

The Story of the Evolution of Life

BY T. F. PALMER.

(Continued from last issue)

Then there is the celebrated case of the wingless insects of Madeira. Some 600 species of beetles inhabit this island, many of which are confined to it, though they are closely related to species residing on the adjoining continent. Now 200 species of these beetles are incapable of flight although their parent species on the African coast fly perfectly well. Among the insects of Kerguelen Island a similar phenomenon exists. All the numerous species dwelling in this island—moths, flies, and beetles—cannot fly. Wallace contended that these organisms could not have reached these isles in a wingless state, as no insects of this type inhabiting large land areas are destitute of wings, and therefore they must have lost their flying powers, because such powers proved detrimental. Kerguelen Island is constantly swept by gales, much as Maderia is, and these storm-tossed isles are precisely those places where it would prove an advantage to fly badly, as insects winging their way through the air would run great risks of being blown into the sea.

Adaptation to environment is very strikingly illustrated by the presence of animals in dark caves, both in the Old World and the New, which have become blind. Those animals which dwell in the dark recesses into which no ray of light ever enters have become stone blind. On the other hand, the cave dwellers that inhabit those parts of these retreats that are sufficiently near their openings to permit the passage of a modicum of light, possess eyes that are large and lustrous. And in all the various instances these sightless, or almost sightless creatures, are demonstrably the near relatives of the normal light perceiving animals that dwell in the surrounding area. The blind organisms that live in American caves are closely akin to neighbouring American forms, and the same kinship exists between the sightless fauna of European caverns and their normal neighbours. Further, in the great majority of cases degeneration of the organs of vision has not proceeded far enough to completely obliterate all traces of the functional eyes the animals formerly possessed. The remnants of eyes are to be seen in various stages of obsolescence and, truth to tell, the foot stalks of the eyes of the totally blind crustaceans of the Mammoth Cave remain, although the eyes they once carried have entirely disappeared. Prolonged disuse of the visual organs, coupled perhaps with cessation of selection, account for these interesting phenomena, while they lend no support whatever to the rival theory of special creation.

In the human body are to be found scores of organs in a dwindled state that have been inherited from man's animal forerunners. The complexity of the human framework is so vast that a life's study is essential to enable the morphologist to master all its details. Yet it has been established to the satisfaction of all modern investigators that there exist no bone, nerve, muscle, or vessel of any moment in man's anatomy which cannot be traced in the bodies of superior apes. In the words of a weighty authority if we note the aborted structures then, "the entire corporeal structure of man is an exact anatomical copy of that which we find in the ape."

The second eyelid persists as a vestigial organ in man and other mammals. This structure is found in all backboneed animals from lowly fishes to the most exalted members of the vertebrate order. In birds, this eyelid, the nictitating membrane, as it is called, is very highly developed, and it proves useful to them as a protective organ, while in most other vertebrates higher than the fishes it lingers as a relic from the past. Attached to the human ear are muscles in an aborted condition which are present on a larger and functioning scale in four-footed animals. In the man-like apes, as with man himself,

these muscles survive as useless vestiges, while with the inferior baboons and other monkeys these muscles still serve to move the ears. Similarly with the skin muscles which enable various quadrupeds, including the horse, to twitch the skin so as to drive away flies that torment them by sucking their blood. In man these skin muscles have nearly all degenerated into a functionless state, but our ape cousins still use them.

The form of the human foot, again, testifies to our animal origin. All children display a marked tendency to turn the feet inwards, and are not always successfully trained to turn them outwards, and continue to walk in ungainly fashion through life. In the apes and monkeys the feet are used as grasping organs as well as for progression, and the clutching attitude of the foot is very pronounced in the unborn babe, even more so than in the infant. Two other features are noteworthy. The curvature of the legs, and the lateral extension of the baby's big toe, which confers to this digit a striking similarity to the large toe of the monkeys. These infant characters are even more pronounced in the human embryo and correspond to their permanent condition in apes. The same story is told by the hand, for its grasping capacity in the child is out of all proportion to its needs. Then there is the evidence afforded by the persistence of the bones and muscles of the tail. The absence of the external tail in man is urged by the ill-formed as an obstacle to the acceptance of the doctrine of descent. But as Romanes sarcastically said, the disappearance of the tail in man is exactly what the evolutionist expects, as man's nearest living relatives, the gorilla, orangutan, gibbon, and chimpanzee, are all destitute of an external caudal appendage. The absence of the tail in man presents no real difficulty, but serves to remove one, for the very plain reason that if man still retained an external tail the puzzle would be "to understand how he managed to retain an organ which had been renounced by his most recent ancestors." Nevertheless the man-like apes do possess vestiges of a tail, and so does man himself, while the embryos of men and monkeys sport tails that are longer than their legs. Moreover in the unborn child or ape the tail may be set in motion by muscles which dwindle as the embryo develops, and cases have been recorded by anatomical authorities in which these tail muscles persist even in the adult man. Although this phenomenon is abnormal in the present stage of human development it furnishes conclusive evidence of our tailed ancestry.

