottawa from May 1951 to March 1953 where he did research in semiconductor devices and electronic circuits. From then until September 1958 he continued this research for Clevite Brush Development Co. (Cleveland) and Pacific Semiconductors Co. (Culver City, California).

From September 1958 until his death, Professor Armstrong taught at Queen's University. The follow-



ing two paragraphs, authored by the Head of the Physics Department at Queen's University, are an indicator of Harold's role as a university educator:

Over a period of three decades as a professor of physics he displayed devotion to his students and his discipline, constantly seeking improved ways to convey the ideas and methods of physics in his lectures and in the teaching laboratory.

His contribution to the literature of science covers a variety of fields. His early works report advances in electronic circuitry and investigations of semiconductor devices. He has posed and explained numerous physics conundrums. But his most substantial contributions are to the literature of physics pedagogy, a field he leaves richer through his many innovations in university and high school laboratory experiments, lecture demonstrations and teaching methods.

But Harold Armstrong was more than researcher and teacher. He had profound faith in God as Creator and in the Bible as an inerrant record of origins. This faith, coupled with boundless energy, led him to become one of the most able defenders of scientifically-based special creationism. He will be deeply missed by his colleagues on CRS Board for his sparkling wit and profound comments as well as by the readers of the Quarterly.

George F. Howe

### QUOTE

But, on the other hand, there is the Doctrine of Creation. The world—this planet, that is—and everything in it were made by God and he called it good. To be sure, there was no "society" or "civilization" in Eden. But society and civilization were there, as it were, in *germ* — in the intelligence and imagination which God bestowed on man and in his charge to man to multiply and to subdue the earth.

We ruined it all, before we ever got started, at the Fall; and from that day all of our efforts to build society have been tainted, botched and bedeviled with futility. Nevertheless, the Christian will see the whole effort of history itself—our remorseless struggle to subdue the wilderness and to build cities and to shape an existence for ourselves that is worthy of the name human and not merely bestial—a Christian will see all of this as some sort of response to the divine charge.

Howard, Thomas. 1984. Mere Christianity; a focus on man in society in *The Christian vision: man in society*. Lynne Morris, editor. The Hillsdale College Press, Hillsdale, MI, p. 22.

## EDITORIAL COMMENTS

My most sincere apologies if the June *Quarterly* arrived late. In the transfer of the membership secretary duties from Bill Rusch in Ann Arbor to Glen Wolfrom in Terre Haute, the mailing label preparation was delayed. Hopefully this *Quarterly* will arrive on time.

The invited paper by Dr. H. S. Hamilton is an excellent refutation of the idea that the retina of the eye could have evolved. Stan Vaninger concludes his series on archaeology focusing on the radiocarbon dating method. Below is a selected bibliography of the papers that have appeared in the *Quarterly* dealing with the C-14 "age-determination" method. The Vaninger article should be compared with the thorough paper by R. D. Long (no. 13) on ancient Egypt and radiocarbon dating. Most of these referenced articles indicate that the Earth is quite young.

1. Acrey, D. O. 1965. Problems in absolute age determination. *CRSQ* 1(3):9.
2. Wood, R. W. 1966. The age of man. *CRSQ* 2(4):24-7.
3. Armstrong, H. L. 1966. An attempt to correct for the effects of the Flood in determining dates by radioactive carbon *CRSQ* 2(4):28-30.
4. Lammerts, W. E. 1966. How reliable is carbon 14 dating? *CRSQ* 2(4):31-2.
5. Brown, R. H. 1968. Radiocarbon dating. *CRSQ* 5:65-8.
6. Cook, M. A. 1968. Radiological dating and some pertinent applications of historical interest: Do radiological "clocks" need repair? *CRSQ* 5:69-77.
7. Whitelaw, R. L. 1968. Radiocarbon confirms Biblical Creation (and so does potassium-argon) *CRSQ* 6:78-83.
8. Whitelaw, R. L. 1969. Radiocarbon and potassium-argon in the light of new discoveries in cosmic rays. *CRSQ* 6:71-3.
9. Cook, M. A. 1970. Carbon-14 and the "age" of the atmosphere. *CRSQ* 7:53-6.
10. Whitelaw, R. L. 1970. Time, life and history in the light of 15,000 radiocarbon dates. *CRSQ* 7:56-71.
11. Hefferlin, R. 1972. A mathematical formulation of a creationist-Flood interpretation of radiocarbon dating. *CRSQ* 9:68-71.
12. White, A. J. 1972. Radiocarbon dating. *CRSQ* 9:155-8.
13. Long, R. D. 1973. The Bible, radiocarbon dating and ancient Egypt. *CRSQ* 10:19-30.
14. Clementson, S. P. 1974. A critical examination of radiocarbon dating in the light of dendrochronological data. *CRSQ* 10:229-36.
15. DeYoung, D. B. 1974. Geochemistry of the stable isotopes. *CRSQ* 11:34.
16. DeYoung, D. B. 1976. The precision of nuclear decay rates. *CRSQ* 13:38-41.
17. Tyler, D. J. 1977. The crisis in radiocarbon calibration. *CRSQ* 14:92-9.
18. DeYoung, D. B. 1978. Creationist predictions involving C-14 dating. *CRSQ* 15:14-6.
19. Tyler, D. J. 1978. Radiocarbon calibration—revisited. *CRSQ* 15:16-23.
20. Gladwin, H. S. 1978. Dendrochronology, radiocarbon and bristlecones. *CRSQ* 15:24-6.
21. Dillow, J. C. 1978. The canopy and ancient longevity. *CRSQ* 15:32.
22. Lee, R. E. 1982. Radiocarbon: ages in error. *CRSQ* 19:117-27.

The research paper by John Meyer on the origin of the Kaibab Squirrel and a suggested young age for the Grand Canyon was sponsored by the Research Committee of CRS. This type field work is possible using the Grand Canyon Experiment Station as a base of operation. Terrance Smith and Colin Brown examine the origin of mitochondria from the viewpoint of evolution and/or creation.

Dr. Robert Herrmann begins a series on the necessity for the existence of a "supermind" in the Universe and he attempts to restore causality in science using mathematical models.

I would appreciate any of your comments on the articles, technical notes, and letters to the editor that appear in the *Quarterly*.

Emmett L. Williams



## QUOTE

One must remember, though, that he [Augustine] lived no longer in the Athens of 800 years ago but in the period of mature Hellenism. For several hundred years all philosophical endeavor had centered on the problem of God. The Stoics had deified the cosmos itself, Plotinus's God was "The One," to whom to ascend was every soul's desire. Aristotle's "Unmoved Mover" was still playing a role in cosmology. Where the philosophers seemed to have groped for an answer, Augustine supplied his from the first book of the Bible: *Deus creator omnium*, God is the creator of all things. From the Bible he also drew an answer regarding God's essence. God had revealed himself to Moses through the words: "I Am Who I Am." God is "I Am," the one whose essence is existence. Aristotle had attributed to God the origin of movement, Plotinus the essence of unity; Augustine perceived that God is the Existent who creates existing things out of nothing. [parenthesis added]

Niemeyer, Gerhart. 1984. Augustine's political philosophy? in Morris, Lynne, editor. *The Christian vision: man in society*. The Hillsdale College Press, Hillsdale, MI, p. 55.

## INVITED PAPER

## THE RETINA OF THE EYE — AN EVOLUTIONARY ROAD BLOCK

H. S. HAMILTON\*

Received 16 August 1984; Revised 1 February 1985

## Abstract

*This paper relates to the marked differences between the eyes of invertebrates and vertebrates with particular reference to retinal function and structure, the latter accentuating grave problems in their supposed evolutionary development. In image-producing eyes (Cephalopods and vertebrates) the exceedingly unlikely occurrence of two distinct and structurally contrasting retinas evolving by any non-teleological chance process is discussed. From the material presented it is concluded that omniscient Intelligence has designed and created the organs of vision as we encounter them in living organisms.*

## Introduction

In Genesis One it is recorded that the first "let there be" in God's series of creative acts resulted in the phenomenon of light. From this primary appearance, the importance of light in Creation and all that followed can readily be appreciated. Without light as we know it, our world would not be possible, as it is the energizing force in photosynthesis and it enables us to be aware of, and appreciate, the beauties of God's Creation. Its physical nature, whether a wave motion or a stream of particles, or both, need not concern us here. We are particularly interested in the process of vision, which, in the absence of light, is not possible.

Our eyes, along with the visual pathways to the visual cortex of the brain, mediate the sense of vision. Life, of course, is possible, even if the faculty of sight has been lost through disease or accident, but most people value their visual sense above all others, as about 38 percent of our total sensory input comes to us through our eyes.<sup>1</sup> As our intellectual development and general behavior are largely determined (in the absence of congenital defects) by our total visual faculty, the supreme importance of the latter is very evident. Although in many species the other senses, such as smell and hearing may and do take preference, the importance of the vertebrate eye, as well as in most invertebrates, but not all, is out of all proportion to its size relative to the rest of the body. With it, assisted by optical instruments, man has attempted to probe the secrets of the starry heavens and the extremely minute.

The eye has occupied a prominent place in men's thoughts from the earliest times. This is shown by its depiction in early hieroglyphics, wall paintings, and by such appellations as the evil eye, with the latter implying the possession of strange and mysterious powers. References to the eye appear in early civilizations with priority possibly belonging to India. Hammurabi (c. 1900 B.C.) in his code, prescribed penalties for unsuccessful treatment of certain eye disorders.<sup>2</sup> The ancient Egyptians contributed ideas also, but it was left to the Greeks to begin to fathom some of the mysteries of vision. About the time of Hippocrates (c. 460-357 B.C.) it was thought that derangements in health could possibly be due to innate physical changes in the body rather than being attributed to external supernatural influences. This spurred efforts to discover the form and function of the various bodily

organs, including the eye. Through succeeding centuries various theories of vision were propounded and functions suggested for different parts of the eye as they were identified. It was not until the 14th century that the retina lining the back of the eye was definitely established as the essential organ of vision, functioning as a screen for the image. With the invention of the ophthalmoscope by Helmholtz (1821-1894), for the first time permitting the examination of the interior of the living eye, progress was rapid. Further development of instrumentation enabled the minute anatomy of the eye and the basic functions of its various parts to be elucidated, although there still remain numerous unanswered questions. The eyeball really exists as a housing for its most delicate and complex part, the retina, which will be my concern here.

In surveying the different types of eyes in the animal kingdom it is convenient to separate them into two divisions, the invertebrates and the vertebrates. In each division there is an almost limitless array of organisms to consider, but in only a relatively small number have detailed examinations of the eyes been made. However sufficient representation allows us to arrange the basic types of eyes in adequate classifications to try to determine if there is any evidence for an evolutionary succession.

## Invertebrate Vision

The first fact to emerge from a general survey is that in the invertebrates there is tremendous variety in organs and mechanisms subserving vision, whereas in vertebrates the basic eye pattern is unchanged throughout. In both classifications the design and complexity of the organs of vision are commensurate generally with their needs, although there appear, especially in the invertebrates, to be numerous exceptions to this observation, with the visual efficiency of some seeming to considerably outweigh their projected requirements. Sir Stewart Duke-Elder in volume one of the classical 15 volume *System of Ophthalmology* makes this comment:

The curious thing, however, is that in their distribution the eyes of the invertebrates form no series of contiguity and succession. Without obvious phylogenetic sequence, their occurrence seems haphazard; analogous photoreceptors appear in unrelated species, an elaborate organ in a primitive species, or an elementary structure high in the evolutionary scale, and the same animal may be provided with two different mechanisms with different spectral sensitivities subserving different types of behaviour.<sup>3</sup>

\*H. S. Hamilton, M.D., C.R.C.S., receives his mail at 12587-15A Ave., Surrey, B.C., Canada V4A 1L5.

An example of an elaborate organ in a primitive species is the eye of the Cubomedusan, *Charybdea*, a kind of jellyfish, which has a large cellular lens, a vitreous structure and a complex retina which would theoretically be capable of a degree of imagery. Duke-Elder states, "The biological value of this elaboration in a brainless organism is somewhat speculative."<sup>4</sup>

The latter part of the quote is illustrated by the diving whirligig beetle which has two compound eyes on each side of its head, one above the other, the upper one being for aerial vision and the lower for use underwater when searching for food.<sup>5</sup>

In the simplest one-celled organisms, such as the amoeba, there is generalized sensitivity to light. In the Flagellata and Ciliata this generalized sensitivity is concentrated in an "eye spot" usually near the front end of the organism in association with the mechanism of locomotion. In these primitive eyes, of course, no images can be formed.

Concerning the origin of the Metazoa, G. A. Kerkut writes as follows:

What conclusion can then be drawn concerning the possible relationship between the Protozoa and the Metazoa? The only thing that is certain is that at present we do not know this relationship. Almost every possible (as well as many impossible) relationship has been suggested, but the information available to us is insufficient to allow us to come to any scientific conclusion regarding the relationship. We can, if we like, believe that one or the other of the various theories is the more correct but we have no real evidence.<sup>6</sup>

In the invertebrate members of the Metazoa, all of which lack a dorsal nerve cord with its associated bony axis, there is an almost unlimited variety in size, shape and form. Included are the Coelenterata (hydra, jellyfish, etc.); Echinodermata (starfish, sea urchins, sea cucumbers, etc.); Platyhelminthes and other worm phyla, segmented and unsegmented; Mollusca (clams, scallops, etc.); the very large Arthropoda phylum (shrimp, lobsters, centipedes, spiders, crabs, mites, etc.) and in this phylum the large class of insects with numerous orders.

The eyes in this large invertebrate Metazoan group fall into two general divisions, simple and compound. The simple eye (ocellus) is characterized by a single light sensitive surface cell, as seen in worms. A further stage appears when we find a group of these cells aggregated together, although not connected, at either end of the organism. In the earthworm the light sensitive cells are associated with a network of nerves immediately under the surface, producing a further degree of efficiency, although still very primitive.

As we encounter organisms of increased organization and complexity but still in the simple eye category, we find a "sinking in" of the surface light sensitive cells to form a shallow depression or cup. With deeper sinking from the surface, and a closing over of the latter with the exception of a small hole, a primitive type of pinhole camera is formed, an example being the Mollusc *Nautilus*. In the polychaete worm, *Nereis*, the hole closes. A further refinement takes place when the completed cavity becomes totally separated from the surface layer, forming a vesicle. In all these arrangements the light sensitive cells line the

back of the cavity like a primitive retina, but, as yet, there is no real intraocular structure to focus light sharply upon it. From the light sensitive cells of the retina, nerve fibres accumulate together into a nerve trunk which leads directly to the cerebral ganglia. The term "verted" is applied to this arrangement of the light sensitive cells and their afferent nerve fibres. (Figure 1).

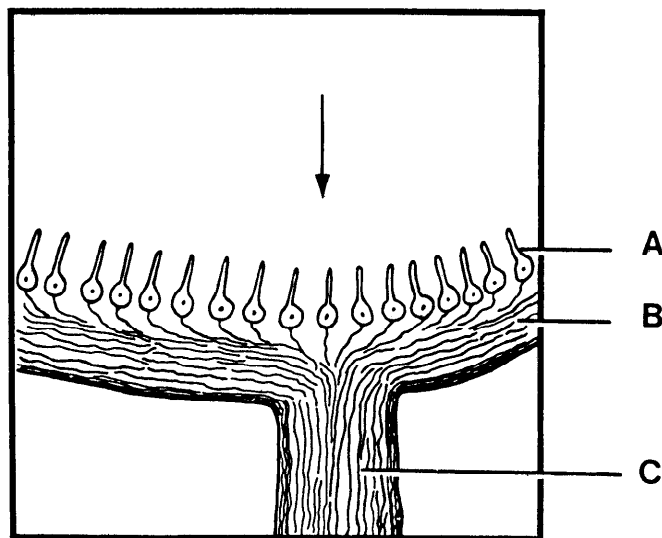


Figure 1. Invertebrate Retina (Verted). Arrow indicates direction of light. A: Light sensitive cells. B: Nerve cell fibre layer. C: Optic nerve.

Examples of the vesicular eye, with the addition of a lens, whose origin remains an enigma,<sup>7</sup> plus an extra-ocular muscle system to move the eye in various directions, are found in two different phyla. These are, among the Polychaetes in the family of Alciopidae, and among the Cephalopods (cuttle fish, squids and octopi), the latter having the most elaborate eyes in the simple eye category among the invertebrates. In the former, the eye of the Polychaete worm, *Vanadia*, has a lens and a vitreous cavity with a retina of the verted type, but it is not nearly so refined as the eye of the octopus, which, of all the invertebrates, most nearly resembles a vertebrate eye in its structure. The octopus has a cornea, ciliary body, iris, lens, vitreous and retina, and is capable of image formation of some degree, although overall quite inferior to the vertebrate eye. Its light sensitive cells and their connections with the animal's nervous system via the optic nerve retain the typical verted anatomical plan of the invertebrates.

Due to the invertebrates' comparatively simple ocular structure and their degree of visual acuity not requiring it, complicated mechanisms of accommodation (focussing) would not be expected. To make up for this lack, alternate methods are found in some species, for example, different static eyes in the same organism, one for near and one for distance (median and lateral ocelli of spiders), or different optical systems in the same eye (grasshoppers).

On the other hand some degree of accommodation is found in nearly all vertebrates. Methods are varied and many, but most can be encompassed by three

categories. A static lens is pulled or pushed forward and backward by appropriately placed intraocular muscles, as seen in many fish, the static lens is displaced forward or backward by muscular compression of the eyeball as in snakes and cephalopods, or the anterior curvature of the pliable lens is altered by the action of the ciliary muscle on the elastic anterior lens capsule, as seen in birds, reptiles (other than snakes) and mammals.

Such an exquisite organ as an eye, even of the simpler kind, is totally useless unless its various components are fully mature and integrated. It is difficult to believe that natural selection would be capable of accomplishing such feats of ingenuity and purpose.

In the simple eye category then, the invertebrate retina and its central nervous connections via the optic nerve follow the standard verted pattern. The few exceptions are found in the simple eyes of some spiders, scorpions and molluscs (*Pecten* and *Spondylus*) where the light sensitive cells of the retina assume a primitive inverted configuration.

It is in the Arthropoda almost exclusively that the compound eye is found, the total visual function being enhanced in many cases by the presence of simple eyes as well. Included are centipedes, millipedes, crabs, some scorpions, shrimp, some spiders and the large class of insects. The fossil trilobite apparently had a large compound eye on each side of its head with three ocelli on top. Each individual unit in a compound eye is termed an ommatidium, which is essentially a tapering, elongated tube-like structure with a surface facet or cornea, simple refracting media and a pigmented retinal cell associated with an afferent nerve at the proximal end leading to the nervous system. These individual units are packed together in a side by side parallel manner forming a compact, somewhat rounded (on the anterior surface) cone-shaped group with a surface mosaic effect. The total visual impression is a summation of the information from each unit. An example is the honey bee. There is no retina as such in a representative compound eye but a few night-flying insects have a modification whereby light from a number of individual units is focused at one place, but this in no way resembles the true retina of the higher simple eye of the invertebrates just described, or that of the vertebrates. This modification is termed the superposition eye. Having briefly described the simple and compound eyes of the invertebrates I now pass on to the vertebrates.

### Vertebrate Vision

It is in the vertebrates that the eye reaches its highest state of organization and over-all visual acuity. In contrast to the invertebrates the basic design is constant and similar throughout, (Figure 2). Modifications of a minor nature are evident depending on the habits and individual requirements of the various species. The basic difference between the vertebrate retina and the retina of the invertebrates which possess one, lies in its organization. In the invertebrates the retina is verted whereas in the vertebrates it is inverted, (Figure 3). The change in configuration and position of the light sensitive cells (hereafter termed the rods and cones), from the invertebrate type to that of the vertebrates is a major one, requiring, amongst others,

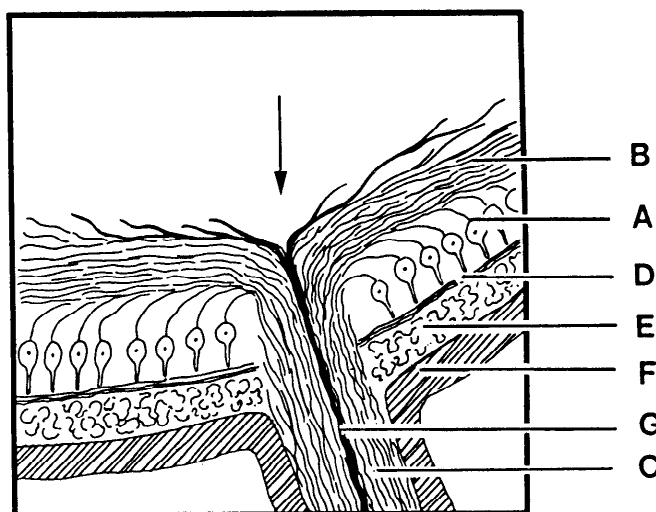


Figure 2. General Plan of the Vertebrate Eye. A: Cornea. B: Pupil. C: Iris. D: Lens. E: Vitreous. F: Sclera. G: Choroid. H: Retina (light sensitive cells, connecting cells and nerve fibre layer). I: Optic nerve. J: Fovea. K: Central retinal artery.

alteration in their blood supply, the rearrangement of the connection between the rods and cones and the optic nerve fibres, and the provision of a cone dominated fovea centralis for acute central vision. Thus the vertebrate eye is capable of sharp retinal image formation. We have seen that the eye of the invertebrate Cephalopods is also capable of image formation. In this respect therefore, organic evolution, if true, has been responsible for the appearance of an image-forming eye, not only once, which would be a remarkable enough achievement, but twice, each differing from the other in anatomical and physiological retinal characteristics. This feat would be assigning to organic evolution powers and abilities away beyond the capabilities of such a non-teleological, chance, hit and miss process.

As a consequence of the path which the afferent nerve cell fibres take in exiting from the eye through the sclera, there is unavoidably, at that place, an area where the retina is devoid of rods and cones, (Figure 3). It varies in size and shape in different species, but in comparison to the total retinal area it is quite small. As the exit site is not at the posterior pole of the eyeball, the resulting blind spot in the peripheral visual field is eccentric and barely noticeable if at all. The degree of binocular vision in many vertebrates is such that the blind spot of one eye is "covered" by the visual field of the other eye, rendering this minor defect devoid of any practical importance whatever. Of all the vertebrates, birds have the highest general ocular efficiency,<sup>8</sup> but in man, because his brain is the most highly developed and organized three pound moiety of matter in the universe, his total visual faculty is unsurpassed.

### Evolution of Eye Not Likely

In a recent article in *Creation/Evolution* it was stated that this retinal rearrangement in the vertebrate eye is a "curse" with the nerves and blood vessels that serve the light sensitive cells passing in front of them partially obscuring the field of vision and that the octo-

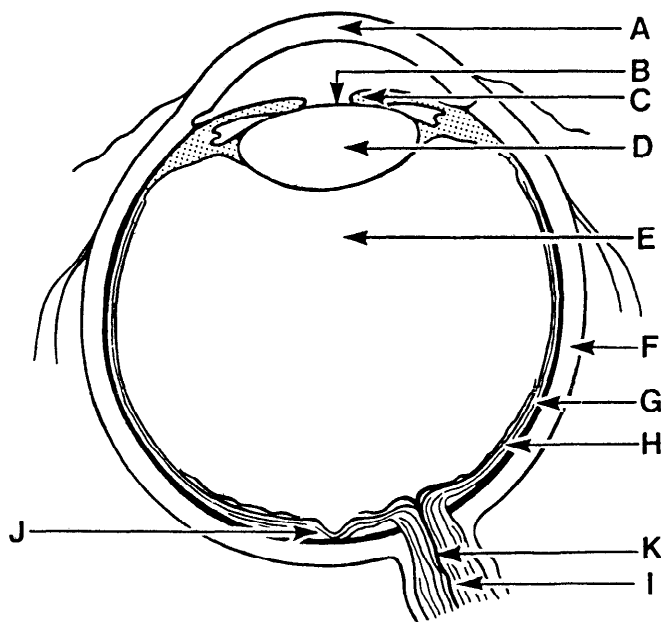


Figure 3. Vertebrate Retina (Inverted). Arrow indicates direction of light. A: Light sensitive cells. B: Nerve cell fibre layer. C: Optic nerve. D: Pigment cell layer. E: Vascular choroid. F: Sclera. G: Central retinal artery.

pus and other cephalopods have the retinas of their eyes put together "correctly" with the nerves and blood vessels tucked behind the photosensitive cells.<sup>9, 10</sup> That this anatomical and physiological opinion is unfounded is shown by the following facts.

