Editorial Comments

Four editors have served our *Quarterly* previous to my term:

Walter Lammerts	(1964-68)
George Howe	(1969-73)
Harold Armstrong	(1974-84)
Emmett Williams	(1984-89)

It is both a privilege and challenge to continue the high level of scholarship which these men have established. As you may know, the entire process of *Quarterly* preparation is voluntary: research, writing, peer review and editing. Your subscription fee goes entirely toward the publication and delivery of the journal.

This is the 101st issue of the *CRS Quarterly*. Twenty-five years of the Creation message have been completed, beginning in 1964. With confidence in this strong heritage, I enter the editorship with two immediate goals. First, our *Quarterly* needs articles that are useful to the reader, whether pastor, teacher, scientist, speaker, or just a loyal friend. This implies articles with original research and ideas, with applications and suggestions for further study. Dr. Emmett Williams has made a good beginning in this regard. *Second*, our *Quarterly* subscription list needs to be expanded. The material is too valuable for the present limited circulation of the journal. Which areas can you help us in as we begin our second quarter century together?

Don DeYoung, Editor

INSTRUCTIONS TO AUTHORS

1. Manuscripts shall be typed and double spaced.
2. An original plus two copies shall be submitted to the editor of the Quarterly.
3. All submitted articles will be reviewed by at least two technical referees. The editor may or may not follow the advice of these reviewers. Also, the prospective author may defend his position against referee opinion.
4. The editor reserves the right to improve the style of the submitted articles. If the revisions of the editor and referees are extensive, the changes will be sent to the author. If the changes are not suitable to the prospective author, he may withdraw his request for publication.
5. Due to the expense involved, manuscripts will not be returned to authors.
6. All references (bibliography) must be presented in the style shown in the Quarterly. If a prospective author is not familiar with the CRS format, the editor will furnish an example reference page.
7. All figures and drawings must be prepared professionally. No sloppy hand drawings or freehand lettering will be accepted. The editor reserves the right to approve submitted figures. Unacceptable illustrations will result in rejection of the manuscript for publication.
8. Any manuscript containing more than 25 pages is discouraged. If a topic cannot be covered to the author's satisfaction in this length of pages, the author must divide his material into separate papers that can be serialized in the Quarterly.
9. The Quarterly is a journal of original writings. Only under unusual circumstances will I reprint previously published manuscripts. Never submit an article to two or three journals, including ours, hoping all of them will publish your work. I consider this practice unethical. When submitting an article, please state if the material has been published previously or has been submitted to other journals.
10. Book reviews should be limited to 500 words or less.

MORE CREATIONIST RESEARCH (14 YEARS)*—PART II: BIOLOGICAL RESEARCH

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Abstract

Biological creationist research in the past 14 years is reviewed as it was in the first decade of the Creation Research Society (Gish, 1975)[a]. *See Part I: Geological Research* CRSQ *25:161-70.*

Variable Production of Growth Rings in Bristlecone Pines

Dendrochronology, the establishment of a chronology, or dating by counting tree rings, assuming that each ring represents an annual growth cycle, can be extended by matching tree-ring patterns of old living trees with patterns of long-dead trees. One tree commonly used for this purpose is bristlecone pine *(Pinus aristata)* because of the long ages of some living specimens and because multiple growth rings in bristlecone pine under usual circumstances are very rare.

*See Gish (1975).

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[a]Available from CRS Books, 5093 Williamsport Drive, Norcross, GA 30092 for $2.00 prepaid and postpaid.

Bristlecone pine trees growing in the White Mountains have been explored for this purpose. This range of mountains is east of the Sierra Nevada Mountains and separated from them by a fairly wide desert valley. The area is about 14 miles east of Big Pine, California. Using bristlecone pine dendrochronology, ages as old as 7,100 years have been obtained. Walter Lammerts (1983, pp. 108-15) has discovered, however, that under certain experimental conditions, extra growth rings could be induced in bristlecone pine, calling into question the reliability of dendrochronology in establishing accurate absolute ages.

He measured growth rates of seedlings of bristlecone pine under various conditions, including normal outdoor conditions; ordinary greenhouse conditions; greenhouse conditions supplemented by maintenance at a temperature of 70°F with no extra light; greenhouse conditions supplemented by a heat lamp for 16 hours per day and maintained at a minimum of 70°F; and greenhouse conditions supplemented by treatment with fluorescent light for 16 hours per day, and maintenance at a minimum of 70°F. The group that showed the most rapid growth was the group given the treatment with the heat lamp. The fluorescent light treatment was next most effective in promoting growth, but considerably less so than the heat lamp. The use of the heat lamp and fluorescent lamp simulated a 16-hour daylight period, with the heat lamp providing extra heat, of course. The plants maintained at 70°F with no extra light exhibited considerably less growth, even less than those plants held under ordinary greenhouse conditions. Those plants grown outdoors had a growth rate only a fraction of those grown in the greenhouse.

