Editorial Comments

Dr. H. S. Hamilton continues his defense of the concept that the eye had to be a created organ. In this issue he notes that the evolution of creatures from a water-dwelling environment to a land-dwelling one presents some serious changes that had to be accommodated by the eye and are better explained by design. The topic of the age of the Mississippi River has been discussed previously in the Quarterly. A. W. Mehlert presents evidence that the river is actually quite young. I invited Dr. D. Russell Humphreys to write a paper on his model of the earth's magnetic field. He postulates that the age of the field is quite young but he allows for field reversals. Dr. Thomas Barnes will respond in the March 1989 Quarterly.

Barry Setterfield was invited to reply to the criticisms of his model on the speed of light. He wrote to me stating that his reply would be delayed. It will appear in the Quarterly at a later date. However the minisymposium continues with a defense of small curved models of the universe by Dr. John Byl and an elementary discussion of the Doppler effect by Vincent Ettari.

There have been many discussions of australopithecines in recent Quarterlies. Wayne Frair's letter to the editor adds new information on the topic. There are many other shorter selections in the Quarterly including a brief introduction to spider webs (evolution or design?) by the editor. I hope you will find much to interest you. Please send all future manuscripts to Dr. Donald B. DeYoung, Grace College, Winona Lake, IN 46590.

Emmett L. Williams, Editor

Remarks by the President

This year the Creation Research Society has completed its twenty-fifth anniversary. Great changes have occurred during these two and a half decades. In the two decades before the 1960's, generally, the evolutionary community was ignorant of the creationist foundation which was being laid. In the 1960's they became aware of creationists because of the activities of the CRS and that of many other creationist organizations which had become active during those years. In the 1970's, as a result of proliferation of creationist literature and debates the evolutionary community became alarmed by creationists. An important anti-creationist book was published in 1977 and some evolutionists signed a pact indicating their belief that evolution now should be promoted as a "fact."

As the 1970's ended and the 1980's began, the evolutionary community became increasingly antagonistic toward creationists. The first issue of an anti-creationist periodical appeared in 1980 and various anti-creationist books and articles began to proliferate. For the purpose of combating the "threat" of creationism, groups were organized throughout the United States these merging into a so-called "National Center for Science Education." Activists in this organization perceived that the increasing creationist influence could lead to a downfall of quality science education and they tried to oppress creationists and to censor creationist beliefs from science classrooms and educational literature.

Now as the second quarter-of-a-century of CRS history begins, I see evidence of a softening of the tension between the evolutionary community and creationists. The National Center for Science Education appears to be shifting its emphasis from fighting the creationists toward upgrading the quality of science education and more evolutionists are carefully reading creationist literature. Also there seems to be more communication between opposing sides and members of each are participating in conferences held by opposing groups.

Hopefully, as the final year of the 1980's commences and the last decade of this century is dawning there will be a general acceptance of the creationist model as a viable alternative within the scientific community. This goal will be accomplished, God helping us.

Wayne Frair

THE EYE OF THE AIR-BREATHING VERTEBRATE: DID IT EMERGE FROM THE SEA?

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Abstract

According to evolutionary hypothesis, life originated in the primitive seas, swarming there for many millions of years before aquatic vertebrates emerged on land. This transfer involved many anatomical and physiological adjustments and modifications among which were important alterations to the eyes. Some of these obligatory ocular changes are discussed with the conclusion that omnipotent and omniscient Intelligence, not natural processes, was responsible for the design of the eye in air-breathing vertebrates.

Introduction

According to present evolutionary dogma the first stirrings of life took place in the ancient seas about three billion years ago, arising from fortuitous combinations of certain elements and compounds therein, in spite of the improbability of such an occurrence (Thaxton, Bradley and Olson, pp. 3-4). From these postulated simple beginnings the first cell somehow materialized with all its complexity and huge information load. Over vast stretches of time, life forms gradually increased in organization and complexity until about 500 million years ago when the fossil record reveals an amazing outburst of complex invertebrate sea dwelling creatures for which there are no known fossil antecedents.

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As upward evolution supposedly progressed, the first vertebrates appeared in the form of pre-fish cyclostomes surviving as present day lampreys. Bony fish subsequently dominated the sphere of living organisms for millions of years exhibiting, along with the cyclostomes, the typical camera-like eye structure with its inverted retina, a pattern which repeats throughout the whole vertebrate phylum.

Invertebrate eyes, on the other hand, are classified into simple and compound. The first type varies from the simple light-sensitive eye spot in unicellular organisms to the much more complicated eyes of the squids and octopi which, in a number of ways, resemble the typical vertebrate structure, but with certain very important differences (Hamilton, 1987b, pp. 82-5). The compound eye is found in the honey bee. I will be concerned with the eyes of the earlier vertebrates as the latter supposedly emerged from the sea to dwell on land.