In the first place the blood supply to the rods and cones in the vertebrate eye, comes not from the blood vessels passing in front of them (central retinal artery, vein and branches), but is derived totally from the choriocapillaris. This is the innermost part of the very spongy and vascular choroid which lies adjacent to and directly behind the rods and cones, and which, in no way whatever, offers any obstruction to light reaching them. Walls has this to say about the blood supply to the rods and cones in the vertebrate eye:

The nervous tissue of the retina (other than the rods and cones, HSH) probably does not have a high rate of metabolism, but the rods and cones are very sensitive to any interference with their supplies of materials and oxygen. These come from the choroid, which aside from its light-absorbing function is wholly devoted to the nutrition of the visual cells. The turnover of substances must be very great, for the choroid is very rich in blood vessels which comprise most of its bulk in many animals.<sup>11</sup>

There is one known exception, the eel, *Anguilla*, in which, the choroid being absent, the whole retina, including the rods and cones, is nourished from a network of superficial vitreous vessels.<sup>12</sup>

As stated above by Walls, the rods and cones require a lavish blood supply, in fact greater than any other bodily tissue. That the central retinal artery and branches do not take part in this is borne out by the fact that if the artery is occluded by disease, or experimentally severed, the viability of the rods and cones is not affected.<sup>13</sup>

The usually small branches of the central retinal artery and vein, lying as they do in front of the rods and cones on the nerve cell fibre layer and supplying the intraocular conducting cells and fibres with oxygen and nutriment, in vertebrates do offer a very minimal hindrance to light reaching the rods and cones and thus produce micro defects in corresponding parts of the visual field. Because the course of the retinal vessels is not exactly similar in the two eyes the pattern of these micro defects is dissimilar. In an animal with some degree of binocularity, this factor, along with their micro size, renders any visual consequences or disability of absolutely no importance. Central vision is not hindered in any way, as in the foveal area of the retina there are no branches of the central retinal artery or vein.<sup>14</sup> It is evident therefore that the vascular supply to the vertebrate retina offers no impediment whatever to light reaching the rods and cones in the important central foveal area and is of no detriment to optimal ocular function elsewhere.

In the inverted retinal plan the light sensitive ends of the rods and cones are intimately associated with its pigment layer. Adjacent to this thin layer are reflective tissues or crystals, usually of guanin. There are different combinations and arrangements but the function of this stratum, termed the tapetum,<sup>15</sup> is to reflect back to the rods and cones any light that might not have been absorbed by them in its passage through the substance of the retina. Such light, if not reflected back, would be absorbed by the choroid, or other retinal tissues. Avoidance of such loss is important in those animals active at night when it is essential that all available light be utilized.

In some compound eyes in the invertebrate division, the pigment in each ommatidium, in which there are many variations on the standard plan, acts in a somewhat tapetum-like fashion. In a few invertebrates, spiders for example, which have primitive inverted retinas in their lateral and medial posterior eyes, a simple tapetum exists but it is not a feature of the invertebrates generally. The tapetum is then a structure helping the retina to utilize to the maximum all the light available to it. It is difficult to credit a purposeless, chance and random entity such as natural selection with the capability to initiate and produce such a mechanism.

In the vertebrates the nerve fibres which converge to form the optic nerve do pass in front of the rods and cones, but are not myelinated as they are in most of the rest of the body. Myelin is an opaque whitish substance which coats nerve cell processes. However, being absent in the eye, the anterior position of the unmyelinated nerve fibres offers practically no hindrance to light proceeding to the rods and cones. Congenitally, and abnormally in the human, and very rarely (0.5 percent of eyes) a small patch of these nerve fibres in the retina may be myelinated, producing an area of reduced appreciation in the visual field, of which the individual is usually completely unaware.

Hogan and Zimmerman mention with regard to the arrangement of the nerve fibres at the foveal area, the most important part of the retina: "It will thus be seen that at the fovea centralis the layers of the retina are spread aside so that the light may fall directly on the true receptive elements, namely the cones."<sup>16</sup>

Walls, commenting on the retina as a whole says:

Standing on the external surface of the retina proper, and constituting its receptive layer, are the rods and cones. These elongated cells thus point away from the light which must pass through the remainder of the retina to reach them (hence the complete transparency of this tissue as contrasted with the brain which has a similar histological organization).<sup>17</sup>

Thus, instead of being a great disadvantage, or a "curse" or being incorrectly constructed, the inverted retina is a tremendous advance in function and design compared with the simple and less complicated verted arrangement. One problem amongst many, for evolutionists, is to explain how this abrupt major retinal transformation from the verted type in invertebrates to the inverted vertebrate model came about as nothing in paleontology offers any support.

The eye has always presented a problem to the evolutionist. In his *Origin of Species* Darwin referred to this difficulty:

To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical aberration, could have been formed by natural selection, seems, I freely admit, absurd in the highest degree.<sup>18</sup>

Much work has been done since Darwin's time but a viable evolutionary solution appears as ephemeral as ever, illustrated by the following quotes.

It would seem therefore, that despite the considerable amount of thought expended on the question, the emergence of the vertebrate eye with its inverted retina of neural origin and its elaborate dioptric mechanism derived from the surface ectoderm, is a problem as yet unsolved. Indeed, appearing as it does fully formed in the most primitive species extant today and in the absence of transition forms with which it can be associated unless by speculative hypotheses with little factual foundation, there seems little likelihood of finding a satisfying and pragmatic solution to the puzzle presented by its evolutionary development.<sup>19</sup>

Froriep (1906) the great German anatomist stated that the vertebrate eye sprang into existence fully-formed, like Athena from the forehead of Zeus.<sup>20</sup>

J. H. Prince in his *Comparative Anatomy of the Eye* has written as follows:

One of the essential and most important differences between vertebrate and invertebrate eyes is that in the former the receptors (light sensitive cells) point outward toward the choroid (inverted), whereas in the invertebrates they mostly point inward toward the lens (verted). But for that obstacle we should have been deluged with theories on the original evolution of the vertebrate eye from the invertebrates.<sup>21</sup>

Also, "There are many theories of how the reversed eye (inverted) would have arisen from the unreversed (verted) eye but on the basis of the facts none of them are viable."<sup>22</sup>

## Conclusions

In this generalized account of the retinal structure of invertebrates and vertebrates many significant differences have been pointed out between them.

Some evolutionists have claimed that the simple verted type of retina as seen in the invertebrates, apart from the compound eye which lacks one, is properly and correctly constructed as compared with the poor and inefficient vertebrate plan. This is said to be due to the fact that, in invertebrates, there is no blind spot in the peripheral field of vision, and no blood vessels or nerve fibres passing in front of the rods and cones to minimally interfere with light reaching them. These factors have been shown to be of no real anatomical or functional disadvantage in the vertebrate eye whereas in the latter are found many superior qualities and attributes amongst which are the following: A very vascular choroid lying, not in front, but behind the rods and cones supplying them with an abundance of blood and nutrients; the possession of a fovea centralis or a macular area necessary for clear and sharp central vision; a tapetum to utilize all the available light entering the eye and a lens to ensure that incoming light focuses accurately on the rods and cones, particularly the latter as they are concentrated at the fovea. How such an advantageous and efficient arrangement could be labelled a curse or be said to be incorrectly designed is hard to comprehend.

That a mindless, purposeless, chance process such as natural selection, acting on the sequelae of recombinant DNA or random mutations, most of which are injurious or fatal, could fabricate such complexity and organization as in the vertebrate eye, where each component part must carry out its own distinctive task in an harmoniously functioning optical unit, is inconceivable. The absence of transitional forms between the invertebrate retina and that of the vertebrates poses another difficulty. Here there is a great gulf fixed which remains inviolate with no seeming likelihood of ever being bridged. The total picture speaks of intelligent creative design of an infinitely high order.

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## ARCHAEOLOGY AND THE ANTIQUITY OF ANCIENT CIVILIZATION: A CONFLICT WITH BIBLICAL CHRONOLOGY?—PART II

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### Abstract

*Two of the pillars used in support of the conventional chronology of ancient history have been the Carbon-14 dating method and astronomical dating methods. In recent years it has been recognized that there are many problems with the C-14 method and that the results of C-14 analysis are often discarded when they do not yield expected results. Velikovsky's attempt to penetrate the secret workings of the scholastic establishment shows that not all the problems of the C-14 method are technical ones. Both Velikovsky and Courville as well as other writers have exposed the weaknesses and inadequacies of the astronomical methods used to establish certain dates in Egypt's ancient history. With these two so-called "pillars" removed, the conventional chronology of ancient times loses some of its awesome sanctity and we can feel much less inhibited about considering the alternative presently being worked out by Velikovsky, Courville, and others.*

*The only other possible source of conflict with Biblical chronology is the duration of man's pre-historic era. But one of the main factors in assigning long intervals of time to man's pre-historic periods is evolutionary bias. If we dispose of the unfounded myth that man evolved from ape-like animals over a period of millions of years, then there is no reason why the cultural developments that occurred during the pre-historic ages could not have occurred over a relatively short interval of time.*

### Introduction

In Part One, I outlined the work that has been done in recent decades by a number of different scholars toward a radical reconstruction of ancient history and have shown the relevance of that work to the question of whether the antiquity of civilization in the Ancient Near East is in conflict with Biblical chronology. Several topics that are very relevant and closely related to the subject matter discussed in Part One will be discussed.

### The Carbon 14 Cover-up<sup>1</sup>

In the late 1940's, Dr. W. F. Libby developed the Carbon-14 method for dating organic material. When Dr. Libby's work was made public, Dr. Velikovsky was immediately interested in this process as a possible means of verifying his revised dates for the New Kingdom dynasties of Egypt. In 1953, he wrote to Dr. Libby and sent him a copy of *Ages in Chaos* which had just been published the previous year. In his letter, Dr. Velikovsky briefly described his historical reconstruction and indicated the kinds of results he expected if C-14 analysis were to be performed on material from the 18th and 19th dynasties. Dr. Libby immediately returned the book claiming that he could not understand it and wrote that he knew nothing of Egyptology or archaeology.

Ten years later Dr. Libby wrote in an article in *Science* that C-14 dates had to be separated into two groups — Egyptian and non-Egyptian — because the whole Egyptian chronology was subject to possible systematic errors and he admitted that many of the results from Egypt gave dates that were too young by as much as 500 years. But during this 10-year interval, Dr. Velikovsky had not been idle. Over a period of 11 years, from 1953 to 1964, Dr. Velikovsky and several associates of his were engaged in a letter-writing campaign to various museums and C-14 laboratories in an effort to have the C-14 method applied to material from the New Kingdom period.

One word of explanation is in order before we discuss the letter-writing campaign. Creationists are accustomed to thinking of C-14 dates as being highly inflated. Creationists generally agree that the C-14/C-12 equilibrium ratio in the atmosphere was greatly disturbed by the extraordinary conditions brought about by the Flood. The non-equilibrium conditions that existed during the period after the Flood served to greatly inflate the C-14 dates from that time with the effect gradually tapering off as a new equilibrium point was approached. While Velikovsky felt that catastrophes such as the Flood could temporarily throw off C-14 dates, he also felt that during periods when the C-14/C-12 ratio was close to an equilibrium, that the C-14 method might very well give reasonably accurate results. Velikovsky felt that the New Kingdom period in Egypt was sufficiently removed from any major catastrophe so as to yield meaningful results.

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Velikovsky wrote first in 1954 to Professor Frederick Johnson of the Robert S. Peabody Foundation for Archaeology in Cambridge, Massachusetts. Dr. Johnson had written a chapter included in Libby's book, *Radiocarbon Dating* (1952) entitled, "The Significance of the Dates for Archaeology and Geology." Velikovsky inquired why no dates from the New Kingdom were included in the chapter and whether any tests were made on New Kingdom material. Dr. Johnson replied that he knew little about Egyptian Archaeology and suspected that no dates for objects from the New Kingdom had been determined. I would expect Dr. Johnson would be in a position to know. But we will get to the bottom of this later. On the other hand, possibly we may not!

In that same year (1954) Dr. William C. Hayes, Curator of Egyptian Art at the Metropolitan Museum of Art in New York City, wrote in reply to an inquiry about C-14 dates from the 18th dynasty that he knew of none and he added that "in the light of the very complex knowledge we have on this tightly dated and closely recorded period, it would serve no useful purpose to have this done." When Dr. Hayes was asked to supply suitable material from the 18th, 19th, and 20th dynasties to be dated, he replied that none was available for the 19th and 20th dynasties and that it would be months before he would be able to have someone look for some material from the 18th dynasty. The request was made by Dr. Robert Pfeiffer, Chairman of the Department of Semitic Languages and History at Harvard University, who was very supportive of Velikovsky. Dr. Pfeiffer then, in 1955, wrote to Dr. Dows Dunham, Curator of the Department of Egyptian Art at the Boston Museum of Fine Arts, asking for material from the 18th, 19th, 20th, 25th, and 30th dynasties. Dr. Dunham replied that no material was available for any of these periods.

In 1960 Dr. Velikovsky wrote to Dr. D. J. Wiseman of the British Museum asking if the Museum would submit some material from the New Kingdom for C-14 dating. The letter was referred to A. F. Shore, Assistant Keeper of the Department of Egyptian Antiquities at the British Museum. He replied that there had been, as far as he knew, no radiocarbon tests of material from the New Kingdom and that he did not expect such a test to give results that would differ from the accepted chronology of Egypt. Dr. Velikovsky wrote back to A. F. Shore and Dr. Wiseman suggesting that if indeed the dates of the New Kingdom dynasties and rulers were so certain, then what better way could the accuracy and reliability of the C-14 method be verified than by testing some New Kingdom samples.

These letters were referred to Dr. I. E. S. Edwards, Keeper of the Department of Egyptian Antiquities and Chairman of the Radiocarbon Dating Advisory Screening Committee at the British Museum. Dr. Edwards simply replied that he hoped someday some well-dated New Kingdom samples could be tested. In a subsequent letter, he indicated that there was a problem with obtaining "really safe, uncontaminated material" for testing. It seems that, at this point, Dr. Edwards comes close to "letting the cat out of the bag." His concern about finding uncontaminated material from the New Kingdom suggests that he was aware of some

tests that had already been made which yielded unexpected results. Nothing else could have caused this concern over contaminated material. When unexpected results are obtained, it is frequently assumed that handling of the material before testing caused contamination producing erroneous results. If this kind of reasoning is followed, then the sole purpose of the C-14 test is to verify the accepted chronology, not to serve as an independent check.

That same year (1960), a letter from Dr. Klaus Baer, Assistant Professor of Egyptology at the University of California, confirmed what we have learned from several other sources: "As far as I know there are no radiocarbon datings of any objects from the New Kingdom." He also echoed the opinion that such tests would add nothing since New Kingdom dates were well established by astronomical dating methods.

Let us summarize. No C-14 tests on New Kingdom material have ever been made. C-14 tests on New Kingdom material are totally unnecessary. And furthermore, there is no material available for such tests. Velikovsky had encountered a scholastic/bureaucratic logjam.

By now, Velikovsky was beginning to suspect that New Kingdom material had been tested but that the publication had been suppressed due to unexpected results. In an article in the *Palestine Exploration Quarterly*, J. O. D. Johnston quotes Professor Brew as saying,

If a C14 date supports our theories, we put it in the main text. If it does not entirely contradict them, we put it in a footnote. And if it is completely 'out of date,' we just drop it.<sup>2</sup>

Apparently, this practice is quite common. Robert E. Lee has cited J. Ogden III as saying that "fewer than 50 percent of the radiocarbon dates from geographical and archaeological samples in northeastern North America have been adopted as 'acceptable' by investigators."<sup>3</sup>

Actually, things had already begun to break loose during the previous year. In 1959, Dr. Froelich Rainey of the University of Pennsylvania revealed that the C-14 laboratory at that University had dated samples from every period of Egypt's history including the New Kingdom. Dr. Rainey had also admitted that "there are many serious problems in the C-14 method." Then, in 1961, a Curatorial Assistant in the Department of Egyptian Art of the Metropolitan Museum of Art in New York City revealed that in 1947 samples from the New Kingdom had been supplied to Dr. Libby at the University of Chicago and that these samples had been judged to have been contaminated. This can only mean that the samples had been tested and that the results were not what was expected. In 1962, Dr. David Baker, a sympathetic reader of *Ages in Chaos*, visited the C-14 lab at the University of Pennsylvania and had a long visit with Dr. Rainey and Dr. Elizabeth K. Ralph, who is in charge of the Radiocarbon Laboratory there. Dr. Baker related his conversation with them to Dr. Velikovsky in a letter:

... Mutual friends secured for me a most favorable introduction to Dr. Froelich Rainey, Director of the Museum of the University of Pennsylvania. Dr. Rainey is a vigorous, enthusiastic, obviously very well informed, courteous gentleman in his

late middle years. At no time was your name brought up by me or by anyone else at the University. I told Dr. Rainey that I was interested in the latest findings that have bearing on the date of the Exodus. My position as a professor of religion in Ursinus College and a long-time interest in the matter had prompted my quest for information in this area. . . .

"The dating of Egyptian history," said Dr. Rainey, "is one of the most controversial matters in the whole realm of Archaeology today. On the basis of radiocarbon dating we have come up with a very serious difference of 600 years between the old chronology and the radiocarbon evidence! We do not know how to account for it. It seems to extend throughout Egyptian history, but the earlier dates are off more than more recent ones. Fortunately we have an astronomical fix in the time of Seti I, so we are pretty sure of his date, but before him we are in real trouble. Right now our Museum, the British Museum, and the University of Leiden are working furiously to try to find out the cause of the discrepancy. . . .

"Is it your opinion then," I asked Dr. Rainey, "that we may expect some very drastic changes in the dates of early Egyptian history in the next few years?" He replied: "Yes. And not only in Egypt but in the dating of the entire Ancient World, especially the Near East."

Dr. Rainey then called Miss Elizabeth K. Ralph who is in charge of the Radiocarbon Laboratory of the University of Pennsylvania. This laboratory is located in marvelous quarters in the basement of the new Physics Building. A special guide took me to Miss Ralph.

Miss Ralph is a deeply serious, dedicated scientist, whose whole life is bound up with her work. She received me most kindly, was in no wise hurried in answering my inquiries, and most willingly answered all my questions and gave me access to all the information she had!

In addition to confirming everything that Dr. Rainey told me, she furnished me a wealth of other information. . . . Miss Ralph was insistent on the wide gap between the so-called archaeological dates of Egyptian history and those derived from radiocarbon dated materials. In almost every case the radiocarbon dates are significantly younger. Today, they feel they can date to within an accuracy of 25 years in some instances. I found her working on a huge graph on which she had entered every reported item of radiocarbon Egyptian evidence, plotted against the archaeologically determined dates for the same materials. This graph shows a very unmistakable trend throughout Egyptian history in the interest of younger dates. She is trying to ascertain what the cause may be.<sup>4</sup>

Finally, ten years later, in 1971, two New Kingdom samples from the British Museum were dated by the radiocarbon method. Both samples were from the tomb of Tutankhamun (King Tut) of the 18th dynasty, who was the son and successor of Pharaoh Akhnaton. Seven years earlier, in 1964, Velikovsky had written to Dr. Elizabeth Ralph expressing his view that Tutank-

hamun lived not in the 14th century B.C. but rather in the ninth century B.C. and that if some short-lived samples from his tomb could be dated, he expected the results to be approximately 840 B.C. In 1971, Professor I. E. S. Edwards of the British Museum forwarded the results to the University Museum at the University of Pennsylvania. The results of the two tests were 846 B.C. and 899 B.C. When these results were not published, the Director of the laboratory of the British Museum admitted that results which deviate substantially from what is expected are often discarded and never published. When Dr. G. W. Oosterhout of the Delft University of Technology of the Netherlands wrote to the British Museum in 1972 in an attempt to verify the results of these tests, he received a reply stating that the laboratory at the British Museum had made no measurements on material from the tomb of Tutankhamun.

### Astronomical Dating Methods

The conventional chronology of ancient Egypt depends upon several very crucial dates determined by astronomical methods. The earliest of these dates is 1872 B.C., the seventh year of Sesostrius III, fifth ruler of the 12th dynasty in the Middle Kingdom. This date allows historians to calculate the reigns of all other 12th dynasty rulers and to establish the date of the end of the dynasty and of the Middle Kingdom (1786 B.C.) This latter date is crucial and the famous Egyptologist Sir Alan Gardiner admitted that, "to abandon 1786 B.C. as the year when dynasty 12 ended would be to cast adrift from our only firm anchor."<sup>5</sup> But this is exactly what Velikovsky, Courville, and others have done by showing that many of the assumptions of the astronomical dating methods are invalid.<sup>6,7</sup> The dates of Tuthmosis III of the 18th dynasty and Seti I of the 19th dynasty are also determined by these astronomical methods. None of the dates fixed by these methods have been retained in the revised chronology.

### Pre-Historic Man

We have already seen that according to Courville's revision, civilization began in Egypt around 2150 B.C. and developed in Mesopotamia at a time somewhat earlier than that. This much is compatible with the date of the Flood (2519 B.C.) as calculated from Old Testament chronological data. But what about pre-historic man? Table V (CRSQ 22:38) shows the conventional dates for the pre-historic ages of man in Palestine. These dates vary slightly from source to source; for example, two books recently checked dated the beginning of the Mesolithic period at 9000 B.C. and 8000 B.C. respectively. Some have dated the end of the Paleolithic at 32,000 B.C. or earlier.

The reader will notice that the further back in time that we go, the longer these pre-historic ages are in duration. Although a full discussion of the antiquity of pre-historic man is beyond the scope of this article, we would like to make three brief suggestions regarding the lengths of these ages:

- (1) The acceptance of the long duration of these pre-historic ages is due in part to C-14 dating. It is during these periods, immediately after the Flood, that we would expect the C-14 dates to show the greatest inflation. Although the problem of C-14 dating is very complex with many factors being in-

volved, creationists generally agree that the Flood greatly upset the equilibrium of the C-14/C-12 ratio in the atmosphere and that a return to the vicinity of a new equilibrium may have required hundreds of years. Thus, the inflation of the C-14 dates would be the greatest immediately after the Flood and then gradually taper off.

- (2) I do not think that the C-14 data are entirely responsible for the acceptance of these very long pre-historic ages. In part it is due to an evolutionary bias concerning pre-historic man. It is assumed without proof that the beings who lived during these ages were in the development stage somewhere between ape-man and modern man. Once this evolutionary presupposition is granted, it is only very natural to conclude that it would take these pre-historic beings thousands of years to develop the tool-making and pottery-making industries that characterize these levels. But if these pre-historic beings were the direct descendents of Noah and his sons, then cultural recovery and restoration could begin immediately and there would be nothing to prevent the tool, weapon, and pottery-making industries from progressing rapidly.
- (3) Finally, the thicknesses of these pre-historic occupational levels do not point to the very long periods of time that are customarily assigned to them (see Table V, CRSQ 22:38). Rather, the opposite is true; when compared to later periods, the thicknesses of the pre-historic levels suggest that they are rather brief relative to the evolutionary time scale that is normally imposed on them.

Whether the entire stone age can be accommodated within the period from the Flood (c. 2500 B.C.) to the beginning of civilization (c. 2200 B.C.) is a question that is beyond the scope of this work and deserves considerable study. A number of factors would have to be considered including the possibility that during the period immediately following the Flood, the physical environment was such that the accumulation of occupational levels was somewhat (but not drastically) accelerated.

Many creationists may want to leave open the question of whether there are gaps in the genealogical records of Genesis 11. If this were the case, there would be no difficulty in fitting the pre-historic ages into the interval between the Flood and the beginning of human civilization. Courville (who does not allow for such gaps) has argued that the Flood occurred at

the end of the Paleolithic age which would alleviate the problem considerably, but this solution may not be acceptable to many who regard the Flood as having laid down the vast majority of the geological strata.<sup>8</sup>

### Conclusion

During the course of the last 100 years, there has been a steadily accumulating mass of historical and scientific data that has resulted in the progressive lowering of the date associated with the beginning of human civilization. If we accept the general thrust of the historical revision that has been initiated by the work of Velikovsky, Courville and Bimson (as does this writer), then this trend has continued right up to the present.

These same writers have also shown that the C-14 method and the astronomical methods of dating do not support the conventional history of ancient man as is commonly advertised.

The result of these developments is that there no longer appears to be any problem at all regarding the antiquity of human civilization conflicting with the Biblical record of the Flood and the chronology implied by Genesis 11. The historical revision that is now being formulated, especially in the work of Courville, suggests that several centuries elapsed between the Flood and the beginning of civilization.

If we do not allow for gaps in the genealogies of Genesis 11, there may remain a problem regarding the length of the pre-historic ages. That is a question which merits further investigation. But we can safely conclude that the claim made by A. D. White almost 90 years ago, that the antiquity of human civilization proves the Biblical chronology to be impossibly short, is no longer valid.