Lammerts discovered that seedlings left to grow under ordinary greenhouse conditions, with no extra light or heat (Lammerts' home is in Freedom, California, where temperatures are cool enough in winter so that no growth took place during that period), exhibit only one growth ring after 2.5 years. The most significant of Lammerts' findings was the discovery that an extra growth ring could be induced by depriving the plants of water for two to three weeks in August and then resuming watering. Ordinarily, Lammerts had found, a three-year old bristlecone pine exhibits two growth rings, since, as noted above, no growth ring forms in the first 1.5 years of life. When Lammerts examined three-year-old bristlecone pine trees which had been deprived of water for three weeks in August, followed by normal watering during a warm month in September (September is often the warmest month of the year there), he found that they had three growth rings instead of the two expected. Four-year-old bristlecone pines similarly treated exhibited four growth rings instead of the three found for similar plants whose growth was not interrupted by depriving them of water for two to three weeks in August.

Lammerts points out that soil moisture is at an optimum in the spring, and then diminishes steadily to such an extent as often to halt growth. Then, as the high pressure builds and the heat increases, even more stress has to be endured by the young pine forests. In the early fall, however, evaporation from the formerly existing large lakes again results in clouds and early fall rains, even in such inland mountain areas as the White Mountains. The pine trees would then resume growth, as Glock noted, with the result that another flush of growth and resultant growth ring occurs, just as in the experiment where the young seedlings formed an extra growth ring following return into the ground under the mist system after their drying out.

In the spring, the hot sun and increasingly long days would act the same as the heat lamp treatment, only more so, and stimulate growth of the pine trees, especially in June and July, thus causing them greatly to extend their root systems. This would make them even more vulnerable to stress resulting in cessation of growth until the early fall rains.

Lammerts cites considerable historical evidence that the part of the U.S. embracing this area of California, and actually much more, was much wetter in the past. The Great Salt Lake, in Utah, is a remnant of Lake Bonneville, which had an area of 50,000 square miles. Its decrease in size is said to be correlated with a 200-year period of drought beginning about the year 1200, as determined by tree ring studies. Even as late as 1860, the snowfields of the High Sierras were much larger than recently. As Lammerts points out, with extensive snowfields there would be much evaporation from them in the spring and early summer. The prevailing westerly winds would carry this evaporation over the areas easterly as clouds yielding rain to an extent considerably more than at present. The growth in the spring and early summer would cease during the dry period in late summer. Then, after an early fall rain, or possibly snow, followed by a hot spell in September, growth would resume, yielding an extra growth ring.

Lammerts postulates that it is possible that the presumed 7100 years of age postulated for some bristlecone pines could be reduced to an actual age of about 5600 years, assuming that extra rings would be formed by effects of stress during 50% of the approximately three thousand years since the end of the Flood. Lammerts acknowledges, of course, that it yet remains to be seen whether these results can be duplicated with older bristlecone pines.

Loss of Vigor Due to Mutations

In an earlier publication, Tinkle (1971, pp. 183-5) had reported the loss of vigor in tomato plants, due to a mutation which resulted in pleiotropy and extra cotyledons. Tinkle (1975, p. 52) has since reported the results of additional tests on tomato plants and on campion. Seeds of mutant tomato plants, bearing three cotyledons, and seeds of normal plants were planted in a cool, fairly light basement. After two months, 20% of the three cotyledon plants had survived, while 37% of the normal two-cotyledon plants were surviving. Tinkle found the mutant to be a late-bloomer, and after a light frost, 76% of the leaves on a mutant plant showed damage, while only 54% of the leaves of the normal plant revealed damage. The normal plants were also higher yielding, averaging a total weight of fruit of 119.3 oz. compared to 92.0 oz. for the three-cotyledon plants.

Tinkle also obtained three-cotyledon campion among normal two-cotyledon plants. After transplanting to outside soil, the mutant plant showed considerably more loss of leaves and leaf damage than did each of three normal plants. Tinkle concluded that even a small change in morphology, due to mutation, causes a significant derangement of physiological function, as evidenced by loss of vigor.

Post-Fire Survival of Chaparral Relative to Recovery by Seedlings and Crown Sprouting

George Howe (1976, pp. 184-90) has studied the regrowth of two chaparral shrubs, *Adenostoma fasciculatum,* H. & A. (chamise) and *Ceanothus crassifolius* (buck brush), after fires in the Newhall, California area. He found that chamise seedlings are important in regeneration of chamise populations, even though fire-damaged chamise plants can regenerate by sprouting from their crowns. Burned buck brush plants, in contrast, are unable to regenerate by crown sprouting and are thus limited to seedling regrowth following destruction by fire.