Walls (1963, p. 576) noted as follows:

> The origins of all peculiarly amphibian ocular features must be sought far from the 'highest' fishes in the imperfectly known chondrostian-dipnoan-crossopterygian series of patterns.

Evolutionary details of such would inevitably be speculative but the same general principles as observed in present day water dwellers and air-breathing forms would, of necessity, be involved. Some of the marked differences in the eyes of these two kinds of vertebrates will be outlined.

The Evolutionary Succession.

The vertebrate phylum, according to evolutionary theory, is of enormous antiquity and is derived from the primitive Agnatha, jawless fish, whose ancestry is unknown (Davidheiser, 1969, p. 306). The only surviving jawless members are the hag fish and lampreys. From these the true fish possessing jaws and paired fins supposedly evolved. Three classes of true fish emerged, *Placoderms* (armored fish), *Chondrichthyes* (cartilagenous fish) and *Osteichthyes* (bony fish).

The main line of descent continued through the Rhipidistia, the only known living member being the caelocanth. It is supposed that these organisms could already breathe air and so with a change of fins into legs, a change of the hearing apparatus and marked alterations in the eyes, they could survive on land. With the supposed drying of the swamps most of the Dipnoi disappeared and only those amphibians with the necessary ear and eye changes which had adjusted to being on land, survived. Only three groups of amphibians have persisted to the present; frogs and toads, salamanders and newts and the wormlike caecilians. From the main line there subsequently evolved the fully terrestrial vertebrates, the reptiles and from them, in due course, the birds and mammals.

Perplexities, Problems and Puzzles

Changing from life in the water to that on land demanded a great number of alterations in form and function. Among them was the redesigning of the ear and eye to register and respond to aerial sound and light waves respectively.

Throughout the vertebrate phylum all eyes are constructed on the general plan of the camera with the entering light being brought to a focus on the light-sensitive retina lining the posterior two-thirds of the eyeball. Here, light energy is changed into electrical impulses which are conducted via the optic nerve to the visual cortex of the brain where they are interpreted, resulting in environmental awareness which may or may not result in overt activity.

There are many minor individual variations in the standard vertebrate pattern in fish and land dwellers but basic principles are involved and it is to these that the following is directed. Most of the various parts of the eye are involved in this transformation. In the environmental change from water to air the eye had to undergo two very major modifications. The first concerns the refractive state and the second involves the integrity of the eye in the new waterless surroundings.

Cornea

The cornea of the eye serves two main functions. Being the front transparent layer of the eye it transmits light to the interior of the eyeball. Corneas vary widely in absolute area with respect to the size of the eyeball in different animals, but in general they are larger in nocturnal creatures than in diurnal ones, as more light enters the eye and a larger field of vision is subserved. For example in fish that live in the deeper waters it is found that the corneas are quite large in comparison to the size of the eye as a whole.

Being the first layer that the light strikes, the curved cornea also serves as a refractive surface and, along with the lens, forms the mechanism bringing light to a focus on the retina posteriorly. To function properly the cornea must be kept moist or it would become cloudy losing its transparency with ensuing loss of vision. Living in a watery environment this is of no consequence but it becomes a great problem once the water dweller comes on land, necessitating that the eye somehow quickly provide its own source of moisture.

With regard to the refractive role in aquatic eyes the cornea plays practically no part, as it is immersed in a medium with almost the same index of refraction, thus nullifying any function in the focusing process. On the other hand a vertebrate cornea on land, being in a different medium, does play an important role assisting, in conjunction with the lens, in directing incoming light to a focus on the light-sensitive cells (rods and cones) of the retina at the back of the eye. For this reason it is essential that the corneal surface be perfectly smooth and rounded. In the water dweller, since the cornea does not enter into the refractive function, minor irregularities and furrows on its surface which are frequently present, are of practically no significance.

To assist in streamlining, even although in a minor way, the cornea of the fish is much flatter than in an air-breather, in which, for all practical purposes, it can be considered to be round. This corneal flattening results in the anterior-posterior dimension of the eye in fish being considerably less than it is in land vertebrates (Figure 1). The vertebrate cornea typically consists of five layers and this plan is the norm throughout both water and air dwellers although there are numerous modifications in both categories.