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### QUOTE

In some very sad sense, which is very human indeed, science is a very human enterprise. Among other things, science is mercilessly competitive. Science does have its tough entrepreneurs no less than does any branch of business. Stories, such as the story of the double helix, have amply revealed the fierce pursuit of prizes which go only to the very first and never to the best second, let alone to the second best. Enough is also reported through newspapers about the keen competition for research grants, for the funding of new equipment, for new laboratories and institutions—a competition which at times mobilizes the public opinion of entire states and even wider regions. Teams of anthropologists stake out claims for elusive distant valleys with no less rush and jealousy than was the case a hundred years ago with homesteaders and somewhat earlier with gold diggers in California.

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## ORIGIN OF THE KAIBAB SQUIRREL

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### Abstract

Since its origin, the Grand Canyon of the Colorado River has provided an effective barrier, isolating the Kaibab squirrels on the north rim from the Abert squirrels on the south rim. The differences in these squirrels have been used as a classical example of the role of geographical isolation in evolution. This paper examines the differences in the two populations and describes the nature and extent of the isolating mechanism. It then evaluates the applicability of the violations of restrictions of the Hardy-Weinberg equilibrium population. The study concludes that the Kaibab squirrel populations should be an ideal test group for assessing the extent of changing gene frequencies across the uniformitarian time scale claimed for the formation of the Grand Canyon. Evidence is presented showing violations of all of the Hardy-Weinberg restrictions for an equilibrium population but with only minute differences between the two populations. This does not correlate well with the standard explanation for the time of formation of the isolation barrier. It is suggested that these data provide indirect evidence for a very recent origin of the Grand Canyon.

**Key Words:** *Sciurus aberti*, Kaibab squirrel, Grand Canyon, Geographical isolation, Hardy-Weinberg equilibrium.

### Introduction

The Grand Canyon of the Colorado River is of interest to creationists, not only because of its geological features, but also because it represents what is probably the world's most sharply delineated barrier to terrestrial animal movement. Here, the Colorado River separates the Kaibab Plateau on the north from the Coconino Plateau on the south by the largest canyon on earth. The Grand Canyon, 5,000 feet deep and from 12 to 15 miles in width, encompasses most of its 200 mile length by nearly vertical walls of rock.

The natural history and management of the tassel-eared squirrel (*Sciurus aberti*) has generated considerable interest in recent years, resulting in the publication of a bibliography of 175 entries.<sup>1</sup> This animal is widely distributed throughout the Ponderosa Pine forests of the southwest. Because of specific needs for the cones and terminal buds of the Ponderosa as a food source, these squirrels, like the forest they inhabit, are characterized by a discontinuous distribution.<sup>2</sup> See Figure 1 for a map of present distribution.

In northern Arizona the Grand Canyon of the Colorado acts as a barrier separating the two populations of these squirrels. The population north of the canyon (Kaibab squirrel) is confined to the Kaibab Plateau (see Figure 2 for a map showing place names used in this paper), an area 60 miles long and 35 miles wide, ranging from 8,000 feet in elevation upward to about 9,200 feet (see Rasmussen, reference 3, for a detailed analysis of the biotic communities of the area). The population south of the Grand Canyon (Abert squirrel) is found not only in higher areas of the Coconino Plateau, but also in an arc southward into central Arizona, eastward into New Mexico, and northward into the Colorado Rockies. There are also several isolated populations in Mexico.

Because of differences in color between the two populations separated by the Grand Canyon, evolutionists have used this feature as "... a classical example of the role of geographical isolation in evolution."<sup>4</sup> See reference 5 for use in college textbooks. The pur-

pose of this paper is to survey the biology of the tassel-eared squirrel, examine the actual differences between the two populations, evaluate the nature and extent of the Grand Canyon as an isolation barrier, and explore the reasons why they should have undergone extensive differentiation if violations of the restrictions of the Hardy-Weinberg equilibrium population are valid.

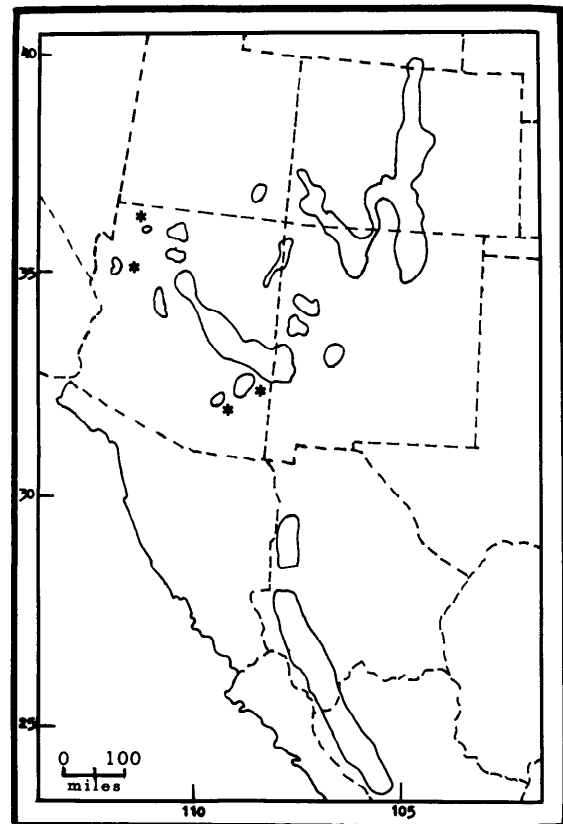


Figure 1. Distribution map of Tassel-eared squirrels. This map has been compiled from a number of sources with adjustments made from personal observations and known distributions of Ponderosa Pine to which the squirrel is confined. Starred areas indicate localities where present populations are thought or are known to have been introduced by man.

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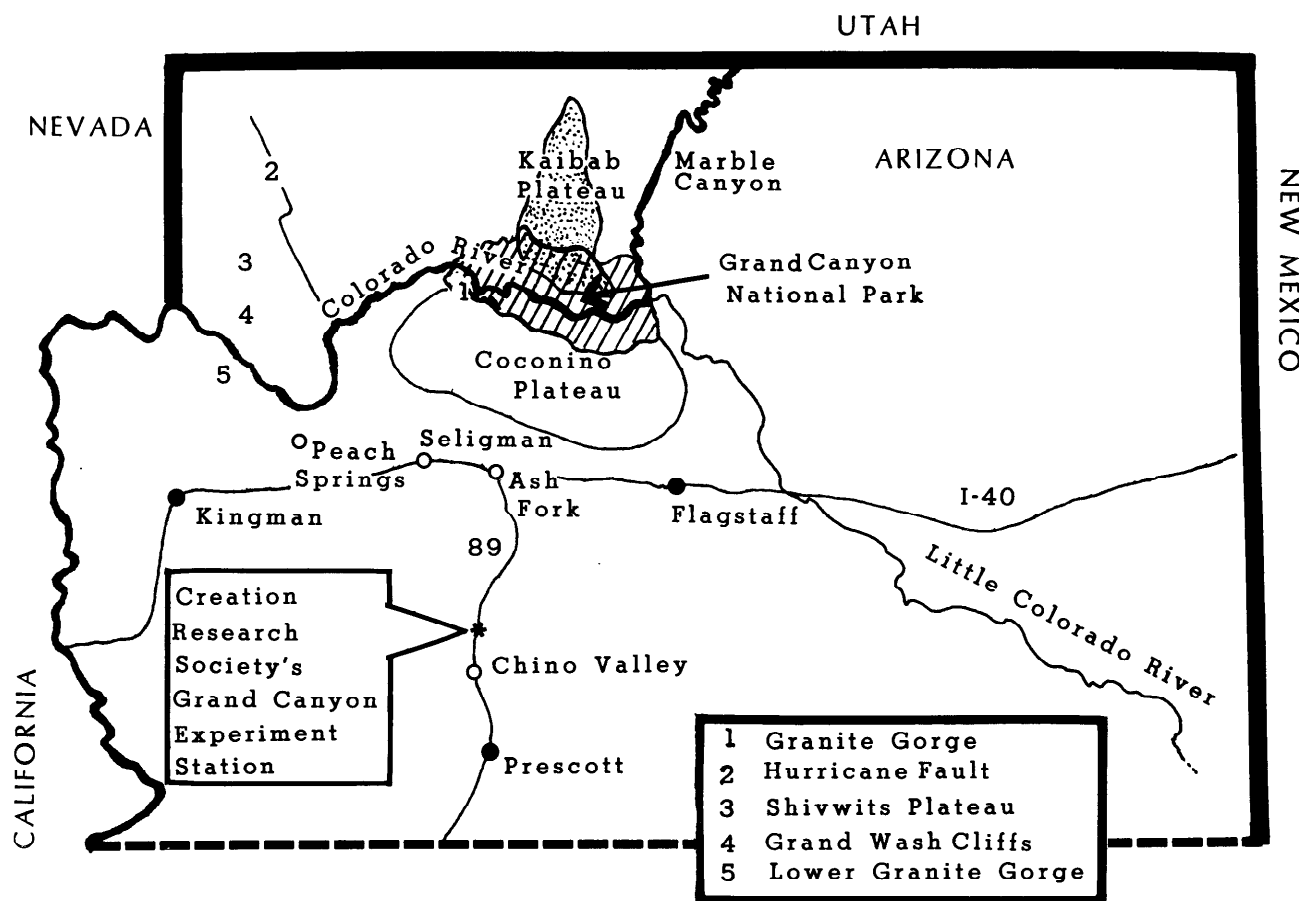


Figure 2. Map of the Grand Canyon region and vicinity showing place names mentioned in the text.

Finally, I will attempt to show that tassel-eared squirrel distribution and limited morphological differences provide direct evidence of extremely limited intraspecific changes and indirect evidence for a recent origin of the Grand Canyon as an isolating mechanism.

#### Abert Color Description

In general, the main color features of the typical Abert squirrel include a dark-colored tail, white belly and steel-gray body. More specifically, the body possesses a steel-gray color resulting from hairs which are black at the base and midsection, but white or tan-colored at the tip. A rufous-brown spot of variable size is found on the back, usually extending three-quarters of the way across and running from the shoulder blade to near the base of the tail. There is much variability however. The rufous spot on the back is due to hairs which are black at the base but reddish brown at the tips. However, some hairs in this region are black to the tip. Thus, the characteristic color results from intermingling of different hair-tip colors.

The tail is gray on the dorsal side across four-fifths of the width and nearly to the tip. The lateral edges are white (see Figure 3). The gray color derives from each individual hair having repeating black and white regions. A dark lateral line extends from the lateral foreleg, along the lateral stomach area to about the hip region; but again much variability exists here. This lateral line usually varies from 10 to 20 mm. in width with considerable variation in length.

The belly tends to be nearly pure white in most specimens with the color extending to about the tip of the tail on the ventral side and along the lateral edge of the dorsal side. White coloration also extends to the ventral and lateral chin areas, ventral forelegs, and dorsal front and rear feet. Dark hair is found in the pubic area, and the base of the ear is brown.

#### Kaibab Color Description

The Kaibab is considered to be the most handsome of all North American squirrels. (See Hall's "White Tails and Yellow Pines" for a delightfully written popular account of this animal.) Its unique white tail flashes its presence as it jumps from limb to limb or attempts to conceal itself by flattening against the top of a high branch.

A more careful examination of typical individual animals reveals the white tail is streaked with a central line of dark hairs, especially on the dorsal surface. Except for the nearly pure-black belly and the white tail, the Kaibab appears similar to the Abert in all other respects.

#### Abert and Kaibab Color Variations

The animals sampled in the present study were all specimens found in the research collection of the Grand Canyon National Park. Most of the animals were obtained from road kills within the park itself. Thus the two groups may not represent the full range of variations possessed by the tassel-eared squirrel in Northern Arizona. For example, the variations seen

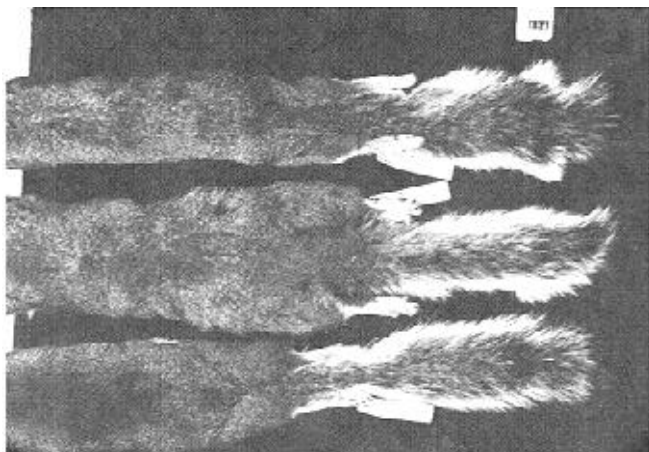


**Figure 3. Photographs of typical Abert squirrel tails. Even though Abert tails are usually described as black and appear this way at a distance, these museum specimens show that a significant number of white hairs are present, especially along the lateral edges.**

within the Kaibabs which I was able to examine may display only a limited amount of the variation seen within the total populations, since the animals were sampled from within the Grand Canyon National Park which makes up only a small part of their entire range. Body and tail color variations are tabulated in Table I and displayed in photographs in Figures 3 through 6.

Coloration within the Abert squirrel populations tends to be quite variable. This has been noted by Ramey and Nash<sup>7</sup> for populations along the Colorado front range. In their view of the tassel-eared squirrels, Hoffmeister and Diersing<sup>8</sup> indicate that coat color polymorphism is so common in this group that "Analyses were made without using color because of its variability within species of tree squirrels." They go on to state "Because of the variability of color and the absence of a correlation of color with other morphological features, color is not considered an important taxonomic feature." This would appear to be an approach not totally acceptable to all taxonomists. Numerical taxonomists in particular assign values to characteristics without any weighting factors.<sup>9</sup> While Abert squirrel tails in the Grand Canyon National Park Study Collection tend to be quite uniform in coloration (see Figure 3, but note from Table I, nine percent show a slight tendency toward banding), Kaibab squirrel tails show a considerable range (see Figure 4). These vary from almost pure white (except for the median area) to significant darkening (18 percent), approaching but not reaching the level of coloration seen in the Abert only.

In the 94 museum specimens examined, considerably more abdominal color variation was seen in the Aberts than in the Kaibabs. Abert abdominal coloration in some specimens was almost pure black while it was nearly white in the majority of cases. Kaibab squirrel abdominal colors varied from pure black to a significant number of white hairs seen along the mid-ventral region. In no case, however, did the light color approach that seen on the typical Abert. In addition, Aberts show considerable variation in brown tufts at the base of the ear and extent of the lateral line (see Table I).

Nevertheless, the similarities between certain Aberts and Kaibabs are striking. This is illustrated by the fact that Hall<sup>10</sup> refers to some of the squirrels on the north rim as "Abert-like Kaibabs." In my examination of the Abert specimens in the Grand Canyon National Park Study Collection, I noted a drawer of animals marked "Kaibab-like Aberts." While the average color characteristics for Kaibabs and Aberts show significant differences,<sup>11</sup> it is possible to pick "outliers" in each population that are very similar in coat color. Thus the "Kaibab-like Aberts" on the south rim show very close resemblances to the "Abert-like Kaibabs" on the north rim. Confirmation of rumored reports of white-tailed Aberts in the upper Beaver Creek drainage basin in the Coconino National Forest would be highly significant in establishing additional similarities between "outliers" in the two populations.

### Taxonomic Status

The Kaibab squirrel was first reported by Merriam in 1904<sup>12</sup> and classified as *Sciurus kaibabensis* in contrast to *Sciurus aberti* for the rest of the population throughout the southwest. This classification has recently been modified however. Cockrum<sup>13</sup> has attributed subspecies standing to the Kaibabs. The important work of Hoffmeister and Diersing<sup>14</sup> using principal component analysis and numerical taxonomic methods based on morphological measurements of 244 animals from 20 different localities seeks to clarify the situation. Based on the results of this study they conclude:

We are convinced there are five recognizable subspecies of *S. aberti*, but we have hedged with *kaibabensis*. *S. kaibabensis* is separable primarily on color-pattern, and this color and color pattern separation from other subspecies is complete at above 95 percent. Therefore, we hesitantly recognize *S.a. kaibabensis* as our sixth subgroup (subspecies).

In his monumental work *A Field Study of the Kaibab Squirrel in Grand Canyon National Park* representing over a decade of observations, Hall<sup>15</sup> accepts this classification; even though as mentioned previously, he uses the Kaibab situation as "a classic example of the role of geographical isolation in evolution." Thus, at

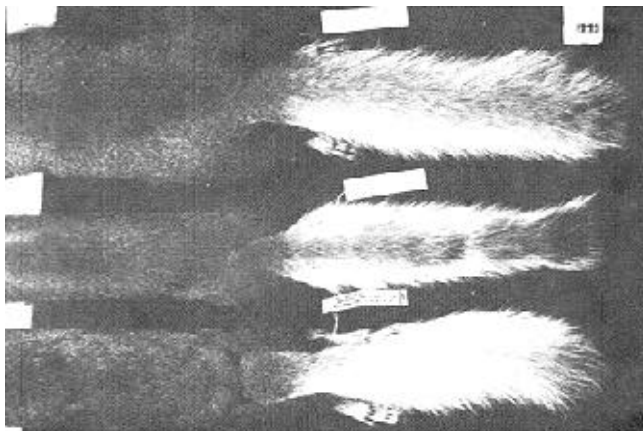


**Figure 4. Photograph of Kaibab squirrel tails. The lower specimen displays the typical nearly pure white tail while the other two examples show significant presence of dark hairs centrally.**

**Table I**  
**Comparisons of Body Color Variations Within and Across Abert and Kaibab Groups of Tassel-eared Squirrels**

| Characteristic                                                                                                 | Abert (%) | Kaibab (%) |
|----------------------------------------------------------------------------------------------------------------|-----------|------------|
| 1. Small brown patch on back, less than ½ length of body and less than ½ width of back.                        | 12        | 6          |
| 2. Extensive dorsal brown patch extending at least nearly full length of body and extending over edge of hips. | 21        | 30         |
| 3. Slight tendency toward tail banding.                                                                        | 9         | 0          |
| 4. Brown tufts at base of ears.                                                                                | 51        | 0          |
| 5. Narrow or short and indistinct lateral line.                                                                | 16        | 0*         |
| 6. At least some black mottling on belly.                                                                      | 30**      | 100        |

This table is based on examination of 94 squirrels, 67 Aberts and 17 Kaibabs. \*71% show thick (up to 30mm) black lateral line which appears as an extension of black on belly. \*\*One Abert shows very extensive black on belly. Of particular interest is the normal variation seen within the Abert squirrels, presumably the parent population for the isolated Kaibab population.

the time of writing, it appears that the accepted technical name for the Kaibab squirrel is *Sciurus aberti kaibabensis*, the name reflecting subspecies classification for the squirrel.

The work by Hoffmeister and Diersing merits further attention. The following discussion requires critical examination of several of the figures from their paper, and thus presupposes that their work is in hand for evaluation by the reader who wishes to pursue this critique in detail.

Of special importance is their Figure 3 (locality clusters projected on the first two principal components) and Figure 4 (dendrogram depicting phenetic similarities among locality clusters.) Based on the data presented in these two figures, it is of interest to note the remarkable similarities obtained for the Kaibab and the Abert squirrels. Hoffmeister's and Diersing's own analysis of the displayed data, however, appears to be somewhat inaccurate in one aspect. They claim:

As with principal component analysis, this Numtax (computer program for numerical taxonomy) analysis indicates that the squirrels from the Kaibab Plateau . . . are most like squirrels from the Coconino Plateau. . . .<sup>16</sup>

While this is valid for the Numtax data presented in their Figure 4, it appears at variance with the principal component data displayed in their Figure 3. Kaibab squirrels in their work are shown to be more similar to Abert squirrels found south of the Coconino plateau on the central Mogollon Plateau. The locality cluster which is the most similar to Coconino Plateau Abert squirrels is found along the northern Arizona-New Mexico border.

In addition, Hoffmeister and Diersing's categorizing the Kaibab squirrel as a subspecies is somewhat puzzling. In their Figure 4 the level of statistical significance for the dimensionless similarity index is set at

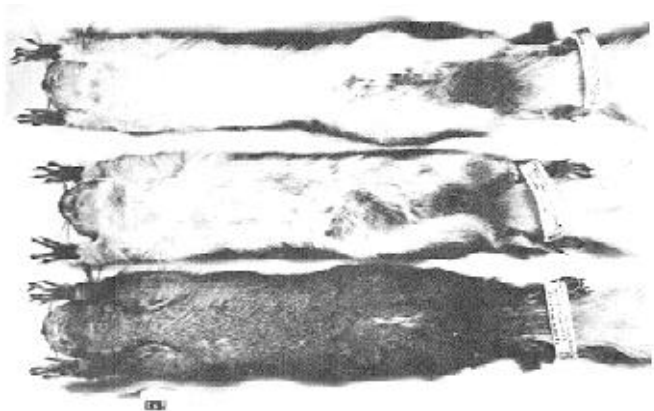


**Figure 5. Photograph of Abert squirrel abdomens. The lower specimen displays the usual white belly while the top specimen displays an almost pure-black belly. The middle specimen is intermediate in abdominal coloration.**

above 0.527 (the lower the number the greater the similarity). Examination of this Figure, however, indicates that the branching point for Kaibabs and south rim Aberts is barely above the 0.260 level. Only two other sets of locality clusters (out of 17 displayed here) show lower values (i.e. higher degrees of similarity). There are 13 branching points for the other locality cluster which show more divergence from each other than for the Kaibab-Abert complex. Of these, only five achieve statistical significance. Based on this data they accept five clear subspecies but equivocate on "*kaibabensis*." If coat color is ignored, as they have chosen to do, then there is no objective data forming a basis for separating the Kaibab squirrels from the Abert squirrels, even at the subspecies level. If the data do not support this taxonomic scheme, we must ask why it is that they are nevertheless assigned to a subspecies different from their south rim relatives. One wonders if it is not the evolutionary presupposition that is the controlling factor, demanding significant changes across time for isolated populations—changes which the data do not support.

It is my contention that the data support the idea that the south rim Aberts and the north rim Kaibabs form, for all practical purposes, one continuous population because of the minute differences. It is only the

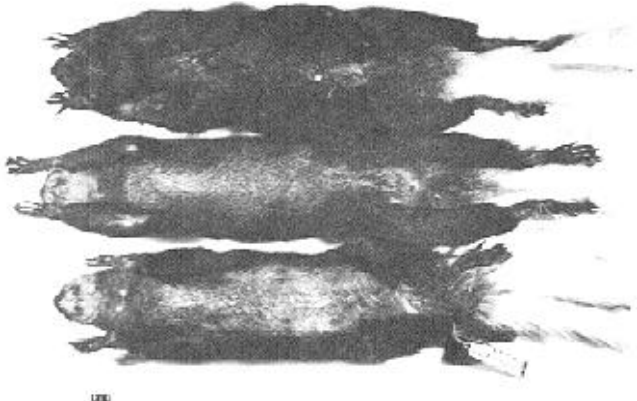


**Figure 6. Photograph of Kaibab squirrel abdomens. The lower specimen displays the usual dark belly while the top specimen displays the lighter colored form. The middle specimen is intermediate in belly coloration.**

recent origin of the Grand Canyon which now separates these two similar populations. Our own data (unpublished observations) based on 28 measurements from the skulls of each of 10 individuals, are in agreement with Hoffmeister and Diersing who also suggest "The sample from the Kaibab Plateau . . . and the sample from the Coconino Plateau . . . differ little from each other. . . ."<sup>17</sup>

### Grand Canyon Climatology

Although located only a short distance apart and characterized by similar flora and fauna, the two rims of the canyon present strikingly different climatological environments for the two squirrel populations. Even more striking is the difference in weather features between the floor of the canyon at Phantom Ranch and either rim. The extent of these differences in precipitation, temperature, and humidity are shown in Table II and displayed graphically in Figures 7 and 8.