Some evolutionists have maintained that chaparral genera, which resprout from old plants, as well as repopulate burned areas by seedlings, routinely have fewer species because they reproduce vegetatively by sprouting, thus bypassing microevolutionary changes which accompany the sexual life cycle involving new seedling generations. Howe noted, however, that chamise, which regenerates vigorously by seedlings after destruction by fire, is limited to only three species. These results conflict with both the observations and theory of Vogl and Schorr (1972, p. 1186), who stated,

> We strongly suspect the *Arctostaphylos* and *Adenostoma* seedlings seldom contribute to mature chaparral cover . . . We hypothesize that a suspected preferred attraction of animals to seedlings allows the resprouts to grow relatively undisturbed particularly with high herbivore densities.

Howe does state that further research is necessary to determine if chamise seedlings respond differently in the San Jacinto Mountains, where Vogl and Schorr made their observations, compared to the Newhall California area, where Howe made his observations.

As noted by others, *Ceanothus* (buck bush), which regenerates exclusively by seedlings, has numerous species (58). Other genera, which regenerate by both sprouting and seedlings after fire, possess fewer species, ranging downward from *Quercus*, with 12 species, to genera like *Pickeringia* (chaparral pea), and four others that have only one species per genus. Thus, generally, a large number of species within a genus does correlate with the ability to reproduce by seedlings only. Some evolutionists, such as Wells (1969), suggest that the "ancestral," or "primitive" condition was the ability to crown-sprout, and that the loss of this ability within a genus leads to greater rates of speciation and to enhanced specialization in species, due to increased intensity of natural selection. Howe suggests, however, that the reverse may be true—that the ancestral characteristic may have been the lack of ability to crown-sprout, since the greater number of species within *Arctostaphylos* and *Ceanothus* are unable to crown-sprout. Thus, species that crown-sprout are outnumbered in both genera, because the rate of speciation slowed, or even stopped, in those lines in which crown-sprouting developed.

Howe points out that whichever may be the case, no real evolution, certainly not macroevolution, is involved, since, from beginning to end, chaparral remains chaparral. The real question in origins is, of course, not how to account for the varieties of chaparral but how to account for the origin of basic plant kinds, such as, for example, chaparral, pine trees, peach trees, and bougainvillea. Howe further points out that it is merely an assumption that all species within a genus have arisen from a common ancestor by natural means and he finally points out, with support from biologists who are evolutionists, that many of the supposed species within the genus Ceanothus may be mere varieties within a single species. In fact, the 58 species of *Ceanothus* may possibly be reduced to just three species.

Howe concludes that since the chamise chaparral, *Adenostoma,* not only reproduces by crown-sprouting but also reproduces vigorously by seedling after a fire. Yet the genus *Adenostoma* has only three species and there is nothing inherent in the ability to rapidly speciate in those genera which possess the ability to repopulate by seedlings. Howe suggests that further research should include hybridization studies to determine which species in the genus *Ceanothus* are true species and which may be mere subspecies. Further studies are needed to discover if there are other genera which, although presently believed not to do so, actually do repopulate after fire by seedling regrowth.

In a later paper, Howe (1982, pp. 3-10) discusses, in greater detail, the evolutionist and creationist explanations for the two methods of reproduction, resprouting, and seeding after fire.

The Creation Research Society Grand Canyon Experiment Station

George Howe (1984, pp. 9-16) has described observations that he and John Meyer made during a trip to the Creation Research Society Grand Canyon Experiment Station (GCES) and its environs. The GCES, located on 2.5 acres, is about 22 miles north of Prescott, Arizona, and about six miles north of Chino Valley, on U.S. 89. Howe and Meyer recorded many notes on both the fauna and flora of that portion of Arizona. They suggest that the GCES can be used as a center for studies of the biology and geology of an area within a 200-mile radius of the GCES.

Howe and Meyer suggest several research projects and have invited suggestions from others. Their suggestions include research on lichens growth rates; factors governing the growth rates and survival of junipers; a search for new crops suitable for production on an economical scale in a type of environment similar to that near the GCES; hybridization experiments to determine the limits of plant created kinds, the determination of chromosome numbers in various plants as another assist in delimiting plant kinds; the restoration of native grass cover which has been displaced by human activity; and various other studies utilizing other features within a 200-mile radius of the GCES, including, of course, the Grand Canyon, the south rim of which lies about 110 miles north of the Station.

Since Howe's paper was published, the GCES has been fenced, a well has. been installed, and other facilities have been placed in readiness for the construction of a research building which has been approved by the CRS Executive Board. All activities related to the GCES, as well as all other research projects supported by the CRS, are supported by income derived from the CRS Laboratory Project Fund. The principal of this fund is kept intact, only the interest earned on the fund is spent on research activities. Tax-deductible donations to the fund may be sent to the CRS Laboratory Project, 1306 Fairview Road, Clarks Summit, PA, 18411.