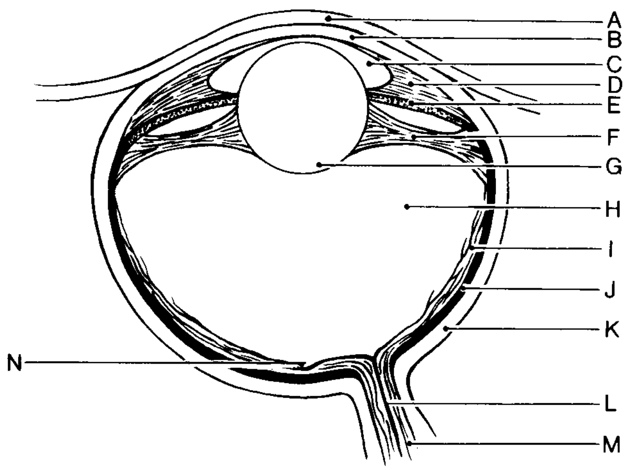

Figure 1. Eye of Water Dwelling Vertebrate (Schematic) A—Corneal epithelium. B—Scleral cornea. C—Anterior chamber. D—Annular ligament. E—Iris. F—Suspensory ligament. G—Lens H—Vitreous. I—Retina. I—Choroid. K—Sclera. L—Central retinal artery. M—Optic nerve. N.—Fovea.

Iris

The size and shape of the pupil is largely determined by the state of contraction or relaxation of the sphincter and dilator muscles embedded in the substance of the iris, the colored part of the eye. In fish, pigments of various colors are scattered through the iris substance giving its varied colors of yellow, red, gold, purple, etc. A layer of cells containing guanine (the purpose of which is not known) often covers the front surface of the iris giving the eye its metallic sheen. In fish generally, the pupil is often quite large, round and inactive due primarily to poor or absent musculature. Also, since the large and firm spherical lens projects through the pupil and almost touches the cornea (Figure 1) there could be little space for any significant iris movement. The latter for most of its length is anchored to the cornea by the annular ligament, thus further immobilizing it. When the pupils contract minimally they do so sluggishly with the musculature reacting directly to light as there is no innervation from the central nervous system.

In air-breathing animals existing in a different environment in which extremes of light and shade are the rule, one finds a much more active pupil. This ability is mediated by a highly active iris, the musculature of which (sphincter and dilator fibres) is innervated by the central nervous system. Amphibians being the first among the vertebrates to exhibit this control. There is no annular ligament to restrict iris movement. The lens is further back thus enlarging the capacity of the anterior chamber which is, in both cases, filled with a watery fluid (Figure 2).

Lens

A most important part of the eye is the crystalline lens which is found in vertebrates only, with very few exceptions, and whose origin is a mystery. The lens in water dwellers constitutes the only means of bringing light to a focus on the retina. In contrast, the lens plus the cornea mediate this function in air-breathers.

In the typical water dweller the lens is spherical and situated far forward in the eye almost touching the cornea (Figure 1). This position gives a wide field of vision and maximum refracting power to the animal which is essential as it is the sole means of focussing incoming light on the retina.

As an example of an initial air-breather, in the amphibian (frog for example), the lens is firm (as in fish) but in the adult tends to be somewhat oval rather than spherical and is further back from the cornea with a resulting deeper space between them. This space, termed the anterior chamber, is normally filled with fluid, mostly water. The cornea is round, not flattened, smooth and not irregular. As the eye now functions in air the refractive properties of the cornea come into play assisting the lens to focus light on the retina. This extra available focussing power in the amphibian and other air-breathers, if no further adjustments were made, would cause the image to come forward off the retina and into the vitreous. To overcome this problem the lens can now fall back from the cornea with a flattening of its anterior surface curvature. These two changes together restore the image to the retina where it should be. To expect that these extremely precise and necessarily co-ordinated anatomical and optical transformations could result from the action of natural selection on mutations which are almost entirely deleterious or lethal, is inconceivable.

Because the lenses in both fish and amphibians are firm, focussing, or the act of accommodation, cannot be accomplished in the same manner as in reptiles (snakes excepted), mammals and birds, where the curvature of the elastic anterior surface of the lens is altered by muscular effort. In fish and amphibians focussing for near and distance consists in moving the lens as a whole forward or backward from its position of rest. From the different positions of the lenses in these two, it is obvious that a different musculature arrangement would be needed in each case to accomplish the desired result. Sometimes an hinge mechanism is involved. In general, in fish where the