Table II

Summary of Climatological Data from the Grand Canyon South Rim, Phantom Ranch (bottom of canyon at Colorado River) and North Rim

|                                                | G.C.N.P.<br>S. Rim<br>6950 ft. | Phantom<br>Ranch<br>2570 ft. | Bright<br>Angel<br>N. Rim<br>8400 ft. |
|------------------------------------------------|--------------------------------|------------------------------|---------------------------------------|
| 1. Yearly temperature mean (°F)                | 48.8                           | 69.2                         | 44.0                                  |
| 2. Mean daily maximum temperature (°F)         | 62.5                           | 81.8                         | 56.1                                  |
| 3. Mean daily minimum temperature (°F)         | 35.1                           | 56.5                         | 31.8                                  |
| 4. Highest recorded temperature (°F)           | 98                             | 120                          | 91                                    |
| 5. Lowest recorded temperature (°F)            | -16                            | -9                           | -25                                   |
| 6. Mean frost free days                        | 148                            | 331                          | 101                                   |
| 7. Yearly mean precipitation in inches         | 14.46                          | 8.39                         | 22.78                                 |
| 8. Yearly mean inches of snow, sleet, and hail | 64.9                           | 0.2                          | 128.7                                 |

These data are derived from *Climatological Data*, U.S. Department of Commerce. Means are reported for the period from 1941 to 1970. Extremes for south rim and north rim are reported for 1931 to 1972. Extremes for Phantom Ranch are reported for 1935 to 1972. Calculated statistical deviations from mean values are not available.

These data, based on observation periods ranging from 29 to 41 years<sup>18</sup> indicate dramatic differences in weather patterns across the width of the Grand Canyon. In the author's own experience it is quite possible to start an early morning descent from the south rim in mid-winter surrounded by a howling snowstorm, only to meet upward-bound hikers who report moderate temperatures, sunshine, and no precipitation at the bottom. Thus, any small terrestrial mammal accustomed to the high, cool woodlands which attempts to traverse the canyon would find itself in a hostile environment at the bottom.

Furthermore, this warmer, more xeric climate of the lower canyon extends far up the north wall. As the sun warms the north side, the heated air rises and curls back over the north rim. This produces a zonal suppression-type situation where semi-desert plants such as the cliff rose, various cacti, yucca, and agave grow in a strip a few dozen meters wide separated by only a few more dozen meters from the Ponderosa pine forest<sup>19</sup>. Thus, even in the possibly more mesic and cooler climates of past millennia (see reference 20 for details), the north wall heating effect would have presented a xeric environment for vegetation which might have otherwise occupied the lower reaches of the canyon.

### Age of the Grand Canyon

Of major interest in evaluating the isolation of Kaibab squirrels on the north rim is the time factor involved. It is clear from an examination of the pertinent literature that the evolutionary explanation for the history of the Colorado River in the vicinity of the Grand Canyon has not crystallized and seems unlikely to do so for the foreseeable future. Hunt<sup>21</sup> refers to this as "the grand problem of the Colorado, the age of the Grand Canyon."

This problem appears to arise in large part because of the unquestioning acceptance of certain widely divergent radiometric dates associated with various parts of the Grand Canyon area. For example, some investigators believe<sup>22</sup> the lower end of the Canyon is geologically young based on a 10.6 million year age from radiometrically inferred dates of the Fortification Basalt Member of the Muddy Creek formation which sets the upper limit. They also suggest the lower age limit is set by the 2.6 million year date estimated for basalt at Sandy Point which overlies gravels deposited by the Colorado River. Further upstream at the upper end of Lower Granite Gorge, an abandoned canyon breaches the southeast wall of the Grand Canyon and presumably represents the ancient but now abandoned course for the Colorado River flowing south and west through the Kingman area and back into its present course below Needles, California. Debris now filling this canyon has been estimated at 18.2 million years. The stretch of the Colorado upstream from the Grand Canyon is thought to be 30 to 40 million years old.<sup>23</sup>

A number of interesting hypotheses have been put forward in an attempt to harmonize the geography of the area with the inferred radiometric dates and various geological features of the area.<sup>24-26</sup> Some of these are as follows:

1. "The precocious gully" hypothesis. This view suggests that the course of the Colorado River above the Grand Canyon has always been essentially as it is today. However, in earlier times it flowed out through the Little Colorado in reverse from the latter river's present flow. Thus moving southward through the Little Colorado, it eventually emptied into the Rio Grand. In more recent times, a smaller river eroding its headlands eastward breached the ancient drainage course of the Colorado and captured the drainage system by river piracy. Hunt<sup>27</sup> has criticized this view, suggesting it was improbable for what must have then been a very minor river with very limited drainage basin to capture a river the size and volume of the original Colorado.

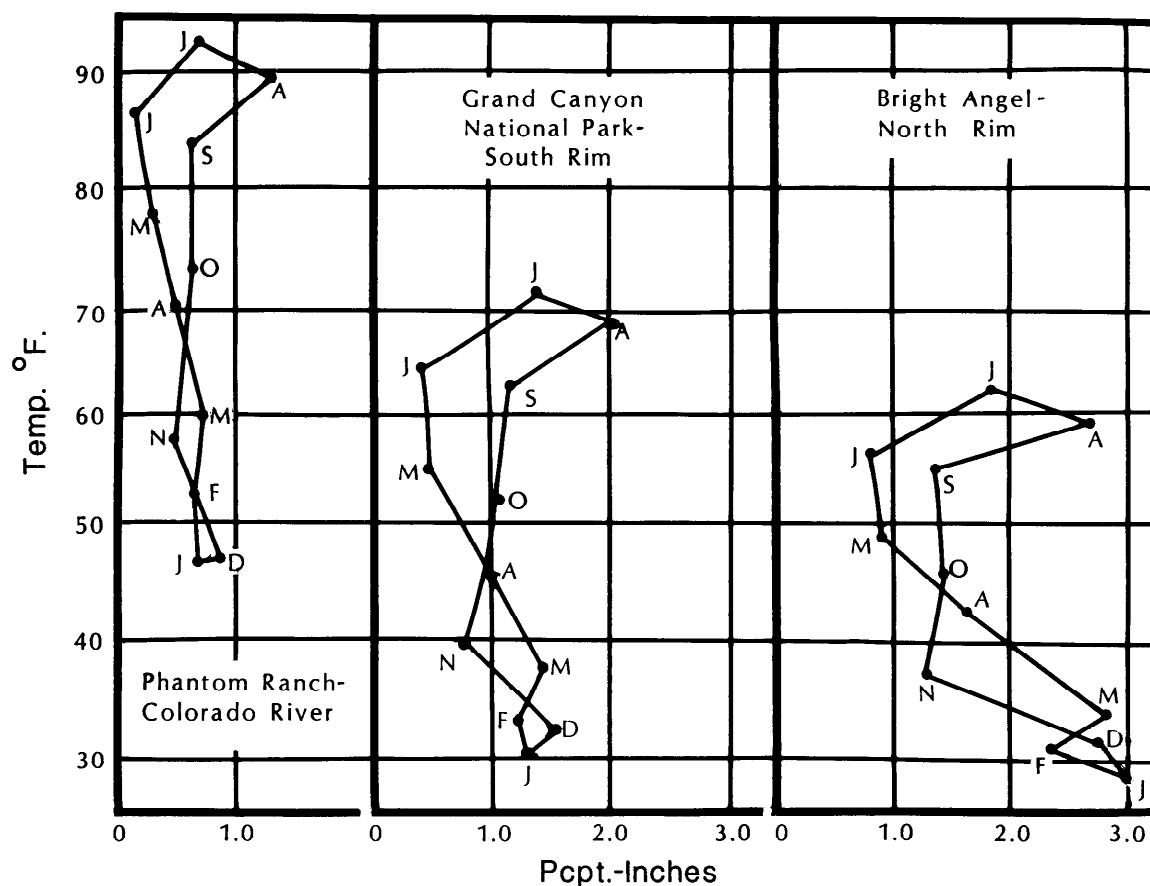


Figure 7. Climographs relating precipitation to temperature for three weather stations located in the Grand Canyon and on adjacent rims. Locations are the same as for stations for data from Table II. Means are derived from data reported for the period of 1941-1970. Abbreviations at data points represent months of the year.

2. "Precocious cave" hypothesis. This view put forward by Hunt suggests that the Little Colorado River never reversed directions, but in fact carried large quantities of water from a large mountainous region to the southeast which has since largely disappeared, having been faulted off the edge of the Colorado Plateau. To the west of the Grand Canyon, the Colorado River turned south (instead of its present northward course toward the Hurricane Fault) and drained through the ancient basin at Kingman, Arizona. This route was eventually blocked by volcanics or uplifts forcing the river into lakes and vast underground caves in the cavernous late Paleozoic limestone which plunges down a 1,000 foot syncline to the northwest towards the Grand Wash Cliffs. Dissolution and collapse of these caves opened the way for the present course of the River in that vicinity.

3. "Anti-gravity waterfall" hypothesis. Surely named tongue in cheek, this view holds that the ancestral river left the Colorado Plateau north and east of the Shivwits Plateau. To do so, Hunt points out,<sup>28</sup> would require that the stream flow up and out of the Grand Canyon and on to the rim of the higher adjacent plateau through a reversed waterfall!

An additional radiometrically inferred age for the Canyon is derived from the volcanic flows which at one point substantially blocked the flow of the Colorado. Radiometric values for these flows suggest the canyon was within 50 feet of its present depth 1.8 million years ago.<sup>29</sup> McKee,<sup>30</sup> however, believed that

the canyon itself is between seven and nine million years of age. Matthews<sup>31</sup> suggests seven million years. It is clear that no current evolutionary explanation has found universal acceptance among the geology experts on the area.

We are thus left in a bit of a quandary when trying to arrive at an evolutionarily inferred age for the isolation of the Kaibab from the Abert squirrel population. Given differences of opinion regarding the process of formation of the canyon, the dates assigned to the dissection of the Coconino-Kaibab Plateau by the Colorado River must vary widely from one authority to another. For the sake of simplicity and to be on the conservative side, I will arbitrarily work with a value of two million years. Even the Colorado River itself without a major canyon would provide a significant isolation barrier for the squirrels. Furthermore, given present rates of mass wastage, landslides, and other factors working to enlarge the canyon, a uniformitarian approach would appear to demand as much elbowroom as possible for present processes to have created a canyon five thousand feet deep and 10 to 15 miles across. Thus a two million year figure must be a minimum for significant isolation of the two populations, if one accepts evolutionary time scales.

In view of this postulated time span of separation, it is instructive to look at the forces for change which may be operating on the Kaibab squirrels within this framework.

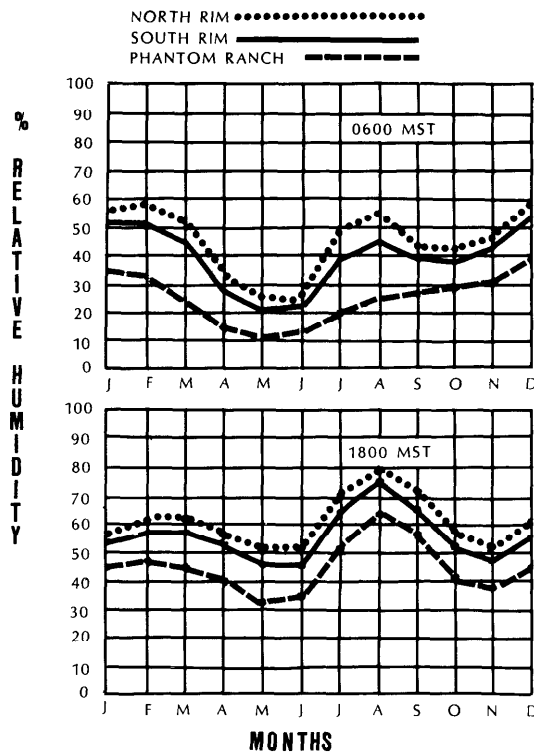


Figure 8. Estimated monthly mean relative humidity readings at 0600 mountain standard time (MST) and 1800 MST for three weather stations located in the Grand Canyon and on adjacent rims. Locations are the same as for data from Table II. Means are derived from data reported for the period of 1941-1970.

### Hardy-Weinberg Law, Equilibrium Populations and the Forces of Change

Most discussions of the supposed process of evolution center about exceptions to the restrictions necessary for the Hardy-Weinberg equilibrium population. For example, Stansfield<sup>32</sup> in his widely-used textbook, attaches such importance to this concept in his chapter on the subject that he states: "This chapter is extremely important because it sets the stage for a thorough understanding of the remainder of this book" (nearly 300 pages). Volpe<sup>33</sup> suggests "An understanding of the Hardy-Weinberg equilibrium provides a basis for recognizing the forces that permit evolutionary change." In view of the importance attached to the Hardy-Weinberg equilibrium concept by evolutionists, it is instructive to consider this idea, the conditions under which it fails to apply, the implications of this failure, and finally, how the whole concept relates to the Kaibab squirrel situation.

The quantitative aspects of the Hardy-Weinberg equilibrium are covered in almost any standard text on evolution. The paper by Howe and Davis<sup>34</sup> presents a thorough creationist evaluation in the larger context of natural selection. In general the Hardy-Weinberg equilibrium population is a group of interbreeding organisms which have a stable gene frequency throughout the population from one generation to the next. This fixity of gene frequency in space and time results in a static gene pool (defined as all genetic information distributed among an interbreeding group of individuals). This hypothetical population of or-

ganisms can only exist under one unique and highly restricted set of conditions. Stansfield<sup>35</sup> presents 10 of these restrictions and their implications:

1. The population is composed of a very large number of sexually reproducing diploid individuals (theoretically infinitely large).
2. Mating is completely at random, including selfing in random amount; this implies that each gamete of one sex has an equal chance of uniting with any gamete of the opposite sex.
3. Both alleles are adaptively neutral, i.e., there is no selection for or against either allele; all genotypes have equal viability and leave progeny directly in proportion to their respective frequencies.
4. The population is closed; no immigration into, nor emigration from the population is allowed.
5. Mutation from one allelic state to another is disallowed.
6. Generation overlap does not exist.
7. All members of the population are of equivalent reproductive age.
8. Meiosis is completely normal so that chance is the only factor operative in gametogenesis and segregation of alleles into functional gametes.
9. Gene frequencies are identical in males and females of the population.
10. Parents make equal contributions to the heredity of their offspring.

He goes on to explain the significance of these restrictions:

As long as a population conforms to these restrictions: neither the allelic frequencies of the gene pool nor the genotypic distribution of the population would change from one generation to the next. The population is said to be in *genetic equilibrium*. Violation of any of the restrictions on the Hardy-Weinberg model would produce a change in the gene pool (evolution). Since it is virtually impossible for any natural population to conform to all the Hardy-Weinberg restrictions (e.g. no population is infinitely large, completely random mating probably never exists, mutations cannot be prevented, etc.) evolution is almost inevitable.

Howe and Davis<sup>36</sup> note the significance of the Hardy-Weinberg equilibrium population as follows:

The evolutionist uses this stable base from which to launch an argument for change within gene pools. He asserts that the assumptions listed are important precisely *because* they are impossible to attain in actual populations. For this reason he views the Hardy-Weinberg equation as describing a hypothetical null set or "non-evolving" population to which real populations may be compared.

### Does the Kaibab Squirrel Population Satisfy the Requirements of an Equilibrium Population?

The extent to which the Kaibab squirrels violate the tight restrictions of the Hardy-Weinberg model should give us some insight into the rate at which the population is changing across time. Thus, if the population

conforms to all of the restrictions we should expect a stable gene pool, even across immense expanses of time. On the other hand, if any of the restrictions are violated we should expect to see progressive changes; and the extent of these changes should at least be roughly correlated with the time involved and the degree of restriction violation. Therefore, let us now consider the available information relating to each of the hypothetical restrictions:

1. Population is composed of a very large number of sexually-reproducing diploid individuals (theoretically infinitely large). Considerable concern has been attached to the Kaibab squirrel population size in recent years. National Forest Service personnel have derived a number of population estimates for the Kaibab squirrel based on various sources. These data are presented in Table III. Here it is seen that in the last 19 years, estimates range from a low of 10,000 to a high of 27,000 individuals. It should be noted that it is extremely difficult to secure accurate population number estimates from small, secretive, free-ranging mammals. Thus, these yearly values do not necessarily reflect population crashes and blooms. On the other hand, there is at least subjective and anecdotal evidence, as well as research data suggesting that population numbers do vary widely over time.

**Table III**  
**Estimated Number of Existing Kaibab Squirrels**  
**for the Years Indicated**

| Year | Estimated Number of Kaibab Squirrels |
|------|--------------------------------------|
| 1965 | 10,000 +                             |
| 1966 | 15,000 - 16,000                      |
| 1968 | 18,000 +                             |
| 1970 | 22,000 +                             |
| 1974 | 18,000 - 20,000                      |
| 1975 | 22,000 +                             |
| 1977 | 25,000 +                             |
| 1978 | 27,000 +                             |
| 1979 | 18,000 +                             |
| 1980 | 20,000 +                             |
| 1981 | 22,000 +                             |

Perhaps the mean value for the indicated years can serve as a working number. Thus, the total population for the Kaibab squirrel averaged over the last several decades appears to be a bit over 20,000, though Hall<sup>37</sup> thinks the present number may be lower than in previous times due to decrease in forest vigor. Thus the population of Kaibab squirrels is clearly not 'theoretically infinitely large.'

2. Mating is completely at random, including selfing in random amount. It is highly unlikely that any squirrel is capable of self-fertilization. In addition, given the extent of the Kaibab plateau and the limited range of an individual squirrel (well under 100 acres),<sup>38</sup> mating must be much more likely with members of the population in the vicinity than with those located at some distance. On a higher level of resolution, the squirrels are not even locally evenly distributed, preferring certain select trees over all others. Recent evi-

dence<sup>39</sup> suggests this is due to the chemical composition of trees. Thus, with an erratic distribution pattern throughout the Kaibab Plateau, mating cannot be completely at random.

3. Both alleles are adaptively neutral, i.e., there is no selection. This must hold for all genes within the gene pool. Stansfield<sup>40</sup> questions if any characteristic can be adaptively neutral. Patterson<sup>41</sup> asserts that even if some characteristics were adaptively neutral, it would be impossible to recognize them or their effects. He suggests:

The fact that some attribute of an organism appears useless to us is no guarantee that it is so. Investigations of apparently useless features has shown that some do, after all, have survival value. And while it may be possible to show that a certain feature has survival value and is subject to selection, it is never possible to show that a feature has no such value, and is selectively neutral: we may not have looked carefully or closely enough.

Many other evolutionists reject the concept (for example, see Dobzhansky, reference 42). This situation is therefore similar to attempts to demonstrate the existence of vestigial organs (see reference 43 for a review of a paper relating to this problem).

Furthermore, when one compares the climates faced by the Kaibab and Abert squirrels, it would appear that a number of alleles which should be adaptive for the environment of the Abert population would be less than optimal for the Kaibab population which faces quite different environmental challenges as previously discussed.

In addition, the characteristic coloration of the Kaibab squirrel presents some interesting problems, particularly if one assumes that natural selection is adapting it to its new and climatologically-different home on the north rim. Hall<sup>44</sup> discusses a number of possible adaptive roles for Kaibab body coloration. Two of these views and his objections are summarized as follows:

1) *White tail Cryptic Value*. However, squirrels run with tails extended, thus still making the dark body an easy target. It often rests with tail extended, thus not concealing the dark body. The tail is still white in the summer thus making it even more visible than the Abert.

2) *Signalling to other members of the Species*. But this involves primarily the ventral surface of the tail which is light in both groups.

In my own experience, location of eight Kaibab squirrels in a few hours was greatly facilitated by the presence of the white tail which could be seen through rather dense foliage even when the rest of the squirrel was not visible. Hall concludes that none of the proposals attempting to explain the presence of the white tail in the Kaibab are adequate.

Finally, the wide range of coat color polymorphism seen in the Kaibab (see Figures 3-6 and Table I) suggests that not all patterns can be adaptively neutral or of equal adaptive value.

4. The Population is closed. At the present time this restriction does appear to hold rather firmly. The unique geographical location of the Kaibab Plateau with desert on three sides and the Grand Canyon on the fourth side does appear to be a rather insurmount-

able barrier to immigration and emigration, particularly since the tassel-eared squirrels are restricted to the high altitude Ponderosa Pine forests. On the other hand, if one holds a uniformitarian approach to the origin of the Grand Canyon rather than a catastrophic origin, one must assume a rather gradual development of the canyon, which in its earlier years would have provided, at best, a partial barrier to the movements of squirrels. Thus while this restriction now holds rather tightly, it apparently did not always do so. In addition, there are several sub-populations of Kaibab squirrels which are only partially isolated from the main population. The squirrels living on the Powell Plateau which is an extension of the Kaibab Plateau would be an example of this.

5. Mutation is disallowed. The albino form of the Kaibab is surely the ultimate result of a point mutation. Since mutations are considered random changes in the genetic material, it can hardly be denied that all parts of the genome are subject to this process. To disallow mutations in the Kaibab squirrel would be to undermine great sections of modern genetics. Thus it is clear the Kaibabs do not conform to this restriction.

6-7. Generation overlap does not exist and all members of the population are of equivalent reproductive age. However, the maximum verified age of tassel-eared squirrels is nine years with an average adult life span of three to four years.<sup>45</sup> Any female can produce a number of litters in a life time, thus necessitating generation overlap and ruling out equivalent reproductive age for all members of the population.

8. Meiosis is completely normal. Meiotic aberrations have been well studied and are clearly wide spread throughout the plant and animal kingdoms. While we are unaware of any specific data on this subject relating to the tassel-eared squirrels, it would be astounding, indeed, to find that they had escaped this particular vagary of reproductive problems.

9-10. Gene frequencies are identical in males and females and parents make equal contributions to the heredity of offspring. Not only is this restriction generally unlikely in any population, but also the presence of sex chromosomes of necessity lead to a violation of these restrictions. Since the male chromosome is much smaller than the female, this feature alone would demand that male and female contribution to the genome of the offspring are by their very nature unequal. These restrictions must also fail the test of credibility.

Of the 10 restrictions mandatory for an equilibrium population and gene pool stability from generation to generation, at least eight of them clearly fail the test of credibility and supporting data. One (closed population) must have been violated in the early isolation of the population if the evolutionary scenario based on uniformitarianism is correct. The probability for the validity of the final restriction (meiosis is completely normal) is vanishingly small.

Thus, by the above criteria necessary for the equilibrium population, it is obvious that the Kaibab squirrels have had no hope of genetic stability during their existence; i.e., by the standard definition, they should be "evolving" and doing so at a rather rapid rate. If this is the case we must ask why it is that the differences between Kaibab and Abert squirrels are so little in evidence.

### Origin of the Tassel-eared Squirrels in Northern Arizona

How then does one account for the Abert-Kaibab complex from a creationist perspective? To attempt to answer this question we now present a model which is somewhat speculative but nevertheless plausible, being, we believe, faithful to the objective data in hand. The reader will note that the model is *not* in harmony with the dates *inferred* from radiometric procedures and based on uniformitarian assumptions and presuppositions. Critiques of radiometrically based inferred dates have been numerous in creationist literature and will not be repeated here. The interested reader is referred to such important works as Slusher<sup>46</sup> and Whitcomb and Morris<sup>47</sup> for analysis of these problems.

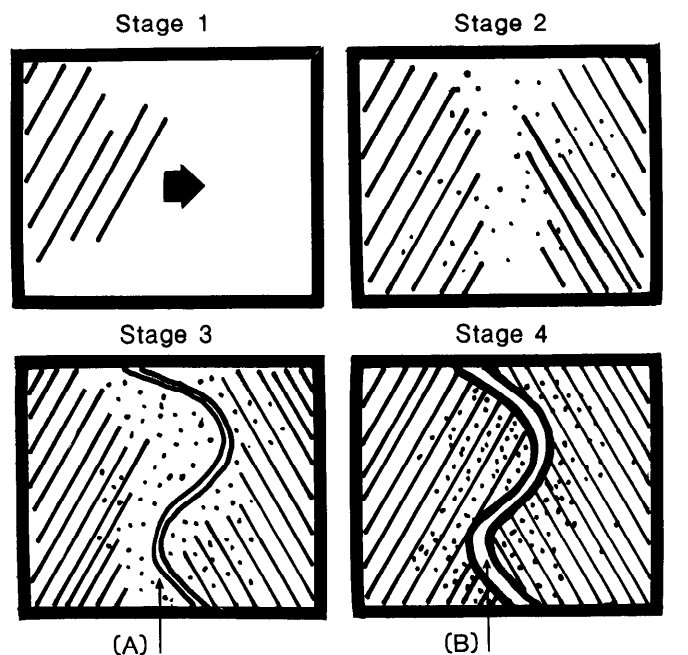
A model should be in harmony with the objective data and sufficiently general to encompass the uncertainties of that data. It should also be sufficiently specific to provide a testable model for future research. Thus the model presented here is a preliminary attempt to meet these guidelines.

The model should consider at least the following features of the tassel-eared squirrel situation in the Southwest:

1. High degree of variability in Abert coat color.
2. Presence of Abert squirrels on the south rim and the distinctively (though not uniformly) colored Kaibab on the north rim.
3. Presence of Kaibab-like Aberts on the south rim.
4. Presence of Abert-like Kaibabs on the north rim.
5. The Grand Canyon as a highly effective isolating mechanism throughout most of its life.