Survival of Organisms in Freshwater and Saltwater

The Flood of Genesis 6-8 destroyed all land-dwelling, air-breathing animals except those on the Ark. What happened, however, to freshwater and saltwater creatures in the mixed waters of the Flood? There seems to be little doubt that many of them failed to survive the catastrophic effects of the Flood and became extinct. Those that survived apparently were able to tolerate the degree of mixing they encountered or were able to take advantage of special conditions existing during the Flood. Norbert Smith and Stephen Hagberg (1984, pp. 33-7) have conducted experiments to determine survival rates of freshwater and saltwater organisms in waters of varying amounts of salt and have also demonstrated that such organisms might have survived the Flood due to layering of freshwater over saltwater.

In the experiments by Smith and Hagberg, a 10-gallon aquarium was partially filled with 20 liters (somewhat more than five gallons) of artificial seawater from a commercial mix (Instant Ocean). The bottom of the aquarium was covered with crushed oyster shells and brine shrimp were added. The water was aerated and maintained at about 22-23°C throughout the experiment. The saltwater fish, Blue Damsel Fish *(Abudefduf uniocellatus)* was placed in the tank. In order to reduce salinity, fresh water was added and salt water was removed, maintaining a volume of 20 liters. Salinity was constantly monitored. Observations were made on the activity and behavior of the fish and the fish were removed to a recovery tank when they showed loss of locomotor activity, as exhibited by their inability to right themselves.

To test the rate of dilution on tolerance levels, salinity was reduced at rapid, intermediate, and slow rates. In the fast rate, salinity was reduced in twenty 1.5 parts per thousand increments in two hours; in the intermediate rate, the salinity was reduced in twenty 1.5 parts per thousand increments in 20 hours, and in the slow rate, the reduction was in twenty 1.5 parts per thousand increments in 40 days. The salinity at which loss of locomotor activity was experienced (in parts per thousand) were: 0.80 ± 0.08 for rapid dilution; 0.88 ± 0.36 for intermediate rate of dilution, and 20.3 ± 1.1 for slow rate of dilution. It appears that a slow rate of dilution, rather than increasing a saltwater fish's ability to adapt to dilution of salt content, actually decreases that ability. That was apparently the case with the Blue Damsel Fish which lost locomotor ability at greater dilution with a more rapid rate of dilution.

In the test of a heterogeneous Flood model (layering of freshwater over saltwater), a 55-gallon tank was filled to a depth of 20 cm with artificial seawater. The bottom was covered with crushed oyster; marine algae were added, and the mixture was aerated. A good growth of algae provided oxygen and brine shrimp were added. Marine organisms, consisting of Striped Damsel Fish, Hermit Crab, and sea slugs (Gastropods), were added. After overnight, a 16-cm layer of freshwater was placed over the seawater without mixing of the two layers. Freshwater organisms, including Mosquito Fish *(Gambusia affinis)*, Goldfish *(Carassius auratus)*, snails, and duckweed *(Semma sp.)*, were added to the freshwater layer. Although there was some increase in salinity in the freshwater layer, and decrease of salinity in the saltwater layer, all animals and plants survived the 30-day duration of the experiment. Except for occasional excursions of the Goldfish and Damsel Fish into other layers, all organisms remained in their own layer, except the Mosquito Fish. These freshwater fish moved freely throughout the aquarium, with no seeming preference for any salinity layer.

These experiments, limited though they were, indicate that at least some marine organisms can tolerate only limited dilution of salt water. It is suggested, by Smith and Hagberg, that the vast majority of marine life was destroyed by the Flood but that small, protected areas of the pre-Flood seas were overlaid with freshwater during the Flood, permitting certain marine organisms to survive the duration of the Flood.

The Creation Research Society Grasslands Experiment Station

A 3.5-acre plot of grassland, approximately seven miles southeast of the town of Weatherford in southwestern Oklahoma, has been made available to the CRS and designated as the CRS Grasslands Experiment Station (GES), with E. Norbert Smith as Director. In 1983, Stephen Hagberg and Smith (1984, pp. 62-6) initiated research at the Station. This research was primarily designed to encourage further long-term studies of various aspects of this prairie plot and the floral and faunal species which inhabit it. This plot has never been under plowed cultivation, although it has been used for winter livestock grazing for at least 75 years. Very little of the once vast prairie grassland area that originally existed in the U.S. still retains its original character, in terms of the composition and relative abundances of the plant and animal species that inhabited it. The GES does provide a small plot of original prairie grassland in southwestern Oklahoma.