Another relic is the vermiform appendix, which is much larger in, and possesses considerable value to herbivorous animals, but it is of undoubted detriment to man. This appendix is a blind gut which runs from the intestines, and should any foreign substance find lodgment therein, inflammation results with the development of the disease of appendicitis, which occasions thousands of painful deaths annually. In apes and men this organ persists as a useless and dangerous rudiment, and it remains slightly larger in the apes and the undelivered human baby, than in adult man.

The external ear of the human embryo closely resembles that of the monkeys, while man's completely developed ear betrays unquestionable signs of its modification from an ape-like form. Our hair again, so far as we retain it, bears the plainest resemblance to that of our arboreal cousins, and it is significant that the aborted hair on the human upper and lower arm "is directed towards the elbow—a peculiarity which occurs nowhere else in the animal kingdom, with the exception of the anthropoid apes and a few American monkeys." This curious arrangement is doubtless due to the life in the trees led by our arboreal ancestors. Wallace observed that the orang in its native forests rests its hands on the crown of its head with its elbows directed downwards so that the falling rain travels along the hairs which thus act as a thatch. In numerous

minor details of hair arrangement man distinctly resembles the apes. Many other similar facts might be submitted, but sufficient has been said to prove man's kinship with the brutes. The body of man is a veritable museum of vestigial relics. Wiedersheim the eminent anatomist has recorded 180 relics of the past in the framework of man. They appear in all parts of his body, including the reproductive, respiratory, circulatory, and digestive systems. Eleven of these vestigial structures are not functional in animals higher than the fishes; we have inherited four from reptilian and amphibian ancestors. In man these organs are always useless and are frequently the occasion of suffering and death.

The facts of embryology supplement the evidences already submitted. As Haeckel, Karl Rabl and others have shown, testimonies to evolution yielded by the fossil record are reproduced in abundant measure by the phases passed through by animals as they advance from the egg stage towards the mature condition. In surveying the evolution of horns, as disclosed by fossil remains, their onward progress was proved. Now this evidence is reproduced in the progressive development of the antlers of the living deer. In the first year, their antlers resemble those of their ancient fossil ancestors, and are single pronged. And from the first to the sixth year of the stag's life, the antlers increase by the successive addition of branches year after year. In other language, these animals in their life history recapitulate the past history of their progenitors, near and remote. With certain reservations, kindred phenomena are displayed in all branches of the animal kingdom. In the stag these changes occur after the attainment of the adult state, but the almost remarkable examples of recapitulation are witnessed in the processes of an organism's development before it is hatched or born. One of the salamanders is strictly terrestrial, yet the young proclaim their descent from aquatic ancestors by displaying in their unborn state the gills which they themselves never use, as they breathe exclusively through lungs, but which were essential to their water dwelling ancestors; and, strangely enough, these gills are so completely formed that were the unborn salamander taken from the parent body, just prior to birth, and promptly placed in water, these small creatures will dart about in surroundings that would soon drown their own mother.

The evidence derived from embryology is in itself ample to establish the truth of evolution. It has been erroneously imagined, however, that animals proceed in the course of their embryological progress through all the stages experienced by their near and distant ancestors in their long evolutionary advance. But, as is indeed obvious, the repetition of each ascending stage in the developing young would entail considerable sacrifice in perpetually reproducing phases of past history which are of no utility whatever to present day animal forms. Therefore in various instances, the ancestral history has been abbreviated into reminiscences of earlier events. Many phases of ancestral life have been blurred, foreshortened, or even blotted out. Yet sufficient remains to compel biologists to regard embryology as supplying some of the most powerful arguments and illustrations of the doctrine of modified descent.

We will now endeavour to the best of our ability to present as clear an outline of the general embryological arguments as the complex nature of the subject will permit.

In the sexual animals, the egg cell of the female, when fertilised by the male element commences to develop. All plants and animals are composed of cells, and the egg-cell is larger than the ordinary cells which build up the body. In man and in many other mammals this cell is about 1/120th of an inch across. The egg or ovum is frequently surrounded by a membrane which is usually furnished with one or more small openings through which the male element passes when it impregnates the egg. Now although the ova of animals in general are substantially identical, these ova or egg cells must not be confounded with what we know as eggs. For in ad-

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