The proposed model is displayed in Figure 9. It is suggested that the original colonizing squirrels, perhaps having few predators and having considerable available habitat, rapidly established themselves in the cool, relatively moist high altitude Ponderosa Pine forests in Northern Arizona and other similar areas of the Southwest. Increasing temperatures and decreasing moisture began to take its toll on the lower altitude Ponderosa Pines. Therefore, in many instances, local populations of Abert squirrels were cut off from their neighbors by the disappearing Pine forests of the valleys. Thus local, higher altitude, Ponderosa Pine forests became isolated islands of vegetation, providing concomitant isolation for local populations of Abert squirrels whose habitat is restricted to these Ponderosa leys. Thus local, higher altitude Ponderosa Pine forests apparently was well underway before the Aberts could establish themselves in the more remote areas since many present areas of suitable habitat are devoid of the squirrel.

One of the populated Ponderosa Pine forest islands that did contain the Abert squirrel was found in Northern Arizona. Here small numbers of early immigrants made disproportionate contributions to the gene pools of following generations (Founder Principle) and natural calamities (forest fires, severe weather, predation) arbitrarily altered gene frequencies in small populations (Genetic Drift). An occasional mutation, although almost inevitably deleterious, further altered local gene pools. By this time stage two of Figure 9 had been reached. Stage three began with the establish-



///// Abert Squirrel    ..... Kaibab-like Abert and  
 \\\\\ Kaibab Squirrel    ..... Abert-like Kaibab squirrels.  
 (A) - Early Colorado River before canyon formation.  
 (B) - Present Grand Canyon and Colorado River.

Figure 9. Proposed model for the origin of the Kaibab-Abert complex in the Grand Canyon region. 1. Migration of the Abert squirrel into northern Arizona. 2. Establishment of local sub-populations. 3. Origin of the Colorado River. 4. Development of the Grand Canyon as an effective isolation barrier. Similar pattern exists today.

ment of the Colorado River course through the southern edge of the Colorado Plateau.

*Sciurus aberti aberti* flourished in the south while *Sciurus aberti kaibabensis* thrived to the north. In between was a hybrid population exhibiting varying degrees of coat polymorphism characteristic of their parent stock. The rapidly developing river course found its way through the center of the mixed intermediate forms and began to deepen its channel, perhaps as the Colorado Plateau uplifted. In a short period of time the river had cut a channel sufficiently deep and wide that it began to curtail free movement of squirrels. As the canyon continued to develop, it provided a highly efficient barrier, keeping the two squirrel populations from sharing gene pools, and thus establishing the populations in essentially the pattern seen today (stage four).

### Conclusion

If any group of animals were ever going to undergo significant degrees of evolution from parent stock and obtain resultant speciation, surely the Kaibab squirrel would be one of the more likely candidates. Supposedly isolated from their neighbors for hundreds of thousands of generations over a period of at least several million years, and significantly violating virtually every restriction of the Hardy-Weinberg equilibrium for a non-evolving population, these organisms, even by creationist standards, should have undergone significant and detectable changes. In reality all they show

are moderate changes, primarily in two coat color characteristics for part of the population. To make things even worse, this species is known to have a highly variable coat-color polymorphism throughout its range. Thus, even the differences displayed appear to be easily accounted for by several mutations and a slight change in gene frequency for one or two loci, all occurring in a limited period of time.

If an organism such as the Kaibab squirrel is able to escape all but a few minor changes in coat color (and these of dubious survival value) given the supposed immense time of rather complete isolation and violation of the Hardy-Weinberg equilibrium, we must ask wherein lies the fault. Is it in the violation of the Hardy-Weinberg equilibrium concept, or is it in the time allotted for gene pool changes to occur?

The Hardy-Weinberg equilibrium population and associated universal violations of restrictions appears to be reasonably well founded, though perhaps of considerably less importance than demanded by the general theory of evolution. Both theoretically, experimentally, and in natural populations I see no problem with its major features.

This leaves us then with the problem of time. How much time has been allotted for the violations of the Hardy-Weinberg restrictions to work? Perhaps the most logical answer for this, and indeed, for the entire study of geographical isolation of the Kaibab squirrels, is that time has been the limiting factor.

If the above conclusion is correct, then this indirect evidence for time limitation has important consequences not only for the biology of the Grand Canyon area but for the actual formation of the canyon itself. If we are correct in our interpretation of the existing data regarding the Kaibab squirrel, then we have no other choice than to assign a very recent origin to the Grand Canyon of the Colorado and its role as an isolating mechanism for the Kaibab squirrel.

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## PERSPECTIVES ON THE ORIGIN OF MITOCHONDRIA

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### Abstract

*The two main theories of the evolutionary origin of the mitochondria are examined. Evidence that is frequently cited to support each theory is presented to determine how well it supports each. It is concluded that most of the evidence can be fit into either scheme, and that even the best data constitute only circumstantial evidence in favor of any evolutionary origin of mitochondria.*

### Introduction

In all schemes of the evolutionary advancement of life there is a point where a relatively simple cell must be converted into the more complex cells of which all higher organisms are composed. There are two general theories as to how this division occurred (Figure 1). The autogenous theory claims the cellular organelles arose through a gradual process of compartmentalization of genes and enzymes present in the ancestor. The endosymbiont theory claims the organelles evolved separately from the main part of what is now the eukaryotic cell and became associated with

it by being engulfed and then forming a symbiotic relationship.

The debate between the proponents of these theories has been long and sometimes acrimonious with each in turn claiming solid proof of its validity. Consequently many students of origins may find this aspect of the debate between evolutionists confusing and could benefit from a short review outlining the pro and con of these two views. We will limit our discussion to the mitochondrion principally because the authors are more interested in animal cell biology than plant. Some researchers feel the phylogenetic relationship between the plastid and its endosymbiotic ancestor has been established much more firmly than for mitochondria. Those interested in studying this aspect of origins should obtain the review by Gray and Doolittle<sup>1</sup> or the article by Rao et al.<sup>2</sup>

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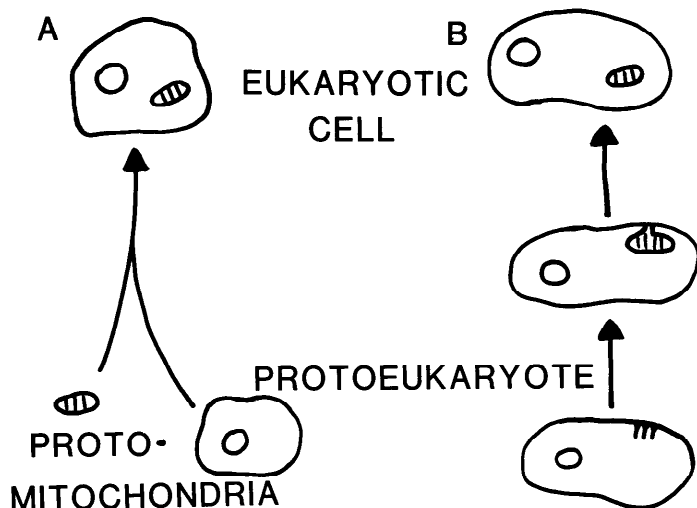


Figure 1. General comparison of the endosymbiotic (A) and autogenous (B) theories. In 'A' an anaerobic protoeukaryotic cell engulfs an aerobic bacterium and develops a symbiotic relationship with it. The endosymbiotic theory maintains that all other cellular organelles arose in a similar fashion. In 'B' the mitochondrion gradually develops as the respiratory enzymes and some DNA are partitioned into a separate compartment.

### Physiology and Morphology

To some the endosymbiotic theory might seem implausible as a possible mechanism. However, it is well known that such close symbiotic relationships do occur. For example, lichen is composed of two distinct organisms which can, with great difficulty, be grown separately from each other. Only when together do they form a structure we recognize as lichen. Lynn Margulis,<sup>3</sup> possibly one of the strongest supporters of the endosymbiont theory, lists 13 examples of known endosymbiosis of which some can be separated and then shown to reestablish the symbiotic relationship. While this does not constitute proof the eukaryotic cells have arisen by endosymbiosis it does prevent us from initially discarding the theory as unwelcome.

The similarity in morphology between mitochondria and some bacteria led early workers to speculate on their possible relationship. Both mitochondria and some bacteria have dimensions of about one micron. However, the highly convoluted inner membrane of mitochondria (Figure 2) does not at all resemble the structure of the inner membrane of bacteria. The membrane lipids of mitochondria and bacteria have also been compared to show their close relation. The prokaryotes (bacteria) have no sterol and only saturated and monounsaturated fatty acids in their membrane, while mitochondria, like the remainder of the eukaryotic cell, do contain cholesterol and polyunsaturated fatty acids in addition to saturated fatty acids. Also, the phospholipid composition differs between prokaryotes and eukaryotes.<sup>4</sup> As an exception the mycoplasma are the only prokaryotes which contain both cholesterol and polyunsaturated fatty acids in their membrane and lack cell walls. While this at first might seem to make the mycoplasma good candidates for the ancestors of mitochondria, a different bacterium, *Paracoccus denitrificans*, has been found which has many more similarities to mitochondria. Typical phospholipid compositions of mitochondria, *Escherichia coli*

and *Paracoccus denitrificans* are compared in Table I. Only the composition of the inner membrane of the mitochondria is reported here as it is generally assumed that if mitochondria did come into existence by endosymbiosis the outer membrane would arise from the phagocytic vacuole. Such a situation can be seen in the development of symbiosis of a bacterium and the amoeba *Pelomyxa palustris*. It is evident from Table I that while mitochondria do have lower levels of phosphatidylcholine than the plasma membrane of eukaryotes (which contain about 80 percent) and that there are similarities between *P. denitrificans* and mitochondrial composition there are also great differences. In particular the content of phosphatidylglycerol is much higher in *P. denitrificans* than either of the other membranes shown. Consequently, while *P. denitrificans* has a phospholipid composition which is closer to that of mitochondria than other bacteria this is no more than circumstantial evidence of a relationship. Table II shows the comparative amounts of saturated, unsaturated and cyclopropane fatty acids esterified to the phospholipids of these membranes. It is pointed out that the amounts of saturated and unsaturated fatty acids in *P. denitrificans* are similar to that of mitochondria. However, the types of fatty acid within each class are quite different. The bacteria (including *P. denitrificans*) have only monounsaturated fatty acids and their longest fatty acids (saturated or unsaturated) are only 18 carbons long. Mitochondria have fatty acids up to 20 or 22 carbons long and they are rich in polyunsaturated fatty acids. Thus it can be said that the similarities in fatty acid composition may be fortuitous and cannot be used accurately to show a relationship.

A consideration of the synthesis of lipids for mitochondria shows that any comparison of compositional data is useless no matter how closely they might converge. All of the lipids used in the synthesis of mitochondrial membranes (sterols, fatty acids and phospholipids) are produced in the endoplasmic reticulum of the "host" cell. The completed phospholipids are

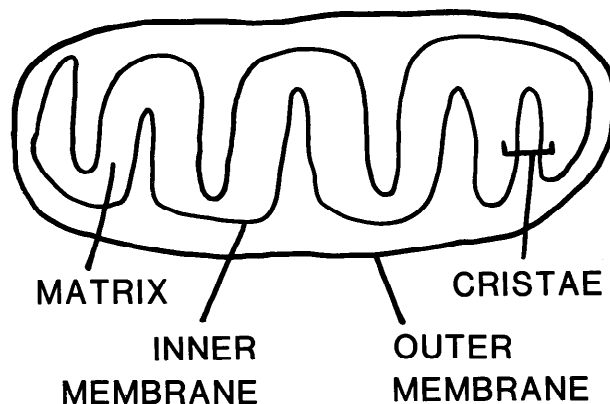


Figure 2. The mitochondria are sometimes called the power house of the eukaryotic cell as they produce the cell's ATP from nutrients and oxygen. The final stages of this oxidative process occur on the cristae which are folds of the inner membrane. These greatly increase the surface area available. Most of the other enzymes involved in respiration are located in the matrix which is similar to the cellular cytoplasm. The mitochondrial DNA is also located in the matrix and is generally circular like that of the bacteria. The outer membrane is similar in composition to the endoplasmic reticulum of the 'host' cell and some even feel it is contiguous with it.

TABLE I

Comparative Phospholipid Composition of Rat Liver Mitochondria Inner Membrane, *Escherichia coli* and *Paracoccus denitrificans*<sup>5, 6</sup>

| Lipid                    | Percent Present |                         |              |
|--------------------------|-----------------|-------------------------|--------------|
|                          | <i>E. coli</i>  | <i>P. denitrificans</i> | Mitochondria |
| phosphatidylethanolamine | 80              | 6                       | 28           |
| phosphatidylserine       | 0               | 0                       | Trace        |
| phosphatidylcholine      | 0               | 31                      | 45           |
| phosphatidylglycerol     | 10              | 52                      | 2            |
| phosphatidylinositol     | 0               | 0                       | 4            |
| cardiolipin              | 10              | 3                       | 22           |
| cholesterol*             | (0)             | (0)                     | (3)          |

\*Percent of total membrane lipid.

then transported into the mitochondria by phospholipid transfer proteins. If the mitochondrion is in fact the descendant of a bacterium it has totally lost the ability to synthesize lipids. As a consequence it makes no difference what the lipid composition of the mitochondrial ancestor is since as soon as it must import its lipids it will take on the compositional characteristics of the host. This might make the autogenous theory seem more attractive as it could be argued to be simpler in that it does not require the loss of a pre-existing ability. In both cases the phospholipid transfer proteins must be fully evolved before the new organelle can function. The timing of this might be slightly less critical for the endosymbiont theory as there is the potential for both the import and synthesis of phospholipid while the import apparatus must be totally functional before the developing organelle of the autogenous theory is fully enclosed. However, such advantages are likely to be slight and open to debate.

TABLE II

Comparative Fatty Acid Composition of Rat Liver Mitochondria, *Escherichia coli* and *Paracoccus denitrificans*<sup>7</sup>

| Lipid        | Percent Present |                         |              |
|--------------|-----------------|-------------------------|--------------|
|              | <i>E. coli</i>  | <i>P. denitrificans</i> | Mitochondria |
| saturated    | 39              | 21                      | 34           |
| unsaturated  | 48              | 78                      | 63           |
| Cyclopropane | 10              | —                       | —            |

### Respiration

Ostensibly the development of the mitochondrion was favored evolutionarily as it supposedly provided the host cell with the greater energy yields possible with oxidative compared to anaerobic respiration. If this is the case some predictions can be made concerning both the host and premitochondrial cells. The host cell would have to have only a fermentative mode of respiration in order for there to be a selective advantage in the acquisition of protomitochondria and the mitochondrial ancestor must have had fully developed oxidative respiration. It is generally assumed that such

an organism would have arisen from a purple photosynthetic bacterium which had lost the ability to photosynthesize while retaining its respiratory chain (Figure 3).<sup>8</sup> The strength of the selection of *Paracoccus denitrificans* as being related to the mitochondrial ancestor is based primarily on its respiratory apparatus as listed in Table III. While many bacteria possess some features of oxidative respiration which are the same or similar to mitochondria, only *P. denitrificans* has as extensive a list of correlations. Further, *P. denitrificans* does not seem to lack any major feature of the mitochondrial respiratory chain.<sup>10</sup> Relatively few bacteria have ubiquinone-10 as their sole quinone, while most mitochondria possess only ubiquinone-10. The bacterium *P. denitrificans* requires 1000 times more rotenone than mitochondria to inhibit NADH oxidation, but most bacteria are not affected by rotenone at all. The enzyme transhydrogenase is involved in the transfer of protons across the inner mitochondrial membrane utilizing the adenine dinucleotides NADP<sup>+</sup> and NAD<sup>+</sup>. It is also coupled to oxidative phosphorylation and similarities have been found in the amount of ATP used by mitochondrial and *P. denitrificans* enzymes. Since it is coupled to oxidative phosphorylation the number of protons (H<sup>+</sup>) moved per oxygen atom can be experimentally determined. Mitochondria have a H<sup>+</sup>/O ratio of six while the bacterium's ratio is eight. This difference is generally attributed to constraints in the experimental design. The bacteria do possess some dehydrogenases not possessed by mitochondria which allow them a wider variation in substances on which to grow. The loss of these dehydrogenases (such as formate dehydrogenase) would not be prevented and might be favored evolutionarily since the substances encountered within the host cell would be expected to be less varied. Of greater importance is the need for the protomitochondrion to acquire an ATP carrier. Normally ATP would be generated in the interior of the cell as it is to be utilized in that cell's metabolism. The mitochondrion, however, is producing ATP for the host cell and must export it to achieve this purpose. The purpose of the adenine nucleotide carrier is to do just that and any endosymbiotic or autogenic protomitochondrion would be useless without it.

From this discussion it is evident that if the mitochondrion did develop from an endosymbiont then this bacterium is a very good candidate for its closest living relative. The critics of this idea generally do not quibble with the selection of *P. denitrificans* but rather point out that the prediction of an anaerobic cytoplasm of the host cell may not be fulfilled.<sup>11, 12</sup> That this is the case is evident from several perspectives. The synthesis of sterols and unsaturated fatty acids, which are mandatory for the growth of eukaryotic cells, is an aerobic process. Even the fermentative eukaryotes such as yeast require a supply of sterol and unsaturated fatty acid to grow anaerobically over extended periods. The synthesis of these lipids takes place on the endoplasmic reticulum which is an integral part of the eukaryotic cell. Since bacteria synthesize no sterol and produce unsaturated fatty acids by an anaerobic pathway it cannot be claimed that the enzymes for lipid synthesis were transferred from the protomitochondrion to the cytoplasm as they are not at all similar.

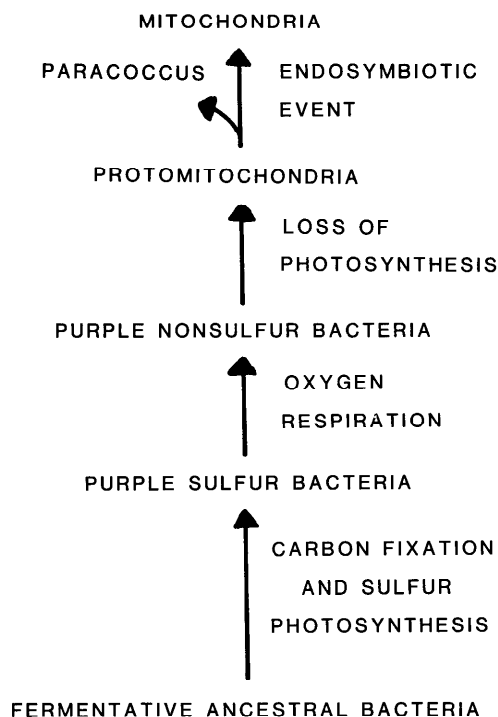


Figure 3. A possible phylogenetic tree of the evolution of the mitochondrion by endosymbiosis.

While aerobic cells require oxygen for their existence they must also be protected from its toxic effects. Aerobic cells therefore possess the enzymes superoxide dismutase and catalase. These enzymes convert the superoxide radical ( $O_2^-$ ) to hydrogen peroxide and then water. Without this form of protection this oxygen radical, which is a byproduct of cellular metabolism, would react with the lipids, proteins and nucleic acids of the cell resulting in their destruction or inactivation. These enzymes are located in the cytoplasm which may indicate the protoeukaryote was aerobic.<sup>13</sup> Alternately these enzymes might have been transferred from the incorporated aerobic bacterium into the cytoplasm of the host. As there is no real evidence as to which of these is so, either theory can conjecture without limit. It should also be pointed out that most of the enzymes and cofactors of oxidative respiration can be found in the nuclear membrane,<sup>14</sup> and eukaryotes have an electron transport system on the endoplasmic reticulum similar to that in the mitochondria, which is important in the oxygen-coupled synthesis of a variety of compounds.<sup>15</sup> This all goes to suggest that the cytoplasm either was never anaerobic or it evolved into an aerobic cell in synchrony with the development of the mitochondrion.

#### DNA

The presence of DNA in mitochondria is probably an expected feature if this organelle arose symbiotically, in which case it would be the remains of the bacterial genome of the protomitochondrion. If so, the present mitochondrial genome should show much in common with the prokaryotes. If on the other hand it is a plasmid which was included in a developing compartment as claimed by the autogenous theory it might be expected to show similarity to the nuclear

genome from which it was presumably derived (Figure 1). Thus these two theories provide us with some predictions we may use in their evaluation.

Bacterial genomes exist as closed circles of double stranded DNA, while eukaryotic DNA is organized into linear chromosomes of double stranded DNA which is wound onto a support protein called histones. Mitochondrial DNA lacks histones and is generally circular like bacterial DNA. However, linear mitochondrial DNA is also found, principally, in the protozoa and a few fungi.<sup>16</sup> The size of the mitochondrial genome is much smaller than the smallest bacterial genome and is in the range of some viruses.<sup>17</sup> Since only 10 percent of the organelle's components are coded for by the mitochondrial genome this small size should not be too disturbing. There is immense variation in size of the mitochondrial genome with yeast being up to five times longer than human, and plant at least five times longer than yeast. In spite of these great differences in length mitochondrial genomes generally code for the same sets of products. These include two rRNA, and some of the proteins involved in the electron transport chain and ATP generation. The length differences are due to wide variations in the amount of inserted DNA with human mitochondrial DNA having almost none of these inserts while yeast mitochondrial DNA has many. In the nuclear genome of eukaryotic cells these intervening sequences are often found in the middle of genes creating a "split gene." Split genes are unknown in bacteria.<sup>18</sup> Thus there are similarities to both eukaryotic and prokaryotic genomes depending on which mitochondrion is being examined. Human mitochondria do not have split genes so resemble bacterial genomes while yeast mitochondria do have split genes and so resemble the nuclear genome. When split genes are transcribed the intervening portion must be removed before a viable message is formed and a protein or RNA can be syn-

Table III  
Comparison of *Paracoccus denitrificans* and Mitochondrial Oxidative Respiration<sup>a</sup>

| Feature                                           | <i>P. denitrificans</i> | Mitochondrion  |
|---------------------------------------------------|-------------------------|----------------|
| Succinate Dehydrogenase                           | +                       | +              |
| NAHD Dehydrogenase                                | +                       | +              |
| Transhydrogenases and FeS proteins                | +                       | +              |
| Ubiquinone —10 sole quinone                       | +                       | +              |
| Sensitive to low antimycin concentration          | +                       | +              |
| NADH oxidation inhibited by rotenone              | (+) <sup>b</sup>        | (+)            |
| Succinate oxidation inhibited by carboxin         | +                       | +              |
| Oxidative phosphorylations H/O ratio 8 with NADPH | (+)                     | (+)            |
| Respiration regulated by ADP levels               | +                       | +              |
| Formate dehydrogenase                             | +                       | — <sup>c</sup> |
| cytochrome o                                      | +                       | —              |
| Adenine nucleotide carrier                        | —                       | +              |

a. present; b. similar; c. lacking.

thesized. In eukaryotic cells this is accomplished by a splicing enzyme which cuts out the excess DNA and rejoins the ends of the valuable message. The inserted material of chromosomal genes does not carry any known information. However, it has been found that in yeast mitochondrial DNA the information needed to make the splicing enzyme is located in the inserted DNA which is to be removed.<sup>89</sup> Another way in which the mitochondrial genome has been found to be unique is that the information for the two rRNA subunits<sup>20</sup> on yeast mitochondrial DNA are so far apart that they must be made at different times.<sup>21</sup> In both nuclear and bacterial cells these subunits are made at the same time. In both bacteria and eukaryotes the transcription of each gene or cluster of genes on the genome is controlled by a special region of DNA located at that gene's leading edge which interacts with inhibitor or activating molecules. In human mitochondrial DNA there is only one such site for the entire genome, while yeast have many.<sup>22</sup>

The genetic code of mitochondrial DNA is known to be different from the "universal" code of the nucleus and bacteria. It has been suggested that this represents the more primitive genetic code of the early stages of cellular evolution. However, the point to notice in our discussion is that not only does the mitochondrial genetic code differ from the universal code but there are differences in code between the mitochondria of different organisms.<sup>23</sup>

We see then that the genome of the mitochondria exhibits such diversity that no conclusions can be drawn as to the validity of the two major evolutionary models of its origin. Indeed, the main impression one obtains is of the many instances in which the mitochondrial genome is unique. This impression remains even if we accept that much of the variation in size and genetic code is due to fairly recent evolutionary events such as random drift.