In their report, Hagberg and Smith describe the characteristics of the soil of the GES and the climate of this area of Oklahoma. They conducted preliminary research into the types of species of plants present on the plot, their relative abundance, and their distribution over the plot. As expected, grasses (Gramineae family) made up the largest portion of total ground cover. Other families represented included Leguminosae, Compositae, and Solanaceae. Beginning in the first week in July and continuing about once a week through the first week of September, a series of plant collections was made at the plot, the specimens being pressed and identified. Two 1m x 1m square plots were spaded up in the downslope and upslope areas. It is anticipated that this will allow study on the course of plant succession on these plots.

This region of Oklahoma is situated between native short-grass prairie to the west and tall-grass prairie to the east. Both "eastern" and "western" species of amphibians (salamanders, frogs and toads), reptiles (turtles, lizards, skinks, racerunners and snakes) mammals (opossums, shrews, moles, raccoons, badgers, skunks, coyotes, squirrels, gophers, rats, mice, armadillos, and rabbits), and many birds are found in the area.

Hagberg and Smith, in addition to a continuation of studies already initiated, suggest a series of other research projects that could be done at the GES that would contribute to the general scientific knowledge in the areas of botany, zoology, and ecology. They further suggest that research here might serve as a basis for an understanding of events leading up to and factors involved in the perpetuation of prairie grasslands under post-Flood conditions, and that ecological studies utilizing the diversity of plant and animal species at the GES might perhaps contribute to the question of origins.

Plant Succession Studies

In the spring of 1969, George Howe and Walter Lammerts staked out areas near their homes in California for plant succession studies, in order to discover any possible evidence for the establishment of varieties and eventually sub-species, which would lend support to the concept of microevolution. The results of studies through 1973, as reported by Lammerts and Howe (1974, pp. 208-28), provided no evidence for the production or enhancement of varieties or sub-species through natural selection. In fact, under unfavorable and catastrophic conditions, natural selection apparently worked to perpetuate the normal or more prevalent varieties. Lammerts (1984, pp. 104-8) reviews the results and implications of the 1969-1973 studies and briefly reports on observations on the plots made by George Howe in March of 1984. Howe's observations on plant varieties and abundances in 1984 merely served to confirm the results he and Lammerts had obtained in their earlier work, with no significant changes being observed.

Lammerts points out the alarming rate at which plant species are becoming extinct. He states that the loss of genetic diversity on a worldwide scale, caused by plant extinction, cannot be overemphasized. One ecological consultant warns us that as many as 100 species of organisms per day will be lost by the end of this century.

Factors Involved in Population Controls

Darwinian evolutionists suppose that extrinsic factors, such as starvation, disease, and predation are responsible for the maintenance of population sizes, and thus lead to natural selection of variants more resistant to these factors, eventually giving rise to new species, and so on, up the evolutionary scale. If it could be shown that organisms possess some intrinsic self-regulating mechanism that controls population sizes, this would weaken the Darwinian evolutionary hypothesis, This inspired interest by E. Norbert Smith (1985, pp. 16-20), in experiments designed to test the effects of various conditions on the reproductive ability of organisms. He reported on the results of his experiments, using the common freshwater arrow-headed planarian, or flatworm *Dugesia dorotocephala*, as his test organism. He designed his experiments to test the effects of such factors as feeding frequency,- population density, nature of substrate surface, metabolic or waste products produced by the planarians, and crawl space on asexual reproduction. Reproduction in *D. dorotocephala* is both sexual and asexual. Asexual reproduction occurs by fissioning. The posterior end of the worm clings to a surface while the anterior end moves away. The tail end breaks off and both pieces regenerate missing parts. Asexual reproduction rates were determined by counting the number of fragments produced per worm per unit time.

Smith found that in each experimental group, increasing worm density reduced the rate of asexual reproduction. Reproduction appeared to be more closely linked to density than to feeding frequency. For example, at a density of two worms per 10 milligrams fed once a week, reproduction is reduced from one fragment every 23.3 days to one fragment every 29.5 days, an increase of 6.2 days. If, however, a density of four worms per 10 milligrams fed twice weekly is employed, one fragment every 42.9 days is produced, compared to one fragment every 23.3 days, employing a density of two worms per 10 milligrams fed twice weekly, an increase of 19.6 days. Similar experiments comparing crowding to feeding frequency, employing other densities and frequencies, produced similar results. Increasing density always reduced reproduction rates. Substrate surface characteristics, such as slime and the presence of metabolic and waste products in the water, seemed to have little or no effect. Increasing crawl space by introducing a microscope slide in a test box, increased somewhat the reproduction rate in the test box compared to the rate in a control box containing no slide.

Smith's results led him to state that the planarian, *Dugesia dorotocephala,* can regulate its population density independently of so-called Darwinian checks, since negative outside forces such as starvation, predation, or disease were not necessary for population homeostasis. This indicates, Smith declares, that animals were designed with the ability to avoid over-exploitation of their habitat.