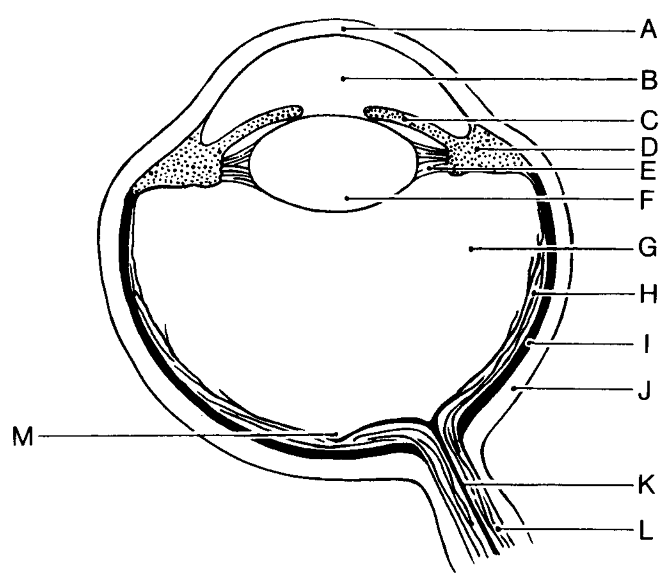

Figure 2. Eye of Air Breathing Vertebrate (Schematic) A—Cornea. B—Anterior chamber. C—Iris D—Ciliary body. E—Suspensory ligament. F—Lens G—Vitreous. H—Retina. I—Choroid. J—Sclera. K—Central retinal artery. L—Optic nerve. M.—Fovea.

lens is situated far forward, the eye is at rest for near vision with the lens being moved backward slightly by muscular effort for far vision. Just the opposite is the case with amphibians where the eye is at rest for far vision with the lens being moved forward a bit by muscular effort for near vision. These movements are accomplished by small muscles attached, in fish to the lens directly (retractor lentis) and in amphibians to tissues closely associated with the lens (protractor lentis). In each case the muscles are anchored securely to various adjacent fixed structures of the eye.

Retina

The retina, being the image bearing stratum of the eye, contains the light-sensitive cells, the rods and cones. The cones, which primarily affect day vision, are concentrated at the posterior pole of the eye with the proportion of rods increasing as the periphery of the retina is approached. These proportions vary tremendously in different animals, with nocturnals having a higher proportion of rods. Cones predominate in diurnal species. The sizes and shapes of these light-sensitive cells vary widely also, with variations in the amount and nature of the photochemical substances they contain, such as rhodopsin and oil droplets. Each species is endowed with the suitable proportion of rods and cones containing the substances indicated for its specific needs. Air and water dwellers alike have a number of layers in their respective retinas conforming generally to the same basic pattern which is characteristic of the vertebrate phylum. To suppose that a non-teleological chance process with a basis in mutations which are almost entirely deleterious or lethal could ever fabricate such fitting and entirely efficient retinal adaptations is placing an intolerable and impossible burden on natural selection.

More Environmental Problems

There is yet another equally serious problem which concerns the integrity of the eye in its new surroundings. It has been stated that the cornea in air must be kept moist. It is obvious therefore that the eye or its neighbouring tissues must supply a continuous source of fluid for this purpose very shortly after the eye leaves its watery environment. Water dwellers do not have or require true eyelids but such are necessary in air dwelling vertebrates, with snakes as an exception. Eyelids accomplish several purposes in serving as a mechanism to spread moisture over the cornea; they constitute a mechanical cleaning apparatus to wash away any foreign material on the surface of the eye, and offer some protection from injury as well as helping to shut out excessive light if required.

Some extant sharks and bony fish do have flaps of fatty tissue at the bony margins of the eyes but these in no way could be termed eyelids and their functions and origins are unknown. In air dwelling vertebrates (again excepting snakes) there are upper and lower lids and frequently a third lid, the nictitating membrane. There are many models and varieties. In some the lower lid is more mobile than the upper with the third being variable in size and mobility. However the basic functions are similar in all.

For purposes of keeping the eyes moist and lubricated the lachrymal and Harderian glands are first found among the amphibians. As an exception the snakes have neither lids nor lachrymal glands, the cornea being protected by an overlying clear layer termed a brille, a structure unique to them (Hamilton 1987a, pp. 188-9). The lachrymal secretion is watery while the Harderian gland produces a sebaceous type of material. Lachrymal and Harderian glands, located under the upper or lower lids come in many sizes, shapes and variations, but they all accomplish the same purpose. The secretion overflows the cornea and is spread by lid action, with some being evaporated, but the rest is mostly drained into the nose through the naso-lachrymal ducts. The mechanism is not the same in all vertebrates as in some the lachrymal secretion predominates while in others it is the Harderian. Whatever the combination the total system is nicely adjusted to the animal's requirements. The Harderian gland is absent in primates.

Conclusions

Having briefly investigated some of the important anatomical and physiological characteristics of the eyes of water and air dwelling vertebrates it is evident that the differences are major obstacles when trying to plot an evolutionary course between the two. The required changes in the refractive or focussing mechanism during the switch to aerial vision are of such precise dimensions, both anatomical and mathematical, that chance processes would appear to be totally incapable and powerless to effect the transformation.

If visual integrity is to be preserved, on forsaking the watery environment, provision for keeping the eye moist must be forthcoming almost immediately, requiring the presence of lachrymal and/or Harderian glands. It would be unreasonable to expect that extremely slow processes such as characterize organic evolution could ever comply with this requirement. The only adequate agent is a supreme Intelligence with an infinite capacity for adaptation and design.

Acknowledgement

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