### Protein Synthesis

Protein synthesis begins with the transcription of the information on the DNA molecule onto a strand of mRNA (messenger RNA). This message is then read by the ribosomes which are composed of rRNA and ribosomal proteins. The ribosome attaches amino acids into a chain in the order specified on the mRNA, a process termed translation. The amino acids are brought to the ribosomes on tRNA (transfer RNA). While this sequence is essentially unchanged in pro- and eukaryotes the ribosomes and other molecules involved are distinctly different. One of the claims made in favor of the endosymbiotic theory was that protein synthesis in the mitochondrion was very similar to that in bacteria. Recent discoveries have shown that this may not be the case.

The transcription of the DNA information into mRNA form involves the enzyme RNA polymerase. The mitochondrial RNA polymerase, like all the enzymes required for mitochondrial DNA synthesis, is coded for in the nucleus. The polymerase of the nucleus and of bacteria is composed of several different subunits and is of high molecular weight. In contrast the mitochondrial polymerase is composed of a single subunit and is of lower molecular weight.<sup>24</sup>

The mRNA of bacteria and eukaryotes differs in the treatment of the 3' tail. In eukaryotic cells a series of

adenine molecules is added one at a time to the 3' end by a special enzyme after completion of its transcription from DNA. In bacteria this polyadenation of the 3' end does not always occur, while a polyadenine tail has been found on mitochondrial mRNA. However, the adenines added to mitochondrial mRNA seem to be added as groups rather than singly.<sup>25</sup>

The ribosome is a central structure in protein synthesis since it is here that amino acids carried on tRNA's are brought together in the order dictated by the mRNA and bonded into a polypeptide chain. The characterization of ribosomes is based on the amount of protein they contain, their base composition and their size. The first problem we encounter in investigating the mitochondrial ribosome is that there is so much variation between them that they show little evidence of a common ancestry.<sup>26, 27</sup> Secondly, it is now acknowledged that the mitochondrial ribosome is vastly different from both their bacterial and eukaryotic homologs. The characteristics of ribosomes are outlined in Table IV.

**Table IV**  
**Ribosomal Characteristics<sup>28-31</sup>**

|                                          | Mitochondria | Bacteria | Cytoplasm |
|------------------------------------------|--------------|----------|-----------|
| <b>Size (Svedberg Units<sup>a</sup>)</b> |              |          |           |
| Mature Ribosome                          | 55S to 80S   | 70S      | 80S       |
| Small Subunit                            | 28S to 55S   | 30S      | 40S       |
| Large Subunit                            | 39S to 60S   | 50S      | 60S       |
| <b>Percent Protein Content</b>           | 60+          | 40       | 40 to 50  |
| <b>Number of Proteins</b>                |              |          |           |
| Small Subunit                            | 30 to 44     | 21       | 33        |
| Large Subunit                            | 31 to 40     | 34       | 45        |

a. Svedberg units measure the size of a particle by the distance it moves in a centrifugal field.

Bacterial ribosomes contain about 60 percent RNA and 40 percent protein while eukaryotic ribosomes are about 50 percent RNA. Mitochondrial ribosomes are reported to often have over 60 percent protein with a great deal of variation between organisms. Likewise, while the number of proteins associated with the subunits of ribosomes of bacteria and eukaryotic cytoplasm is fairly constant, there is great variation in this respect for the mitochondrial ribosome.

There is also great variation of size in mitochondrial ribosomes while bacterial and eukaryotic ribosomes show constant values which differ from each other. Molecular weight determinations using gel electrophoresis also indicated that mitochondrial rRNA are not the same size as bacterial rRNA. If rRNA in the mitochondria were derived from the cytoplasm there should be a correlation between them but this is also found not to be so.

The base composition of mitochondrial rRNA would be expected to be similar to the eukaryotic rRNA if they are both derived from a common ancestor (auto-genous theory). Measurements reveal that while bacterial rRNA is fairly constant with a G+C of 50-55 percent,<sup>32</sup> eukaryotic and mitochondrial G+C contents are variable. There is a rather strong correlation between the base composition of mitochondrial rRNA,

cytoplasmic rRNA and the DNA of the nucleus, which some point to as evidence of a relationship between the mitochondrial and eukaryotic rRNA,<sup>33</sup> i.e. support for the autogenous theory.

The tRNAs of mitochondria are now known to be different from their counterparts in bacteria and the cytoplasm. There are examples of tRNA for certain amino acids resembling the homologous bacterial tRNA, but these are balanced by there also being examples of similarity to eukaryotic homologs. The first tRNA used in the synthesis of protein is termed the initiator and is chemically modified. The mitochondrial initiator is similar but not identical with the bacterial initiator.<sup>34</sup>

While the synthesis of protein in mitochondria was once thought to show a strong relationship to bacteria, more recent studies have shown that at every step mitochondrial protein synthesis is unique.

### Conclusions

#### Selection of an Evolutionary Model

There are three classifications of data discussed in this paper. First, is the evidence such as much of the physiological comparisons which are found to have no weight in either direction. Second, there are items which seem to strongly support one theory over the other. And third, there is that evidence which can support either theory depending on the weight one puts on that particular point and the assumptions one is willing to make. In fact, this third class often extends to include the second class as appropriate assumptions are made to shift its importance from one side of the argument to another. This third class is by far the largest group of data and so it is best to conclude that there is currently no clear cut evidence that shows either the autogenous or endosymbiotic theories to be correct.

#### Impact on Creationism

Many creationists will want to place this evidence concerning mitochondria in perspective regarding the evidence it supplies in favor of creation. The force with which creationism is supported by this evidence ranges from powerful to none depending on one's previous assumptions. The evidence does not demonstrate an undisputed evolutionary origin for mitochondria, which might be taken as support for creation. The evolutionist, on the other hand, will find that the uniqueness of mitochondria does not demand the rejection of evolution. Rather it demonstrates how little we really know about organellar biochemistry and provides no evidence in favor of creation. In the minds of objective workers possibly the most impressive thing about the data is how their support of creation or evolution depends on the assumptions one makes and therefore the weight applied to individual

points of information. These data provide no clear cut "proof" of either model of origins but only circumstantial evidence.

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18. Recently what appears to be a split gene has been found in an archaeobacterium, *Sulfolobus solfataricus* (*Proceedings of the National Academy of Science* 80:3309). Whether this will prove to be common in certain classes of bacteria remains to be seen.
19. Grivell. *Op. cit.*
20. rRNA subunits combine with certain proteins to make the ribosomes, which are special structures on which proteins are made.
21. Gray and Doolittle. *Op. cit.*
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32. G+C refers to the sum of the amounts of guanine and cytosine which are two of the nucleotide bases.
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34. Gray and Doolittle. *Op. cit.*

### QUOTE

In another respect Augustine continued in the path of Greek philosophy while enriching it with elements of Christian revelation: knowledge was for him, as it was for Plato and Aristotle, a matter of "seeing" (*theoria*). He greatly widened and elaborated the derived notion of "inner vision," by means of which he overcame the argument of the skeptics about the unreliability of the senses.

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# SUBPARTICLES AND REALISM IN QUANTUM THEORIES

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## Abstract

*This is the first article in the series entitled Nature: The Supreme Logician. I describe how new methods in mathematical logic automatically yield the logical existence of subparticles. The necessity for subparticles follows from the most basic logical operator that produces a describable change in the behavior of a natural system. Subparticles apparently yield a mediating structure for all quantum transitions, provide an actual substratum for relativistic and cosmological theories and may be the physical bases for a pregeometry. It is shown that subparticles, their applications and their production by a describable supermind process restore a universal causality and determinacy to systems that are describable by means of a quantum mechanical language, among others.*

## Introduction

The formulation of various quantum theories has involved continually two interesting aspects—realism and positivism. Certain physical language descriptions are almost always formulated prior to translating partially such a physical description into a mathematical language. Then, as is often the case, the physical language is expanded beyond those terms that correspond to mathematical entities in the hopes of developing a meaningful description for the causes of observed natural phenomena. Statements vary from those in which almost all of the physical terms correlate directly to mathematical objects such as (A) “a photon is emitted when an atom makes a transition from an excited state to the ground state”<sup>1</sup> to extended statements such as (B) “The most fascinating applications of our rules are, however, not to any material substance but to immaterial fields, the excitations of which appear to us as elementary particles.”<sup>2</sup> (C):

The picture of the world we have finally reached is the following: Some 10 or 20 qualitatively different quantum fields exist. Each fills the whole of space and has its own particular properties. There is nothing else except these fields; the whole of the material universe is built of them.<sup>3</sup>

Then there are applications of discipline language terminology that do not, except in a few cases, correspond to specific mathematical objects such as “every quantum transition taking place on every star, in every galaxy, in every remote corner of the universe is splitting our local world into myriads of copies of itself.”<sup>4</sup>

A major philosophical question is does descriptive quantum theory yield knowledge about real physical objects, causes and some probabilistic form of determinacy (realism) or is it but an imaginary scheme that is designed only to aid human comprehension and produce better predictions of how our classical apparatus will numerically behave (positivism)? Until the present time there has been no direct mathematical approach—including those methods expounded by the advocates of the so-called quantum logic<sup>5</sup>—that could more deeply analyze the internal structure of pure discipline language (metalanguage) statements such as those quoted above. Recent advances in mathematical logic have penetrated, for the first time, some of these realistic statements and have yielded certain interesting consequences. In particular, it is now possible to use a specialized mathematical structure to generate basic

discipline language statements directly. Throughout the remainder of this article I assume that statements such as those listed above do have some realistic meaning. We note that it has been claimed that if we accept statements such as (A) then a question such as (D) “how this photon was created since it was not present before transition took place?”<sup>6</sup> has no meaning with respect to quantum mechanics. And, indeed, (E) “has no answer.”<sup>7</sup> Rohrlich also states, (F) “The world of electrons, protons, and all the rest does exist out there even if we do not observe it, and it behaves exactly as QM [quantum mechanics] tells us it does [in the small velocity limit].”<sup>8</sup> The new results to be delineated below refute the claims that are made in statements such as (C), (E) and (F) above, among thousands of others. Our discussion is being restricted to particle language, even though it is possible to restate our results in the language of fields or simply “things”; but, it appears more useful to retain this particle terminology. In a forthcoming section of this article I discuss how the above quotations and these new results relate to causality and determinacy.

## Basic Methods and Results

Before proceeding, it should be understood that the methods utilized to obtain these “D-world” results are not related in any manner whatsoever to the methods used within the discipline called quantum logic. Further, the “D-world” is one of the general names given to a mathematically generated description for the production (i.e. creation) of natural phenomena, objects or events, the development of natural systems and other interesting scientific concepts. This description utilizes a new discipline language that will be disseminated slowly by means of these articles. Recall that quantum mechanics yields many simple discipline language descriptions that are but slight extension of the terminology used within the mathematical formalism. Let  $h \geq 0$  be a fixed real number and  $N$  be the set of positive integers. For an elementary particle free in space consider the following set of sentences:  $G_A = \{ \text{An elementary particle } \alpha(n) \text{ with total energy } h + 1/n \mid n \in N \}$ , where the measure is with respect to a fixed unit of energy. The  $G_A$  is embedded into the mathematical structure called the “Extended Grundlegend Structure” (EGS) and the EGS is embedded into a nonstandard model for a superstructure based on the real numbers.<sup>9</sup> Let  ${}^*N - N$  be Robinson’s set of positive infinite natural numbers.<sup>10</sup> In a completely rigorous manner,<sup>11</sup> without any ad hoc forcing, the EGS generates the set of statements:  $G_{A'} = \{ \text{An ele}$

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mentary particle  $\alpha(\gamma)$  with total energy  $h + 1/\gamma$   $|\gamma \in {}^*\mathbb{N} - \mathbb{N}$ . Assuming that mass and energy are but manifestations of the same physical quality<sup>12</sup> and that the total energy within such a system of particles is additive then this immediately implies the possibility that such objects as those being described by the set of statements  $G_A'$ , where we let  $h = 0$ , exist in reality. We call these objects "subparticles." If the original elementary particle utilized in statements  $G_A$  has non-zero mass (as a nonrelativistic concept), then by the exact same modelling procedure the subparticles would have nonzero mass. The numbers  $1/\gamma$  are Robinson infinitesimals—the now rigorously obtained "ideal" numbers of Leibnitz—and they may be assumed to represent the mass of such subparticles. On the other hand, other infinitesimal energy quantities characterize the zero mass particles — assuming that such things exist.

In this theoretical investigation I do not assume that simply because the EGS generates automatically the set of statements  $G_A'$  that subparticles are realistic objects. Unless there is some other strong and compelling reason, then we do not postulate the ad hoc existence of subparticles as is done for such objects as tachyons, among others. Recall that tachyons as postulated by Feinberg<sup>13</sup> are assumed to have a rest mass that is measured by a purely complex number  $m_{0i}$ . This trivial assumption implies that such particles would have a real relativistic mass  $m = (m_{0i})/(1 - v^2/c^2)^{1/2}$ , when we let  $v > c$ . Articles have been published recently that continue this so-called research. I shall leave it to the reader's judgement whether or not the assumption that a particle can have a purely imaginary "rest mass" is worthy of the vast public monies spent to develop the "theory of tachyons."

After developing approximately 120 pages of mathematical machinery,<sup>14-16</sup> the following can be established. (1) If we assume that particle behavior varies in time (i.e. particles develop like any natural system) and that the simplest form of human logic—propositional logic  $S$ —is a meaningful logical process for our comprehension of such behavior, then within the EGS there exists a supermind logical operator,  ${}^*S(\{w\})$ , that generates automatically the following statement relative to a background or substratum world—a world that takes on various names (nonstandard physical world, NSP-world or D-world) depending upon the application

(G) There exists a uni-word D-world process,  ${}^*S$ , such that the (objects being described by)  $G_A$  are produced by  ${}^*S$  and during this production there is an *additional* simplistic and necessary process that directly yields numerous many of the pure D-world objects (being described) in  $G_A'$ .<sup>17</sup>

Since the presuppositions that determine statement (G) (i.e. the hypothesis of statement (1)) are fundamental to particle physics, among other disciplines and the operator  ${}^*S$  is a direct necessary and sufficient consequence of these presuppositions, then the assumption that such subparticles exist is not a simple mathematical or theoretical convenience. Indeed, if care is exercised to ensure the consistency of collections of  $G_A$  statements, then the use of a single mathematical structure to generate sets of such statements as (G) guarantees that such (G) collections form the most

consistent descriptions available. Please note that statements such as (G) describe the behavior of a developing natural system in an extended language—the language of the D-world—that includes the standard scientific discipline languages. Further descriptions for the terms used within statement (G) will be given in the analysis section of this article.

### Additional Investigations and Implications

Under the presumption that there are in reality such objects as those being described by  $G_A$  and since statements such as (G) are generated by the EGS if and only if  $G_A$  is embedded into the EGS then further theoretical investigations are warranted. The first and most obvious possibility is to consider the set of all subparticles to be a substratum or a possible pre-geometry that mediates all particle transitions including creation and annihilation. With this in mind the next goal is to consider various consistent methods by which subparticles can combine and yield statements such as (G). One of these methods is the logical basis for all applied classical analysis—the 2200 year old corrected logical process called infinitesimal reasoning—as it is modelled by the EGS. Applying these rigorously appears likely that a special process called "hyperfinite composition" would be the most appropriate to consider. However, due to the difficulties in comprehending the properties of hyperfinite composition a meaningful description as to how subparticles actually mediate such quantum transitions has not as yet been formulated completely.<sup>18</sup> On the other hand, a mathematical process is being developed that gives a very promising but partial description for such mediation. Moreover, it has been shown that the pool of all subparticles may be considered a "real" substratum for various cosmological theories as well as the special theory of relativity.<sup>19</sup>

Once again I point out that statements such as (G) are generated by the EGS if and only if  $G_A$  is embedded into the EGS. These facts tend to refute such claims as expressed by statements such as (C), (E) and (F).

### Causality and Determinacy

Intuitively a general definition of a causal process is that it is a named "process" that has associated with it a describable set of properties that distinguishes it from all other processes within a given set of describable processes. These distinct processes may or may not be numerically characterized in whole or in part. The causal process must apply to specific, describable and identifiable objects, phenomena or events that may or may not be numerically characterizable in whole or in part. The result of a causal process must be a specific, describable and identifiable object, phenomenon or event that also may or may not be numerically characterizable in whole or in part. Of course, originally a (scientific) phenomenon was supposed to be an "observed" event that was, hopefully, describable in a consistent (scientific) discipline language. Since nothing in the micro-physical world is observable directly, then this concept has been extended to include *accepted* descriptions for an *assumed* unobserved object or event—descriptions that usually aid comprehension and prediction.

It is absolutely false to state that science only deals with causes that have numerically measurable characteristics since one of the most basic and often cited "causes" is philosophical or absolute "randomness." It was well known that there are NO numerical characteristics for the concept of absolute randomness. Mark Kac has recently written an article in which he restates these facts.<sup>20</sup> In a future article in this series where I discuss the fact that "scientific randomness" is language dependent, it will be *proved* that almost all of what we call modern cosmology deals with unmeasurable and purely speculative causes that cannot be even indirectly established.

With respect to the describable properties of a cause, some additional questions often arise. Has the human brain been able to describe enough of the causal properties in order to even conceive of reproducing the causal process? Can human beings completely reproduce, in the laboratory, the causal process even if it is assumed that we have a complete description? For many scientific causes the answer to these two questions is a resounding no. For example, it is claimed that some of the major illnesses that afflict mankind at the present time have no completely describable causes. Then even if one believes that the "Big Bang" description is the cause that has produced an apparent textual expansion of our universe, human beings have not, as yet, completely reproduced its properties and created their own personal "toy" universes.

As to determinacy, this term seems to have as many distinct definitions as there are philosophers or scientists who have ever thought about the concept. This concept varies from the strong statement that "certain describable or measurable qualities associated with one event determine totally the describable or measurable qualities of a second identifiably different event" to such paradoxical statements as "there are *no possible* determinacy statements as to how individual objects affect the behavior of other individual objects but there are determinacy statements that predict how large aggregates of such objects will behave and how these aggregates affect the behavior of other such aggregates." It is claimed that this second type or determinacy characterizes totally the atomic or micro-physical domain. We define *determinacy in the broad sense* to be any description for system behavior that is not considered to be philosophically random.

In 1935, Einstein, Rosen and Podolsky<sup>21</sup> correctly proved<sup>22</sup> that if one is allowed to analyze the precise details of the fluctuations that exist during the measurement of certain numerical quantities within this microscopic world as they are predicted by quantum mechanics and ascribe certain predictions to disturbances of one object by the observing apparatus (the cause), then quantum mechanics is not a complete theory. This incompleteness would mean many things including the result that there could be physically meaningful qualities for particles that could not be predicted.

Bohr appears to have come to the rescue of quantum mechanics by a simple extension of his *complementarity principle* to pairs of predictions.<sup>23</sup> Bohr claims that this extension is consistent with quantum mechanics and invalidates the incompleteness argument since as

Bohm states it (H):

because the process in which a quantum is transferred from one system to another cannot be subjected to a detailed rational analysis [using the quantum mechanical language], there is no way to describe precisely the properties and qualities that characterize the system under observation, as distinguished from those of the observing apparatus.<sup>24</sup>

However, Bohr then extends this principle into the philosophical domain. Bohm describes this philosophical extension in the following manner. (I):

No rational concept of the details of the [atomic] process can ever be obtained . . . one is no longer able to describe or even to think about any well-defined connections between the phenomena at a given time and those at an earlier time. . . . We have no way to express precisely the qualities and properties that might define the modes of being of individual micro-objects.<sup>25</sup>

Bohr called this the "irrational trait"<sup>26</sup> and he then renounced causality on the atomic level entirely. (J): in the usual interpretation of quantum theory, the precise magnitude of the irregular fluctuations in the results of *individual measurements* at the *atomic level* are not supposed to be determined by any kind of causes at all, either known or unknown . . . the precise result that will be obtained is completely arbitrary in the sense that it has no relationship whatever to anything else that exists in the world or that ever has existed.<sup>27</sup>

Notice that statement (J) implies that the prohibitions expressed by statement (I) are not confined to the language of quantum theory. Phrases such as "can ever be obtained," "no longer able to" and "we have no way [no language at all] to express" are extended philosophically to include all possible descriptions utilizing all possible languages.

A recent investigation *formally* argues that Bohr's extension of his complementarity principle to predictions, if adjoined to the quantum theory, would make quantum theory *inconsistent*.<sup>28</sup> Thus Bohr's rejection of the incompleteness of quantum theory is invalid and the prohibitions expressed by statements (H), (I) and (J) are meaningless if they are added as additional requirements of the quantum mechanical method. Unfortunately, except for a change in the language used within quantum field theory where the concepts of *virtual* transitions and *virtual* objects are paramount, certain types of discipline language descriptions for micro-physical events are rejected philosophically through application of various insidious devices. The major device is to suppress these new rational descriptions by either ignoring them, or by refusing to communicate these new descriptions either to the general public or the majority of the scientific community for no other reason except a philosophical bias. The rejection of causality and determinacy within the micro-physical world has absolutely nothing to do with quantum theory as a formal discipline. It is based upon philosophical bias and the irrational belief that (K):

we can only conceive of what we meet in everyday experience, or at most in experience with things that are in the domain of classical physics . . . any effort at conceiving of a sub-quantum

level is foredoomed to failure, . . . [we could] never hope to imagine what these entities might be like.<sup>29</sup>

Finally, we point out that Bohr's logical error, the correctness of the Einstein, Rosen and Podolsky conclusion and the new concepts that do allow for a deep descriptive analysis of the atomic domain are unrelated to the famous von Neumann theorem on local hidden variable—a theorem that suffers from other philosophical restrictions.<sup>30</sup>

### An Analysis

As argued in the preceding section, statement (E) and the last sentence in statement (C) are not rationally deducible from quantum mechanics nor from quantum field theory since they are but naive carry-overs of the irrational Bohr philosophy as stated in (H), (I), (J) and (K) and are thus an inconsistent extension of quantum theory. For this reason we must reject such descriptive restrictions as meaningless.

In a previous article<sup>31</sup> the discreteness paradox of quantum mechanics is solved by partially describing the behavior of quantum transitions in terms of the new D-world concepts and language. These D-world concepts *do not* follow our everyday experiences, even though they may follow partially from some of our more unusual experiences. Also as explained in this previous article many of the properties of the D-world concepts are described as best as is possible at the present time and the difficulties of comprehending these notions without some specific training or reflective investigation is fully delineated. These *facts* totally contradict statements such as (K).

In this present series of articles I will introduce these property descriptions and their conceptual meanings *slowly*, so that the reader will have time to investigate and reflect upon their significance.

Referring back to description (G) we further discuss the terms utilized. First, we are dealing with concepts that are analogous to those that appear in the discipline known as Logic. Natural science deals with communicating *descriptions* for the behavior of natural systems. Once descriptions are stated then it is the individual—through experience and comprehension of the technical terms involved within the descriptions—who must then mentally associate them with what is claimed to be reality. Within the D-world this mental association is modelled by means of a relation termed a *realism relation*. This is the reason why we have placed parentheses about the phrases “objects being described by” and “being described” in statement (G). For many of the following D-world interpretations the realism relation is applied and these additional phrases are omitted. The *standard world* is interpreted as the “natural” world that the human being can comprehend, sense, imagine and usually describe using all previous standard world languages and symbolic alphabets. We, of course, exclude from these standard world descriptions all terms that specifically apply to the D-world or terms that compare the pure D-world with the natural world.

Please recall that a mathematical theory and a physical theory are not equivalent in content. A mathematical theory usually has infinitely many conclusions (i.e. theorems) and it is never assumed that all such

conclusions can or should be interpreted within a physical theory. For example, in elementary calculus when we consider the ladder of smallest length that extends from the ground over a fence and contacts a building behind the fence, we are led to a differential equation solution that may yield a negative distance measure. This solution is rejected since it does not appear to correspond to that portion of “reality” under investigation. For this reason, we never assume that all of the conclusions established by a D-world structure have or should be interpreted within the *descriptive* D-world theory. The “art” of descriptive mathematical modelling within the N-world (i.e. natural world) is exhibited by selecting or rejecting as extraneous, various mathematical conclusions and, from this, building a descriptive physical theory that yields a consistent and, hopefully, predictive collection of sentences that accurately depicts the behavior of a natural system. It is a subset of the descriptive theory that then correlates to a subtheory of the original mathematical theory. The same procedure must be used when we attempt to mathematically model a descriptive theory for D-world behavior.