Origin of the Kaibab Squirrel

The tassel-eared squirrel, *Sciurus aberti,* inhabits areas in Arizona, New Mexico, and in several isolated spots in Mexico. It feeds on cones and terminal buds of Ponderosa Pine, so its distribution is limited to Ponderosa Pine forested areas. The Grand Canyon, 200 miles long, 5,000 feet deep, and 12 to 15 miles across, with the Colorado River running through it, acts as a barrier to terrestrial animal movement. What is commonly called the Abert squirrel inhabits the Coconino Plateau, just to the south of the Grand Canyon, and what is called the Kaibab squirrel inhabits the Kaibab Plateau, just to the north of the Grand Canyon, across from the Coconino Plateau. Some zoologists give the Kaibab squirrel species status, *Scuirus kaibabensis,* while others designate it as a subspecies, *Scuirus aberti kaibabensis,* of the Abert squirrel. Supposedly, according to evolutionists, the Grand Canyon has existed for at least several million years, separating the two varieties of the tassel-eared squirrel into populations isolated from one another. This separation, they believe, was of sufficient duration to permit differentiation into separate species, or at least into separate subspecies.

John Meyer (1985, pp. 68-78) examined nearly 100 specimens of Kaibab and Abert squirrels in the Grand Canyon National Park Study Collection. The purpose of his study was to determine the extent of the differences between the Kaibab and Abert squirrels, and, using the generally accepted notions of zoologists concerning the mechanisms required to give rise to variations and the time required for such changes to take place, to estimate the time these two populations of squirrels have been isolated from one another. If the separation of the ancestors of these two varieties of the tassel-eared squirrels into isolated populations was indeed caused by the formation of the Grand Canyon, this estimate would thus provide an approximate time for the formation of the Grand Canyon. Meyer's studies convinced him that the differences between the Kaibab and Abert squirrels were essentially minor, being limited to relatively slight differences in coloration, and thus, if the differentiation were caused by separation due to the formation of the Grand Canyon, the formation of the Grand Canyon must have occurred recently—on the order of thousands of years ago, rather than several million years.

In general, the main color features of the typical Abert squirrel include a dark-colored tail, a white belly, and a steel-gray body. The typical Kaibab squirrel has a white tail and a nearly pure-black belly. Except for these differences, the Kaibab and Abert squirrels appear to be similar in all respects, according to Meyer. There is significant variation in the coloration of both the Kaibab and the Abert squirrel, although the variation is more striking in the Abert squirrel. This variation has given rise to Abert squirrels that resemble Kaibab squirrels and Kaibab squirrels that resemble Abert squirrels. Thus Hall (1967) refers to some of the squirrels on the north rim as "Abert-like Kaibabs," and in the Grand Canyon National Park Study Collection, Meyer found a drawer of animals labeled "Kaibab-like Aberts." Based on 28 measurements from the skulls of each of 10 individuals, Meyer reports that the morphology of Kaibab squirrels differs little from that of Abert squirrels, which is in agreement with the reports of other investigators.

Of the ten conditions which evolutionists assume that must exist for significant genetic variations to arise and thus for evolution to occur, Meyer would definitely associate eight of these, and possibly all ten, with the two isolated populations of tassel-eared squirrels. Based on evolutionary assumptions, then, if the Kaibab and Abert populations of the tassel-eared squirrels have been separated for several million years, these two populations should differ in very significant ways. Because of the minute differences between Kaibab and Abert squirrels that Meyer was able to identify, limited as they were to minor differences in coloration, he maintains that the Abert squirrels on the south rim and the Kaibab squirrels on the north rim of the Grand Canyon represent, for all practical purposes, one continuous population. Therefore, he reasons, the separation must have been recent, thus indicating a recent formation for the Grand Canyon.

While one may agree with Meyer that the data indicate these two populations of squirrels have not been separated for several million years, it will be difficult for some to agree that this establishes an approximate age for the formation of the Grand Canyon. If the Grand Canyon was formed during the waning stages of the Flood, as receding Flood waters drained from the emerging North American continent, there would have been no squirrels on either rim of the newly formed Grand Canyon. It would be many years after the formation of the Grand Canyon before squirrels and other animals could have arrived. It appears more likely that the tassel-eared squirrel migrated to areas on both sides of the Grand Canyon and that these areas have since become ecologically isolated from one another in relatively recent times. Evolutionists, of course, assume that this isolation occurred several million years ago, whatever the causative factors. This assumption, Meyer's work definitely contradicts.

Isolation of the Shiva Temple

> As one stands on the Grand Canyon's North Rim across from Shiva Temple, the view is breathtaking. The panoramic visual sweep of the canyon is stunning. The emptiness is overwhelming, as the lowering sun casts continually changing shadows across the red, tan, and gray strata which make up the walls, buttes, temples, and precipices of the mile-deep canyon. On the opposite canyon wall, one can barely make out the thread-like Kaibab and Bright Angel trails. A tiny splotch of green marks the oasis at Indian Gardens. The only sound impinging upon one's ear is the turbulent wind capering along the precipitous North Rim, the faint cry of an eagle, and perhaps the distant boom of thunder echoing across the mightiest canyon on earth, signalling the late afternoon development of an incipient thundershower. It is difficult to imagine that this lonely outlook was the jumping-off point for a world-famous expedition a half century ago in the fall of 1937.

With this bit of journalistic eloquence, John Meyer (1987, pp. 120-5) introduces his description of a 1937 American Museum of Natural History expedition to Shiva Temple, an isolated butte in the Grand Canyon. This expedition was undertaken by evolutionists, with the conviction that the animals on Shiva Temple had been isolated from their ancestors on the North Rim of the Grand Canyon for many tens of thousands of years, therefore evolution should have produced significant evolutionary differences between animals on Shiva Temple and their relatives on the North Rim of the Canyon. When the results of the expedition revealed no differences between these creatures, evolutionists concluded that the animals on Shiva Temple are not isolated, but can easily scale the walls of Shiva Temple. Therefore, they declared, animals easily cross from the North Rim of the Grand Canyon to the top of Shiva Temple.

Desert conditions prevail in the bottom of the saddle between the North Rim and Shiva Temple. These conditions, Meyer and George Howe believe, might construct a barrier to the movement of small forest dwelling species from the North Rim of the Canyon (elevation about 7650 feet), to the top of Shiva Temple (elevation about 7700 feet), a barrier even greater than the problem of scaling the vertical walls of Shiva Temple. Meyer and Howe therefore undertook a study to evaluate the degree of isolation of Shiva Temple, using direct observation of vegetation, and selected climatic variables and known habitat preferences of the small mammals of the Grand Canyon area (Meyer and Howe, 1988, pp. 165-72).

Using a chartered plane, Meyer and Howe took more than 100 photographs of the vegetation and general topography of Shiva Temple. For the purpose of taking measurements on soil and air temperatures, and relative humidity, five stations were established on the North Rim of the Grand Canyon at 7650 feet, and two stations on the saddle between the North Rim and Shiva Temple, dubbed Shiva Saddle by Meyer and Howe. The bottom of this Saddle has an elevation of 6300 feet. The Saddle is narrow and is flanked on each side by nearly vertical walls which descend at least another 1000 feet to basins below. As Meyer and Howe point out, the Saddle, small in size and very flat, receives direct heating from the sun throughout most of the day and from rising air from below. The horizontal distance between the North Rim and Shiva Temple is about two miles.

Both Shiva Temple and the Kaibab Plateau (which includes the North Rim), are capped by Kaibab limestone—a highly porous material. As a result, there is a complete lack of standing water on Shiva Temple and an almost complete lack on the North Rim. Temperature measurements showed that soil temperatures at the shaded station in the Saddle were as much as 13°C higher than at the shaded station on the North Rim. At the same time, soil temperatures at the unshaded Saddle station were about 12°C higher than at the unshaded North Rim station. The relative humidity was significantly lower in the Saddle than at the North Rim. At all times of measurement, the air temperature was 1 to 6°C warmer on the Saddle than at the North Rim.

Ground-based and aerial observations showed that the Saddle area is populated almost exclusively with pinyon pine and juniper. The top of Shiva Temple and the lower reaches of the Kaibab Plateau at the North Rim, on the other hand, contain heavy homogeneous stands of Ponderosa Pine. Aerial photographs provide evidence that the distribution of plants on Shiva Temple is similar to that of the North Rim. In order to traverse the area between the North Rim to Shiva Temple, it is necessary to descend about 350 feet below the Rim to a ridge which runs nearly one-half mile. One must then descend from the south end of the ridge another 100 feet to reach the Saddle, which is about three-quarters of a mile across. After the Saddle is crossed, to reach the top of Shiva Temple, a climb of about 1350 feet up steep talus slopes and finally a nearly vertical pitch is required. The top of Shiva Temple encompasses an area of about 300 acres.

Meyer and Howe found that the pinyon pine and juniper forests of the ridge and the Saddle between Shiva Temple and the North Rim differ markedly in plant species composition from the two Ponderosa Pine forests on the top of Shiva Temple and the North Rim. Thus, in addition to the climatological barrier presented by conditions in the Saddle, the differences between plant species in the Saddle and on the North Rim and Shiva Temple appear to provide an additional obstacle to migration of small mammals from the North Rim to the top of Shiva Temple. The vegetation on Shiva Temple, on the other hand, is strikingly similar to vegetation on the North Rim.