The entity  $\ast S$  operationally behaves, in a partial manner, like ordinary N-world propositional deduction.<sup>32</sup> Moreover, there exists within the D-world a superconsistent set  $\langle w \rangle$  that contains one and only one object such that  $\ast S(\langle w \rangle)$  (a uni-world process) generates deterministically the objects  $G_A$  and the numerous many  $G_{A'}$ .<sup>33</sup> However, within the N-world there cannot exist any finite and consistent set  $X$  of N-world objects such that the entire set  $G_A$  is generated by  $S(X)$  and there is no set  $Y$  such that any member of the set  $G_{A'}$  is generated by  $S(Y)$ .<sup>34</sup> The N-world operator  $S$  can be shown to behave in a set-theoretically continuous manner. However, within the D-world the operator  $\ast S$  when applied to  $w$  behaves in a *supercontinuous* manner. No logical operator within the N-world can behave in a supercontinuous manner.<sup>35</sup> Supercontinuity can be thought of as an extremely refined “infinitesimal” step-by-step process as compared to a much coarser step-by-step continuity process. Within the D-world the object  $w$  is composed of hyperfinitely many objects that are hyperfinitely combined. The objects of which  $w$  is composed are N-world objects, and pure D-world objects that cannot be utilized directly within the N-world.<sup>36</sup> However, the generation of the hyperfinite set of particles and subparticles is the direct result of  $\ast S$  applied to  $w$ .<sup>37</sup> Operationally, hyperfinite combinations formally behave within the D-world in the same manner as finite combinations behave within the N-world. However, within the N-world most hyperfinite combinations cannot be reproduced with N-world processes. The additional simplistic and necessary process required to produce the hyperfinitely many particles and subparticles is modelled after the process of N-world translations that write one language in terms of another language. However, this additional process is a hyperfinite translation that takes place within the D-world only. From our previous definition it is clear that the production of the hyperfinitely many particles and subparticles being partially described within this analysis is D-world strongly deterministic. Notice the evidence that we have that something like elementary

particles may exist in reality and that the human being does exhibit describable logical processes is indirect evidence that subparticles and supermind processes exist.

Is it possible that the hyperfinite set of particles and subparticles described above could be deterministically selected "prior" to the application of  $\ast S$  to the object  $w$ ? It is a well-known experimental fact that no human being can make a finite choice from a potentially infinite set, such as  $G_A$ , in a philosophically random manner.<sup>38</sup> Even though we may not, at present, be able to successfully predict many finite human choices beforehand, science does not consider such a choice method as philosophically random. Finite human choice is modelled by means of a finite choice operator that is extended to hyperfinite choice within the D-world. It follows immediately that the above set of particles and subparticles can be obtained by a hyperfinite D-world supermind choice process that is not philosophically random. Moreover, as shown elsewhere,<sup>39</sup> the set of N-world particles  $G_A$  is also a direct result of a D-world hyperfinite supermind choice process. Thus from the D-world viewpoint the set  $G_A$  is itself broadly deterministic and can even be considered independent of the  $\ast S$  operator. If we re-interpret  $G_A$  as describing the behavior of a *single* elementary particle and let  $H$  be the collection of all such  $G_A$  sets as they vary over all such elementary particles, then it is a remarkable fact that *any actual* combination of elementary particles and/or subparticles is directly produced by a hyperfinite D-world choice process applied to  $H$  and consequently such combinations of elementary particles are not D-world philosophically random; but, rather, they are produced by a broadly deterministic supermind process.<sup>40</sup>

It is obvious that we are now able to describe some of the behavior of various natural systems not only in terms of an N-world language but also in terms of distinctly different D-world concepts. It is highly significant that we can obtain these new D-world descriptions only because we are able to characterize natural system behavior in terms of a natural language. As an immediate rational conclusion, it follows that we can logically consider such (describable) N-world behavior as the direct result of (partially describable) D-world behavior and, indeed, this yields indirect evidence that the D-world might actually exist. If we could neither perceive nor characterize within a discipline language the behavior of a natural world object, phenomenon or event, then we could know nothing about how the D-world could have produced such behavior. Thus it is what we directly detect and describe that is leading to a partial understanding of the unusual behavior of this "invisible" but knowable deductive world—a world that in future articles in this series will be shown to produce *all* of the natural "reality" that human beings perceive and that science attempts to characterize.

Finally, I do not apologize for the fact that the D-world model can be *consistently* embedded into a Scriptural model for the production of natural phenomena, objects and events. Moreover, even though the D-world model was not constructed originally for application to the natural sciences, it has been discovered that by a simple specific and literal interpre-

tation of certain nonspecific (i.e. primitive) terms the D-world model yields statements that actually predict or parallel numerous statements within Scripturally-based Christian doctrine. Some of these predicted or parallel statements will be presented in the final article in this series.

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## BOOK REVIEWS

*In the Minds of Men* by Ian T. Taylor. 1984. TFE Publishing, P.O. Box 5015, Station F, Toronto, Ontario, Canada M4Y 2T1. 497 pages. \$25.

Reviewed by Don DeYoung\*

Ian Taylor is a Toronto-based writer and researcher with a career in physical metallurgy. He is also the producer-writer of a documentary television series on the Creation-evolution debate. The intense viewer interest generated by this series convinced Taylor that a comprehensive book was necessary. The author states that *In the Minds of Men* was written for those who feel "uneasy" about evolution. It is a 500-page compilation of the main issues, ranging from mammoths to mutations, Niagara Falls to Nutcracker Man, the Sphinx to the speed of light.

Taylor's approach is chronological, showing the historical tension between theistic and secular humanism. He begins with the Greek and Jewish foundations of belief and concludes with a warning of the dangerous movement toward one-world government. Along the way, Taylor explains such details as the recent American withdrawal from UNESCO. The author sees secular humanism as resting on a three-legged stool and he neatly knocks the legs out, one by one. These precarious legs and their founders are inorganic evolution (Lyell), organic evolution (Darwin), and sociobiology (Spencer). Taylor is a very objective and fair writer, and his personal acceptance of Scripture and belief in a recent supernatural Creation are evident.

The book is a rich reservoir of fascinating details. Taylor has done an immense amount of research on the key people and topics involved in the origins question. Lamarckism, circular reasoning, Malthusian logic, vestigial organs, sociobiology—all are explained in the clearest fashion this reviewer has encountered. The

contemporary setting of Charles Darwin is given, touching on the French Revolution and Napoleon, as well as on the Anglican Church. Along with Darwin's obvious talents, the dark side of his life is also exposed like a soap opera. His deathbed conversion is thoroughly debunked. Further, Taylor gives intriguing reasons why Darwin's wife may have originally started the conversion story. Documentation is given to show that Darwin never really understood the Bible, even after three years of theological study at Cambridge (p. 120). A similar close scrutiny is given to dozens of other personalities, ranging from Lyell to Newton and even Margaret Mead. The book contains 80 portraits, 92 other illustrations, 17 Tables of data, 381 detailed footnotes, and 634 references to orthodox and original sources. *In the Minds of Men* is surely a valuable reference book and also one of the most interesting available to Bible-science readers.

A few of Taylor's comments will raise eyebrows, certainly expected in a book of such wide scope. For example he intimates that Genesis 9 supports the cursing of the black race (p. 262). In truth, Ham's curse by Noah is not, in any sense, a proof text for slavery or segregation. I am sure Taylor would agree with my statement, but his discussion is unclear. *In the Minds of Men* may also spend too much time on Setterfield's controversial "changing velocity of light" idea. Six large tables of data are dedicated to this discussion. Of course, if Setterfield turns out to be correct, then this attention to the subject would be amply justified. In describing the *ex nihilo* Creation, Taylor mentions that coral reefs may have instantly appeared (p. 313). If true, much more needs to be said about the appearance of age, since coral reefs fall in the same category as tree rings. That is, present day coral reefs bear the historical print of countless coral skeletal remains and algae secretions.

To counter these apparent minor weaknesses, let me also mention two valuable items in the book. Remem-

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ber the story of the plesiosaur-like creature dredged up by Japanese fisherman in 1977? Taylor describes the episode fully and also reproduces the only photograph of the monster. Then he goes further and explains why the news of the discovery was censored almost everywhere except in Japan, where a postage stamp was issued to commemorate the event! As a second strong point, Taylor reviews the 1633 controversy between Galileo and the Roman Church. Of course, this trial is often used by secular science to show that the church (i.e., Creation) is old-fashioned, wrong, and heartless. However, Taylor neatly reverses the attack. He reminds the reader that if the theologians had not listened to the science of Ptolemy in the first place, they would not have been led astray (p. 25)! This insight is characteristic of much careful thinking in the book.

Ian Taylor's book reveals the foolishness and yet also the demonic tenacity of secular humanism. We are indebted to him for raising the alarm in such an interesting and well-documented fashion. *In the Minds of Men* fills the vital gap of relating the humanities to the sciences. Readers will eagerly await the completion of Taylor's second publication, relating the humanities to spiritual life.

*The Nature and Origin of the Biological World* by Edmund J. Ambrose. 1982. John Wiley & Sons, New York. 190 pages. \$54.95, hard cover; \$24.95: paper.

Reviewed by Wayne Frair\*

This is an unusual book and one which deserves the serious attention of scientists and students of science. The author is Emeritus Professor of Cell Biology at the University of London, and he has had a productive scientific career. The publisher is recognized as a leader in issuing quality scientific works. So a reader may expect—and does receive—a good serving of modern high level but generally understandable information from the natural sciences, all of this in word pictures created to infuse the study of life with “awe and wonder.” In emphasizing the majestic splendor of life the author points out that there appears to be an increasing agreement that there is a factor X which is necessary for explaining the origin of life. Then on page 141 the suggestion is made that “our factor X, being an input of new information, requires the operation of Creative Intelligence.” Later (p. 164) we are introduced to “Divine Intelligence” and to the Creator. Ambrose says:

Although I believe that Divine acts of creation, as described so beautifully in the beginning of Genesis, gave rise to a physical and biological world that was entirely good, I also accept that evil powers have been at work. (p. 169)

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Author Ambrose goes on to point out that much of history shows humanity deliberately to have chosen the “paths of greed and violence” (p. 170). But refreshingly in the concluding paragraph of the book the solution is given that as individuals, people may be redeemed because Christ died on the cross for us. Here in this present life we are to be fitted for the spiritual world we will enter when this life is ended.

At a time when many secularists are lamenting our human predicament we have this book shining as a beacon of hope within the scientific community. Ambrose's philosophy is a positively holistic one which rejects deism, dualism and pantheism. Even though vitalism also is rejected, Ambrose emphasizes that we need to reach beyond where popular mechanistic and reductionistic philosophies leave us.

Because in this book Ambrose deals positively with evolutionists including Darwin, Huxley and de Charadin, I think that readers of the book who are tending to follow philosophies of these men will be more receptive to Ambrose's total message. Ambrose views “microevolution” as a modulating process; but as for macroevolution he points out that:

The records of rocks do not indicate a smooth progression by minute stages up the ladder of complexity. They do not support the idea of ‘gradualism’ so much favoured by the Victorians, which also underlies the mathematics of population genetics. The difficulties are so great that there is at present no general agreement amongst zoologists about the ancestors of any of the major invertebrate Phyla. (p. 117-118)

At the present stage of geological research, we have to admit that there is nothing in the geological records that runs contrary to the view of conservative creationists, that God created each species separately, presumably from the dust of the earth. . . . We know how demanding any work of human creativity can become. May we conclude reverently that the work of the Creator of the universe has not been a simple step of ‘let these things be so,’ but that the Creator has been intimately involved in the development of the biological world and is still so involved. (p. 164)

Most modern Creationists basically agree with these statements but do not believe that all of the created kinds necessarily would have to be considered species according to the biological definition of that term. With regard to belief in the origin of life by “chance,” Ambrose rules it out, saying:

A simple physical consideration in terms of probabilities indicates that no molecules of the type which eventually generated the self-replicating system, found in living organisms, could have originated by random trials. The entire life of the universe is far too short in terms of probabilities. The origin of life should therefore be looked upon as a unique event. (p. 139)

When it comes to the matter of what mechanisms God used in creating new forms of life, the suggestion is given that “the Creator utilized existing forms to generate new forms,” (p. 164) It is pointed out that natural selection currently is not believed to be the force it was conceived to be in a Darwinian scheme. Ambrose concludes that:

There must have been a steady input of new information which we have ascribed to the activity of Creative Intelligence, so raising the level of organisms step by step to ever higher and higher levels of complexity. The whole evolutionary theory is at present in a state of flux and will, I believe, eventually contain the above conclusion. (p. 159)

With regard to mechanics of the book itself and accuracy of the data, I have little with which to find fault. Ambrose says the mule is always infertile (p. 144), but I understand that occasionally there have been exceptions to this. There are very few typographical errors. Near the end of the book is a Name Index. Preceding it is a Bibliography followed by Subject Index, both of these in my judgment being somewhat weak. The value of the book would be greater if *specific* references were included for the various subjects treated in the text.

It does appear in our day that Creationists are having a favorable impact on the scientific community even though there is somewhat of a backlash at the present time. I am encouraged by Ambrose's statement that:

It looks as though the advances in molecular, cellular, and developmental biology, which have been made in recent years and are summarised in this book, have brought us to the stage where a creative view of the origin of life and species no longer needs to be defended against evolutionary arguments. It is the reductionist evolutionist who is now in retreat. (p. 144)

Even though some Creationists and some evolutionists may have hesitancy in accepting this book completely, there is no doubt in my mind that it presages a better quality science in the future. It points to a holistic conception of science wherein the supernatural is an important part. Hopefully the work will become well-known and widely quoted, and it should be required reading for all secular humanists. Interestingly, the author is donating royalties from sale of the book to leprosy charities and missions. I would urge that the book be placed in all high school, college, university and public libraries.

*To God through Science*, by Braulio A. Sáenz. 1984. Vantage Press, New York. 53 pages. \$7.95.

Reviewed by Harold L. Armstrong\*

The title of this work perhaps does not indicate very well its nature; the book is more nearly a philosophical argument, illustrated by points drawn from science.

The argument deals with intelligence and reasoning; and it is found convenient to distinguish concrete and abstract reasoning. Concrete reasoning is considered to be shown in dealing with situations already present; and all animals show at least some traces of it. Abstract reasoning is defined (maybe a little narrowly?) as foreseeing and preparing for future circumstances; and this is found only in humans. (It is not quite clear what the author would do about the squirrel which

stores nuts for the winter.) Thus there is a lack of continuity between man and the other animals; and this gap (although the author does not stress this point) could provide an argument against the evolution of man from other animals.

But there are not only individual men and animals in nature; there are, for instance, cells. And these seem to show something like the defined intelligence or reasoning in dealing with circumstances; in fact, they may show it more consistently than we do. The author argues, as St. Thomas Aquinas did long ago, that this common feature, appearing in so many different situations, must be traced to a common Supreme Intelligence, which is God.

The conclusion is not carried much further in this work, which thus concludes more in Deism than in Christianity. But Christians, and Creationists, may find the book interesting for some of the thoughts which are presented.

*Alive (An enquiry into the origin and meaning of life.)* by Magnus Verbrugge. 1984. Ross House Books, P.O. Box 67, Vallecito, CA 95251. 159 pages. \$14.

Reviewed by George F. Howe\*

In this book, Dr. Magnus Verbrugge (retired urologist F.R.C.S.) undertakes to discuss the history of the abiogenesis origins model which arose as an outgrowth of humanism and was accompanied by the death of man in terms of reductionist philosophy. The author shows that abiogenesis (the idea that long ago life arose naturally from nonliving matter) has real conflict with the hard data of science and that it is based on materialism which is just another religion in disguise—a religion of nihilism in which the abiogenesisist faces the impossible mission of proving that life is actually death. All of this amplifies the title *Alive* as Verbrugge feels there is really something more to life than just the orchestrated physical and chemical reactions occurring at a given time in a life cell.

In the second chapter he shows that ancient Greek philosophers were actually animists, conferring idolatrous identities to such abstract qualities as peace and mercy. Chapter three contains a discussion of Descartes' animism which deified his own thought function. Discussing Hobbes, Leibnitz, Newton, Buffon, Engles, and Oparin, Verbrugge shows that each confused real things called "functors" with the mere actions of functors called "functions"—each also gravitating to some form of animistic worship as well. The author, as a Creationist, objects, refusing to assign spiritual attributes to matter or its mere functions. According to Verbrugge, Creationists should follow the philosophical implications of their view and thereby reject speculative concepts such as spontaneous generation in which the otherwise noted Christian thinker, Augustine, set us all up for ridicule. The book contains a strong emphasis on Creation and a call to readers not to "help out" the Biblical record by substituting some form of evolutionism in its place.

In Chapter four the author discusses the specificity of protein action and demonstrates that even evolu-

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tion biochemists in unguarded moments will admit that all of this complex cellular activity transcends the laws of chemistry. Yet these same evolutionists still appeal to a self-constructed cybernetics to explain origins. In his own discussions, we learn that the noted microbiologist Monod gives these molecules personal qualities by calling them little demons and attributing purpose to them. Yet Verbrugge shows the reader that the protein molecules simply adopt the activity that is predetermined for them by their shape. The author pierces through Monod's biochemical facade to show underneath a raw religion of animism—a system of *faith* in which one barter his own understanding for "voodoo formulae"!

Chapter six begins with a concise and clearly written introduction to cell structure in which Verbrugge shows that chemical reactions in cells are controlled and not random. Here the cell is a functor that restricts or controls the molecules so that they play by cellular rules.

In Chapter seven Verbrugge describes DNA replication and lays bare the unsolvable riddle facing evolutionists in that DNA (which controls protein synthesis) is itself produced only under the auspices of certain specific protein enzymes! In Chapter eight there is an examination of the origin of materialism, vitalism, and monism. In Chapter nine Verbrugge proves that biologists often "adjust" their data to fit what they think "must" have happened in terms of abiogenesis.

The author spends a considerable space, and rightly so, analyzing the work and writings of the Russian communist abiogenesist A. I. Oparin who tried to establish a dialectical rather than a mechanical approach to materialism. Oparin decided on a coacervate scheme of origins since coacervates appeared to vaguely resemble cells. But Oparin had the habit of ignoring how all this might have happened and finally espoused an abstract animism by attributing personality to "organization" itself. According to Verbrugge, Oparin painted a scenario "unburdened by the laws of physics" (p. 72), and all of this amounted to only "word pictures" because Oparin made an unexplained jump from the random conglomerate to a coordinated organism. Yet despite these philosophical and scientific sins, Oparin was honored "... as if he were the witness of creation and rocked the cradle of life." (p. 74)

In this book, the author applies the principles of Herman Dooyeweerd's Law Philosophy (also known as the "Cosmonomic Philosophy") to show that we cannot divide any aspect of a functor without destroying it as a functor. Thus one cannot reduce *number* to something less than *number*. *Space* cannot be reduced to *number* and *motion* cannot be reduced to some aspect of space either. Each of these "aspects" Verbrugge claims are irreducible and they can be displayed as aspects only if a real functor is present. Thus he asserts that as small as one can go in physics and chemistry there are real functors that manifest all four aspects and have their own sphere of action which Verbrugge (following Dooyeweerd) calls "idionomy," and by extension, asserts that one cannot move from physical functors to life itself because— "... physical interaction between physical functors can only yield

the formation of new physical functors, even in a bowl of soup." (p. 84) He quotes the noted biologist Bertalanffy on the next page to show that as far as life is concerned, "... the actual whole shows properties that are absent from its isolated parts."

In Chapter 13 Dooyeweerd's very helpful theory of "encapsis" is explained. In this theory the cell actually holds its molecules captive like a pirate captain who controls the oarsmen in his galley! "The cell is an encaptic functor that directs all its constituents. That includes enzymes and organizers that induce growth. They are mere inanimate molecules, captives of their 'captor'." (p. 92)

Verbrugge shows how the thought behind abiogenesis pleads that somehow certain molecules learned to do clever tricks uncommon to others of their kind! Randomness somehow must have changed into direction and purpose to permit the origin of a self-replicating molecule. The author asserts that although we can discover the idionomy of a functor, "We cannot investigate the origin of this idionomy." (p. 100) He gives the following instructive view of death in a Dooyeweerdian frame:

The order imposed by the organism's idionomy disappears. The encaptic functors suddenly are released from their captivity. They resume their random existence of physical functors without the restrictions imposed on them by the organism. (p. 100)

More to the point concerning the debate about the role of religion and science in origins, Verbrugge acknowledges that certain scientists require that we keep religion out of origins but when these same scientists cannot explain origins within the framework of science, they use beautiful language to clothe illogic. They indulge in loose talk and merely walk around objections, trading science for animism. They appeal to *revelation*—a naturalistic revelation of their own. The following quotation from Verbrugge on page 119 sums up his critique of materialism well:

Like all forms of humanism, materialism is a religion. It cannot be proved but must be believed. And it needs the theory of abiogenesis in order to explain life's origin. But since all experiments to make the theory credible have failed, both theory and religion are now in a crisis. How must a serious materialist respond to that?

The author deals with interesting comments of a few workers who apparently challenge abiogenesis. He highlights Carl Sagan and a group of "true believers" who are intent on keeping the "faith" of materialistic humanism.

On later pages (134-136) Verbrugge reviews differences between the Aristotelian "teleology" and its modern counterpart "teleonomy" as well as the concept of idionomy in which one asserts that life obeys the Creator's laws. Here, as well as at other junctions in the book, the author asserts that science and religion cannot be separated. Some men of science obviously espouse Biblical religion while others substitute an animistic worship of certain aspects of their own study such as number or space. Such reductionism, claims Verbrugge, leads to idolatry and denial of the Creator.

Every scientist takes a religious position in his own area of expertise. He either holds that God

has created the things he studies or he believes in another origin for them. In this way he chooses what he believes to be divine. This is his religion. Whether he realizes this or not does not alter this fact. (p. 140)

This book is beautifully illustrated with sketches at the head of various chapters and a modified photograph of the surf along a coastline on its cover. At the end there is a glossary of scientific and philosophical terms as well as an alphabetical bibliography. Instead of the usual skimpy table of contents found at the start of most volumes, *Alive* contains a four-page set of chapter outlines. Then the next four pages consist of an annotated table of contents which gives the reader clarity of overview.

This book will serve as a primer for many to understand how abiogenesis can be attacked on both scientific and religious grounds. *Alive* could be read and understood by a person of general education and it could find a valuable spot in the libraries and classrooms of philosophy or science in colleges and universities. It will introduce the reader to an important link between one of the world's greatest Christian philosophers: Herman Dooyeweerd—and the cause of Creationism. It can be read with profit by both scientists and philosophers as it will help these two groups to discover the religious root which supplies a common ground between them. It might be given as a relatively inexpensive "tract" to those in the evolutionary abiogenetic camp who may just be open enough to look at the seamy side of their own religious commitment.

*The Argument—Creationism vs. Evolutionism* by Wilbert H. Rusch, Sr. 1984. Creation Research Society Books, 5093 Williamsport Drive, Norcross, GA 30092. 86 pages. \$6.95.

Reviewed by George F. Howe

There is no "argument" about the fact that balance of thought, strength of statement, and clarity of definition are manifest in this newly published C.R.S. book by Bill Rusch—*The Argument . . .* (TA). In the introduction we are told that TA "grew like topsy"; but it was obviously refined and rewritten numerous times as anyone will discover who reads all or part of this finely polished little volume.

Rusch begins by demonstrating that a generous slice of Darwin's great popularity stemmed from the escape Sir Charles provided for himself and others wanting liberation from their responsibility toward a personal God. Rusch further recounts the reticence of French scientists to embrace Darwinism—a leeringness that lingers to the present.

The author records H. J. Muller's dramatic plea for a thoroughly evolutionary biological curriculum ("One hundred years without Darwin is enough."); a historic call which eventuated in production of BSCS textbooks within which evolution was assumed to be "utterly factual." To this transformist battle-cry (that the veracity of evolution has been demonstrated beyond shadow of a doubt), Rusch boldly addresses his last 6 words in TA: "THIS POSITION IS SIMPLY NOT TRUE."

Furthermore, on page 28 he writes that ". . . one encounters a lot of arrant nonsense, written by those who ought to know better, to the effect that evolution is as well substantiated and factual as the law of gravity."

Much ink has been spent lately attempting to convince the public that creationism is not "scientific." Actually, it is shown in TA (by skillful use of what is called the "law of priorities") that one *can* legitimately use the word "science" to describe "creation science" with no qualms because 120 years ago all true "science" was based on creation as a ruling paradigm.

In TA Rusch deals with topics as widely varied as Linnaeus, Lucy, and the "Law of Recapitulation." Concerning the former, he correctly shows that the great taxonomist as a younger worker promoted an outmoded view (absolute fixity of species) but in later years Linnaeus corrected himself by proposing a scheme of *variation* within limits; a view which modern creationists currently espouse and cherish.

Rusch airs poignant objections to evolution penned by such critical writers as Austin Clark, J. C. Willis, Fleeming Jenkin, Richard Goldschmidt, and Heribert Nilsson. On page 39 T. H. Huxley is quoted to show that fossils give little or no evidence in support of evolution and that these same anti-evolutionary data have surfaced as recently as October, 1980, at a Field Museum of Natural History meeting. TA also contains a remarkable quotation showing that design and complexity in the tail feather of a peacock once made Charles Darwin sick!

A survey of C.R.S.Q. and other publications will show that the author of TA has published whole articles on many of the short chapter subjects of this book; a feature that distills the essence of Rusch's long research career into this one package. In discussing human origins, for example, he reprints his valuable table in which man and ape are contrasted by means of 18 criteria. He believes that the *Australopithecines* (somewhat troublesome fossils for creationists) are ape-like rather than ancestral human forms.

In another anthropological chapter the reader is brought up to date concerning discoveries of Leakey and Johanson. It is concluded that *Australopithecus* lived contemporaneously with ancient man—a fact that offers little comfort for dedicated evolutionists. The entire treatment of fossil dating in TA is a landmark of objectivity.

In addition to these and other origins themes, TA contains five appendices including an annotated bibliography, a series of important quotations, a list of creationist organizations, the Humanist Manifesto, and a humanist statement affirming that evolution IS a principle of science.

While TA cannot be called "light" or even "entertaining" reading, it is a highly informative, scholarly, and lucid summary of key points separating creationists and evolutionists. As such it certainly deserves a key-word index which is lacking.

This book will fit equally well in the hands of professors, advanced science students, or general readers interested in the Bible-science dialogue. It will stand properly on references shelves at home, pastor's study, school, or university. *The Argument* is a book that will benefit both skeptic and non-skeptic alike and—"the price is right!"

*Understanding Fossils and Earth History*, ed. by David Tyler, 1984. The Biblical Creation Society, 51 Cloan Crescent, Bishopbriggs, Glasgow G64 2NH Scotland. (£1.00).

Reviewed by John K. Reed\*

*Understanding Fossils and Earth History* is a symposium published as a special issue of the *Journal of the Biblical Creation Society*. Six articles cover a variety of topics related to a creationist interpretation of the fossil record. The reader is carried back to the Precambrian in Christopher Bluth's "The Origin of Invertebrate Life in the Precambrian: an Evolutionary Impasse." However, the supposed vast amounts of time traversed fail to mask serious deficiencies in evolutionary interpretations of that part of the fossil record. Bluth critiques scenarios of Metazoan evolution and analyzes the "Cambrian explosion" in light of recent research. Joachim Scheven, in "The Interpretation of Fossils and the Principle of Actualism," recognizes Actualism as an important methodological constraint for interpreting the rock record. However, he defines "Actualism" without the aid of uniformitarian assumptions and demonstrates the compatibility of Actualism with the Biblical record of Creation and catastrophe. He notes that "The present is the key to the past, but this past will not reveal itself unless the key is tried in the right keyhole." (p. 5). Three articles deal with the fossil record regarding human evolution. David Tyler presents a review of *The Myths of Human Evolution*, a book by Niles Eldredge and Ian Tattersall advocating a punctuationalist interpretation of human evolution. Gerald Duffett theoretically demonstrates that a concept of design linkage anticipates gaps between fossil apes and men. David Tyler uses the case history of the Guadeloupe skeletons to discuss scientific methodology, while arguing in favor of post-Flood burial of the skeletons. The sixth article is by David Watts, and is a critique, not of uniformitarianism, but of Flood-geology models that appropriate undue Scriptural authority. He encourages careful definition of Biblical terms and flexibility of thought outside of strict Scriptural limits.

The editor of *Understanding Fossils and Earth History* states that its purpose is to stimulate meaningful discussion about the fossil record. Some of the articles should succeed in meeting that goal. Joachim Scheven addresses the relationship of history and science, and a methodology for studying the past. Christopher Bluth notes the increasing difficulty for any evolutionary explanation of the Precambrian-Cambrian fossil break, as new studies further define the abruptness of the transition. Gerald Duffett illustrates the dynamic interaction of body parts and function within individual organisms, a principle that seems to rule out simple, stepwise evolutionary change. However, his specific examples, especially the flow chart, also seem to err on the side of simplistic analysis. There is an interesting contrast between Duffett's article and *The Myths of Human Evolution* as reviewed by David Tyler. It appears that while Duffett attempts to theoretically explain the ape-man fossil gap, the punctuationalists merely explain it away.

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A problem common to creationist literature is the lack of large quantities of quality research. *Understanding Fossils and Earth History* is no exception to the rule. The symposium as a whole does not convey to the reader a systematic understanding of the fossil record from a creationist perspective, although Scheven and Bluth write with sufficient scope and knowledge to accomplish the task. Also, the emphasis on human evolution renders the symposium somewhat uneven. It is hoped that the basic purpose of the editor will be realized in spite of its shortcomings, and increasing discussion and research will fill the gaps in creationist literature about the fossil record.

*A History of Modern Creationism* by Henry M. Morris. 1984. Master Book Publishers, San Diego. 382 pages. \$12.95 hb, \$9.95 pb.

Reviewed by Emmett L. Williams\*

This very readable book can be divided into two major sections: one, the history of modern Creationism before publication of *The Genesis Flood* (pp. 17-144) and two, the history of modern Creationism after publication of *The Genesis Flood* (pp. 145-305). Dr. Morris uses this event as the pivotal point of his historical work. This treatise is filled with myriad autobiographical details as well as insights into the Biblical philosophy of the author. The book is well-written and captures the reader's attention.

Dr. Morris gives a brief account of the roots of modern creationism (pp. 17-43) from the view of a scientist or layman (not a theologian) since the philosophy is layman-instigated, i.e., it did not arise from the pulpits of Christian churches. The author mentions many well-known Creationist scientists (pp. 25-28) who were instrumental in the development of modern science.

The effects on society of 100 years of Darwinism up to the triumphant high water mark of this naturalistic philosophy at the worship services held at the University of Chicago in 1959 are noted (pp. 44-77). The high priests of naturalism declared then that Creationism was dead. However with the publication and success of *The Genesis Flood* (pp. 145-170) scientific Creationism was reborn. America, where the revival of Creationism occurred in the twentieth century, is the focal point of Dr. Morris' history. Many Creationists who were leaders in the early 1900's are mentioned, often in a context of their relationship to and influence on the writer (pp. 79-144).

Dr. Morris graciously devotes a chapter (VI) to the Creation Research Society (CRS). The founding of the Society is carefully traced. The only other organization mentioned in such detail is The Institute for Creation Research. However the many facets of present-day Creationism are covered. The author looks forward to the future in chapter X anticipating the battles that lie ahead in the evolution vs. Creation controversy.

He is opposed to litigation as a means of having Creationism taught in the public schools. This is also the position of CRS. It is not likely that the present

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court system is capable of or willing to understand a scientific argument for Creationism.

The dangers of the gap theory, progressive creationism and theistic evolution are outlined. The writer is one of the best-known proponents of the young earth concept and has pointed out the pitfalls in the adoption of an old earth philosophy. If a person believes in a young earth, he has no trouble in rejecting macro-evolution. However old earth views appear to be quite seductive to anxious evangelical scientists who wish to have one foot in the Christian camp and the other in the evolutionary camp. Dr. Morris cites many examples of such compromise. This reviewer was exposed to this unusual attitude several years ago. Two colleagues and I were talking to an evangelical scientist who worked in a prestigious national laboratory. The gentleman quizzed us closely on our belief in the Bible and our Christian testimony. He wanted to make sure we were believers. The conversation developed nicely as all of us agreed on various aspects of the Creation model of science until the subject of the age of the earth was broached. Finding that the three of us were

young-earth advocates our born-again scientist stated unequivocally:

I will not have my scientific colleagues think that I am a dummy by believing in a young earth. I wonder if John 12:43 applies here, (Loving the approval of men more than the approval of God)? Dr. Morris definitely is on the mark when he criticizes this strange attitude. He also indicts fundamental and evangelical churches and colleges for their lack of emphasis on the doctrine of Creation. Unfortunately this problem still exists.

This history is an excellent sourcebook on the who, when, where, and how of modern Creationism. Eight appendices provide the reader with valuable ancillary information. The reviewer highly recommends this volume to any Creationist who would like to know how the present situation developed. Young Creationists can realize that apparently God uses men to accomplish His purpose. Hopefully this book will offer inspiration to young scientists who would like to contribute to the cause. May the Creator grant continued success.

## LETTERS TO THE EDITOR

### Problem with Creationism?

The Panorama of Science column (CRSQ 21:78) was most revealing in that it pointed up a basic philosophical problem with the Creationist viewpoint in general. H. L. Armstrong argued that vitalism could prove to be a valuable counterpoint to the mechanistic arguments of evolutionists. Thus, just as creationists deny that chance and mechanistic processes could in some way be the cause of life emerging from non-life, Creationists should also deny that mechanistic processes adequately explain how a zygote can grow into an adult, how DNA can be the cause of an animal's coloration or instincts, and how brain function can account for mental function.

This would certainly be a consistent denial and would effectively forestall the use of some major arguments against the creationist view of the second law of thermodynamics. (Critics of Creationism commonly cite the example of a zygote growing into an adult, a drop of water forming into a snow crystal, and other self-organizing systems to show that things can naturally go from simple to complex.) If NOTHING can work without vitalism, then there are no truly "self-organizing systems" in nature.

Does this then do away with evolution? Not at all! For, if vitalism were to be granted, what consistent reason could be given as to why this vitalism could not be a cause of evolution just as it was a cause for a zygote growing into an adult or a drop of water forming into a snow crystal? There is, after all, a new trend among "New Age" mystical folks that evolution works through the action of spiritual agencies. (Witness the new book, *The Bone Peddlers—Selling Evolution*, by William R. Fix.) And some Creationists have sought to argue that, without vitalism, evolution is impossible! Does that mean that with vitalism Creationists can begin to accept evolution?

This is the irony, the dilemma, and the paradox. A consistent rejection of vitalism leads to mechanism.

A consistent acceptance of vitalism leads to spiritualistic evolutionism. It is only a partial acceptance of vitalism that makes "scientific creationism" possible, a delicate mixture of naturalism and supernaturalism so just the right Biblical result emerges. I therefore wish to thank H. L. Armstrong for bringing this most basic of issues out into the open.

Frederick Edwords  
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*Editor's Note:* Growth of a zygote to an adult has been covered previously from a Creationist viewpoint in Williams, Emmett L. 1971. Resistance of living organisms to the second law of thermodynamics. CRSQ 8:117-26, which has been reprinted in *Thermodynamics and the development of order* (pp. 91-110).

### Reply to Edwords

I agree entirely with Mr. Edwords that a Creationist—and a Christian—must sometimes steer an exceedingly narrow course between two errors. On the one hand there is the crude mechanistic view, which goes hand-in-hand with atheism; and on the other hand there is an exaggerated vitalism, which is likely to lead to some kind of pantheism. And as he says, the Biblical course is the right one to steer between these dangers.

Must we, though, consider the cases of a zygote growing into an adult, and of water turning into a snowflake, on the same footing? The vitalistic view of the former case should, it seems to me, win by default; for I do not believe that any convincing, detailed description of how DNA, or whatever, could completely control this process, has ever been proposed, let alone agreed upon. As for the snowflake, on the other hand, is its pattern not just an expression of the symmetries existing in a molecule of water? And these things could be explained, at least in a hypothetical way. If one molecule tends to stick to another at a certain

angle, etc., the natural, mechanical result is an arrangement such as that in a snowflake.

Consider again the snowflake patterns seen in a kaleidoscope. These arise entirely from the way in which the mirrors are oriented. Is the case of the real snowflake not somewhat similar?

So I do not think that we need to extend vitalism to nonliving things.

Is there not another distinction between the development of a living thing and that of a snowflake? As for the living thing, every part and process has a function. But one shape of snowflake is as good as another; as far as we can tell there is no particular function associated with any particular shape. This point, that adaptation to a function does not arise through blind, mechanistic means is not, of course, new; Paley used it most effectively.

H. L. Armstrong

### Science and Scripture

I read with interest Randall Hedtke's letter (CRSQ 21:157), Mr. Hedtke posed the question of whether science can be pursued to a point of being offensive to God through an attempt to "validate" God's word, which in essence, is doubting the veracity of God's word. Mr. Hedtke said:

Is there a point at which science, even from a Creation point of view, can become an offense to God? Would not that point be reached when science in its humanistic bent attempts to validate the inspired word of God above and beyond what is required to combat evolutionism? At that point would not the situation be rather like the fellow who has given his word to a friend concerning a certain incident, but the friend insists upon double checking?

I have had questions of a similar nature in the past and perhaps that is why Mr. Hedtke's queries interested me.

I believe that scientific study is not offensive to God if it is done with the proper motives, intents and purposes. Studying how man was created from a scientific standpoint would not be wrong or an offense to God even if it were not used to combat evolutionism. Let me start with an example. As a child, were you ever given math homework and after getting stuck on a problem, you looked up the answer in the back of the book? After finding the answer and then by working backwards you were able to figure out how to solve the problem. Essentially you found the steps and calculations in between the statement of the problem and the final problem solution. Knowing the answer assisted you in finding how to reach the answer. You did not doubt the truth or validity of the answer in the back of the book or the ability of the math book's author to give the correct answers and principles. You believed the math book was correct and your motive was to learn the math problem in the most expedient way. While the method of backcalculating is probably not an optimal learning technique for children's math problems, it may be the best way to solve extremely complex problems in the way that uses minimal time and human resources. Deductive reasoning is focused to prevent wasted resources on inaccurate theories.

Your goal in learning the aforementioned math problem as a child was (hopefully) to study and learn the mechanisms, calculations and steps in between to achieve the answer that one far ahead of you in knowledge already knew. The author of the math book created the example problems so; therefore, knew the steps to their solution. Since you had limited time and background, you took a shortcut to arrive at a solution that greater knowledge of the laws of mathematics would have allowed you to achieve in a more direct and straightforward manner.

Accepting God's laws and word as fact and basing research and science on these predetermined answers merely allow us to take a shortcut in finding the mechanisms, calculations and steps in between required to arrive at the answers we already believe. Just like a child, you believed that the answers in the back of the math book were correct, and hence its author, before you ever began your calculations; the same correlation can be applied to God and His word. We believe all of God's word is correct before trying to "validate" it. This prior belief in God's word is a necessary, but not a sufficient condition in keeping one's scientific study inoffensive to God.

When we speak of "validating" God's word through science, I think there is a chance of misunderstanding what is meant. We do not "validate" God's word through science because we do not believe it, but because we do believe God's word. We go on believing. It is not the trusted friend who is doubted by his friend, but rather others who doubt him. If everyone believed God's word, then science could go to a higher level as God's laws and principles would form the basis for scientific research and would not have to be re-discovered where they are spoken of in God's word. Science would not waste effort and resources in many of the erroneous areas (e.g. evolution) now being pursued. Having God's word is even better than having the answers to problems in the back of one's math book as a child.

Science "validating" God's word (which of course doesn't need any proof) can be right or wrong depending on the belief in God's word one has prior to any scientific inquiry. A second necessary condition for our scientific research to be inoffensive to God is the motive one has in conducting the research. Some suggested proper motives are to glorify Jesus Christ and/or to help others understand God's word and ordered plan for the universe more clearly. A third necessary condition for making scientific research inoffensive to God is the goal or objective one has in doing the research. Some suggested goals that appear acceptable are to glorify Jesus Christ, to help in evangelizing the lost for Jesus Christ, to edify other Christians or to see God more clearly through His Creation. A fourth necessary condition for making science inoffensive to God is asking are we in God's will by doing the research or are we just doing scientific study with no thought of how God wants us to use our time and energy? If properly used, God's word can be used as a guide to steer us in proper directions for our scientific research. Ultimately as science advances, science will become more congruent with God's word if done in an objective manner. Proper scientific study works in harmony with God's word, which, is not offensive to God.

If done with the correct motives and objectives, science can clarify God's word. Gaining a greater understanding of God's word through properly directed scientific study should edify us and strengthen our faith in God's power and perfect order rather than decrease our faith in God (doubting God would be a way of decreasing our faith). Our faith should grow as we see more clearly God's laws, principles and the order of His Creation. Romans 1:20 says that God's invisible qualities are seen clearly through His Creation; even God's eternal power and Godhead (divine nature) are seen through what He has created. Science is based on the study, observation and experimentation of and with the physical universe around us in a systematic way. Nature is God's Creation. Science and God's word are both based (or should be) on the same thing. God wrote His word and created the physical universe on which science is based. Romans 1:18-20 gives us a reason to study Creation through science, that being to learn more of God's eternal power and divine nature. Secondly Romans 1:18-20 gives us a further logical basis and documentation to use what science teaches us, to witness to others about Jesus Christ, as even unbelievers can see God through the things that are made, God's Creation. Thirdly, if we do not use science through the study of God's Creation to spread the gospel of Jesus Christ, then we make it more difficult for unbelievers to see God through Creation. If unbelievers never hear of Jesus Christ and go to Hell, Romans 1:18-20 says, they have no excuse. Science studies God's Creation; God's Creation points people to Him and the study of science can point unbelieving people toward Jesus Christ, often people who may not ever read a Bible. For example, when I was an undergraduate student, my thermodynamics professor came to believe in God through extrapolation of the second law of thermodynamics to time zero (perfect order). That will not get him to heaven, but at least science opened his mind as Romans 1:20 says. He at least listened to talk of Jesus Christ at that point.

We are commanded to study God's word thoroughly in II Timothy 2:15. In II Timothy 3:16, we are told that all Scripture is inspired by God and is profitable for doctrine and instruction in righteousness. In James 1:22 we are told to be doers of the word and not hearers only. Romans 1:20 shows us that we can see God's eternal power and divine nature through the study of His Creation. Scientific study of God's Creation is one way to be doers of God's word as well as a way to help others see God and Jesus Christ.

While doing a research project in the psychology area, I used God's word to assist my research with the expected positive results. I believed God's word before starting my study and designed a study based on principles in God's word. My computer statistical analysis showed no correlational significance of results. I still believed the study would show statistical significance and searched the Scripture until I found an error in my study design. Once the error was corrected, the results showed such a high level of significance between the variables that the maximum value the computer printed was reached (the probability of chance causing the results was less than or equal to one in ten thousand). The statistical chance of error was so small (correlational proof only, not causality)

that it was insignificant for the given study design. The Biblical principle the study was based on was written over 2400 years ago.

When science supports God's word, it is validating itself, as God's word needs no validation. The proper study of science reinforces and strengthens what we already believe to be true, God's word.

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## World Views

The letter written by Marshall and Sandra Hall (*CRSQ* 21:155-56) triggers me to write the following.

There are two antithetical world views. They are:

1. Chance originated everything.
2. Chance originated nothing.

Both of these are religious points of view. Notice the past tense. Since science is defined as requiring repetition of observation procedures, they cannot be scientifically tested. Furthermore, when you say that chance originated everything, you are saying that very long strings of sequential origination events can be unequivocally identified. Such identification, if any, is religious, not scientific.

Switch to the present tense. Antithetical world views are:

1. Chance originates everything.
2. Chance originates nothing.

The first view is the one dominated by superstition, fiction and imagination. The second is the realm where the scientific method is utilized. This method has had huge success. In realms where unequivocal testing is possible, science dominates much present activity. Science is a purposeful activity, originated by thinking beings, not chance events devoid of any concern for truth. It can also be accumulative through the historic past. This assumes the recording of events in the nearby past is correct, not fictional.

Forensic assertions about the remote past are not scientific. They cannot be subjected to repeated testing. Forensic "science" has its place. However, it cannot solve the mysteries of nearby time, such as those associated with the assassination of President Kennedy. How can it solve the mysteries of remote time? It is preposterous to assert that "scientists" can determine, with a probability of one, that events in the remote past are known. Such assertions are religion, philosophy, fiction, or fabrications.

They presume that very long sequential strings of events can be reconstructed. Such strings can be mathematically represented as products of individual independent event probabilities. There must be no zero factors in the product string of probabilities. It is ridiculous to dogmatically insist that such an overall probability must be one, when it is always vanishingly small and usually zero.

It is time that this absurdity be removed from present "scientific" practice. When peoples' civil right to practice science are being denied, by demanding acquiescence to a dogmatic assertion that highly improbable processes are certain, legal redress becomes necessary. Such dogmatic demands, in themselves, are other indications that a religion or philosophy is being prac-

ticed, not science. Science must have tolerance enough to tentatively entertain antithetical beliefs. When it cannot do so, it is converted into a religion. Scientifically speaking, it is dead.

A great need these days is to recognize that we already have a state religion or philosophy, chance originated everything. The dogmatists are insisting that we all acknowledge this as the only truth about origins. We continually hear the expressed fear that we face an assault trying to breach the separation of church and state. The assault has already taken place. A state religion is in place. We continually hear that we need to be a pluralistic nation, except that we must believe chance originated and originates everything.

What a perversion exists now! The Marshalls' points need to be carried one step further. Evolutionism is *not science, it is a religion*.

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Annville, PA 17003

## QUOTE

For more than a decade these premises—diffuse dependency, total transiency, radical relativity and absolute autonomy—have dominated the university classroom more influentially than any and all other alternatives. They have become the masked metaphysics, the covert conceptuality of modern liberal learning. Almost every sampling of student reaction to liberal arts studies in the mainstream colleges and universities in the last decade evokes the overwhelming verdict that recent students considered themselves intellectually constrained to shape their world view by these controlling emphases as they authoritatively permeated classroom teaching and discussion. This naturalist outlook notably differs from the atheistic Communist view only in secondary details rather than in basic assumptions. . . .

Henry, Carl F. H. 1984. The crisis of modern learning in *The Christian vision: man in society*. Lynne Morris, editor, The Hillsdale College Press, Hillsdale, MI, p. 6.

## 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 creation, with a current membership of over 600 voting members (with graduate degrees in science) and over 1500 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is 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 \$15.00 (\$17.00 U.S. for overseas) per year and may be sent to Glen W. Wolfrom, Membership Secretary, P.O. Box 14016, Terre Haute, IN 47803. 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 \$15.00 (\$17.00 U.S. for overseas) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$18.00 (\$20.00 U.S. for overseas).

**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.

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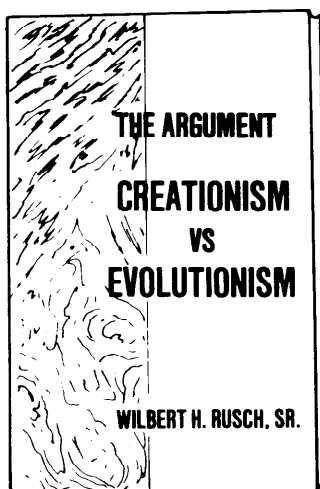
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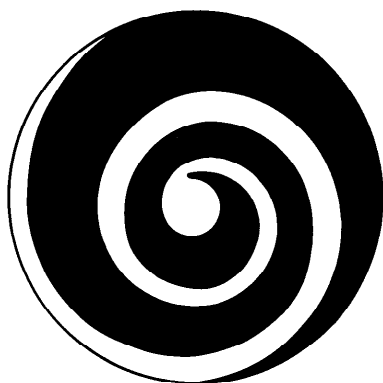
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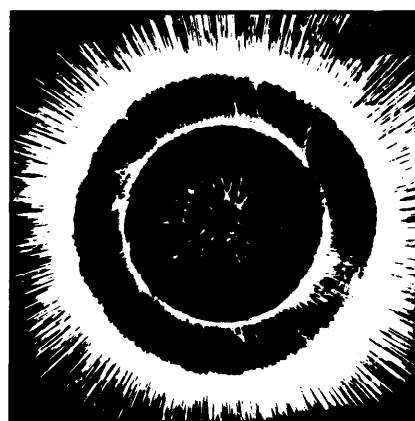
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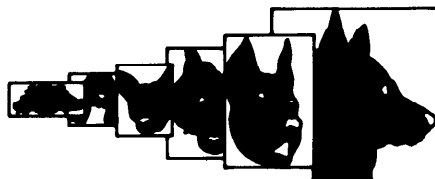
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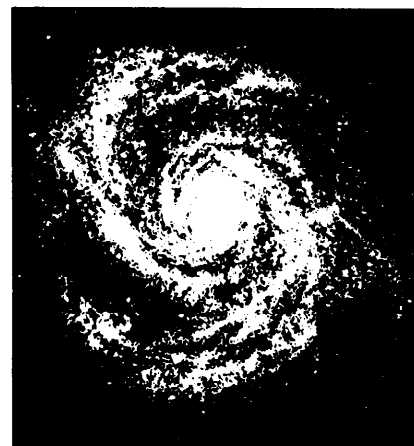
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