As Meyer and Howe note, the climatic and vegetational differences between the North Rim and the Saddle and difficulties of ascending Shiva Temple are not sufficient to block the migration of some mammals from the North Rim to Shiva Temple. On the other hand, there are a number of species of small mammals that inhabit Ponderosa Pine forests but which do not frequent areas which have the types of vegetation found in the Saddle. Furthermore, the Kaibab squirrel *(Sciurus aberti kaibabensis)* is not found on Shiva Temple, even though the Ponderosa Pine, which is found on Shiva Temple, provides the main food source of this squirrel. Thus, if the Kaibab squirrel were able to cross the area between the North Rim and Shiva Temple and ascend Shiva, it would find conditions there suitable for its existence. Thus, the fact that the Kaibab squirrel is not found on Shiva Temple constitutes additional evidence that Shiva Temple is biologically isolated for some mammals from the North Rim.

While indicating that further research is necessary, including a more extensive study of vegetation and the trapping of small mammals in the Saddle area, Meyer and Howe conclude that there is sufficient evidence to indicate a recent origin and significant isolation of Shiva Temple. They point out that if microevolutionary changes may result from the isolation of subpopulations over a long period of time, then, since no such microevolutionary differences between mammals found on Shiva Temple and on the North Rim can be detected, the isolation of Shiva Temple must have occurred recently, if indeed Shiva Temple is isolated. They maintain that there is significant isolation of Shiva Temple from the North Rim for a number of small mammals which are found on both the North Rim and Shiva Temple, thus establishing that this isolation could not have occurred tens of thousands of years ago but must have occurred recently.

Meyer and Howe point out that their data, which support isolation of Shiva Temple for some mammals, provide evolutionary theory with a two-horned dilemma. They state that:

> On the one hand, short-term isolation of small mammals on Shiva Temple presents the problem of a recent formation of this topographical feature. On the other hand, long-term isolation of small mammals on Shiva Temple without concomitant changes in gene frequency is hardly consistent with allopatric speciation.

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THE HIERARCHY OF CONCEPTUAL LEVELS FOR SCIENTIFIC THOUGHT AND RESEARCH

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Abstract

A correct, philosophically neutral definition of science allows scientists complete freedom in what they believe, but requires them to function in accord with rules of the method of science which flow logically from the definition. There are four conceptual levels for scientific thought and research which coordinate and unify the several elements which constitute the practice of science. These conceptual levels are explained and related to the definition of science, to the rules of the method of science and to the freedoms of scientists.

Introduction

In an earlier article (Kofahl, 1986, p. 114) a four-tiered hierarchy of conceptual levels of the practice of scientific thought and research was briefly outlined. The present paper will enlarge on this view of science. The four levels of the conceptual hierarchy are:

*Religious-Philosophical faith or world view,
*Episteme (philosophy of science, epistemology, motivation, goals, etc.) (Gillespie, 1979, pp. 1-18),
*Conceptual frameworks (systems of fundamental concepts, paradigmatic theories and experiments, and assumptions for particular scientific disciplines or areas of research) (Jones, 1971), and
*Scientific hypotheses.

Fundamental to understanding this analysis is the fact that any proper definition of science is philosophically neutral (as delimited in the earlier article) (Kofahl, 1986, p. 112). In addition one must keep in mind the basic rules of the method of empirical science which flow logically from the definition of science. The particular rules pertinent to this discussion are the following:

1. Scientific hypotheses must be so constituted as to be subject to potential falsification by empirical test.
2. Scientific hypotheses may reference only elements of the empirical world and, therefore, may not reference any supernatural entity, activity or influence.

Also pertinent to this discussion are some of the freedoms of scientists which follow from the philosophically neutral definition of science, such as:

1. The definition of science lays no restrictions or requirements on what a scientist may believe.
2. The definition of science has nothing to say about the permissible sources of scientific hypotheses.

I will analyze and explain the four conceptual levels, in conformity with the rules and freedoms just enumerated.

Philosophical-Religious Faith or World View

The all-encompassing conceptual level, that of the scientist's religious-philosophical faith or world view, obviously may incorporate the supernatural—or exclude it. Any restriction to the contrary destroys philosophical neutrality and thus renders science captive to one or another belief system. The absolute freedom for scientists to hold whatever philosophical-religious belief system each one individually may prefer is most important since each person's philosophical view of the world, either consciously or unconsciously, influences everything he thinks or does.

Episteme

The second conceptual level, episteme, includes the scientist's philosophy of science, epistemology, and other such elements as the motivations and goals for his endeavors. It is clear from the history of science that various philosophies of science which have held sway or competed in different periods have related to various theological views of the world. It seems perfectly obvious that a scientist's philosophy of science will reasonably be expected to be logically related to his religious-philosophical world view, whether he be either religious or irreligious in his beliefs. Hence, since science is by definition philosophically neutral, a scientist's philosophy of science may include the supernatural or exclude it, either explicitly or implicitly.

Motivations and goals for one's professional career are likewise commonly meshed with one's belief system. For a Christian engaged in science, one motivation would be the command of God to Adam and to his posterity to subdue the earth and have dominion over

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