

WAS MAN MORE AQUATIC IN THE PAST?

And was it in the sea that Man learned to stand erect? The author explains his hypothesis that we descend from more aquatic ape-like ancestors. He will contribute a further article—"Will Man be more aquatic in the future?"—to next week's issue

by Professor Sir ALISTER HARDY, FRS

ON 5 March I was asked to address a conference of the British Sub-Aqua Club at Brighton and chose as my theme "Aquatic Man: Past, Present and Future". I dealt little with the present, for Man's recent achievements in the underwater world were so well illustrated by other speakers and by films. I ventured to suggest a new hypothesis of Man's origin from more aquatic ape-like ancestors and then went on to discuss possible developments of the future. I did not expect the wide publicity that was given to my views in the daily press, and since such accounts could only be much abbreviated, and in some cases might be misleading, I gladly accepted the invitation of *The New Scientist* to give a fuller statement of my ideas.

I have been toying with this concept of Man's evolution for many years, but until this moment, which suddenly appeared to be an appropriate one, I had hesitated because it had seemed perhaps too fantastic; yet the more I reflected upon it, the more I came to believe it to be possible, or even likely. In this article I shall deal with this hypothesis; next week I shall treat of the future.

Man, of course, is a mammal, and all the mammals have been derived, as indeed have also the birds but by a different line of evolution, from reptile ancestors that flourished more than a hundred million years ago, when the world was populated by saurians of so many different kinds which have long since become extinct. These reptile ancestors in turn were derived from newt-like animals—amphibian creatures—which had only partially conquered the land and had to return to water to breed as do most of our salamanders and frogs of today. It is

equally certain that these earlier amphibians were evolved from fish which, like those primitive lung-fish that still survive in certain tropical swamps today, had developed lungs with which to breathe. Some of these air-breathing fish were able to climb from the water on to the land.

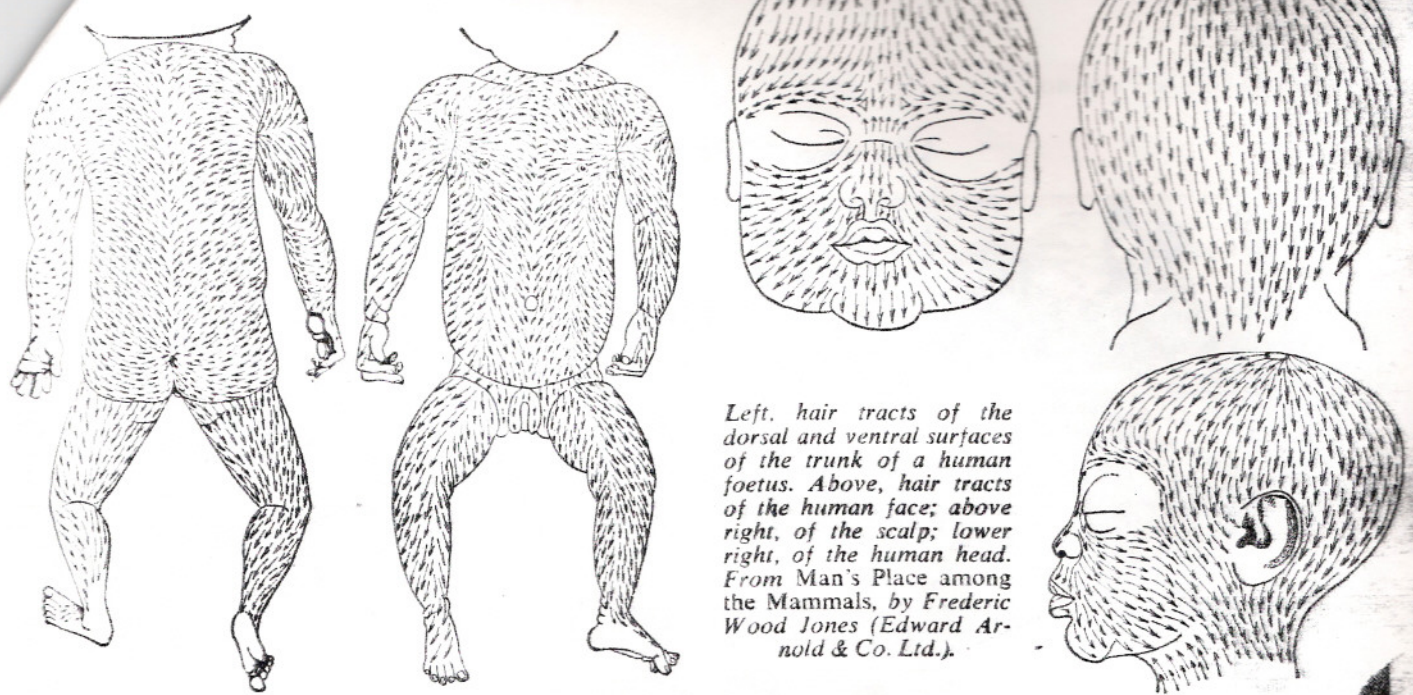
This history of the emancipation of animal life from the sea is very well known. I repeat it only because it forms the background to another story, one that is not quite so familiar to those who are not trained as zoologists. At the same time as this conquest of the land was extending with continually improving adaptations to the new terrestrial life, we see (in the fossil record) a different act repeating itself again and again, first with the amphibians, next with the reptiles, and then with the mammals and indeed the birds as well. Excessive multiplication, over-population, shortage of food, resulted in some members of each group* being forced back into the water to make a living, because there was not enough food for them on the land. Among the reptiles I need only remind you of the remarkable fish-like ichthyosaurs, of the plesiosaurs, of many marine crocodile-like animals, and of turtles, not to mention water-snakes. Then, among the mammals of today we see the great group of whales, dolphins and porpoises, with the vestigial remains of their hind legs buried deep in their bodies, beautifully adapted to marine life; or again the dugongs and manatees belonging to an entirely different group. The seals are well on their way to an almost completely aquatic life, and many other groups of mammals have aquatic representatives which

* The amphibians went back only into freshwater (for certain physiological reasons), not into the sea.

have been forced into the water in search of food: the polar bears, the otters (both freshwater and marine), various aquatic rodents, like water voles and the coypu, or insectivores like the water shrew; and, of course, we must not forget the primitive duck-billed platypus. There are, indeed, few groups that have not, during one time or another in the course of evolution, had their aquatic representatives; among the birds the penguins are supreme examples.

The suggestion I am about to make may at first seem far-fetched, yet I think it may best explain the striking physical differences that separate Man's immediate ancestors (the Hominidae) from the more ape-like forms (Pongidae) which have each diverged from a common stock of more primitive ape-like creatures which had clearly developed for a time as tree-living forms.

My thesis is that a branch of this primitive ape-stock was forced by competition from life in the trees to feed on the sea-shores and to hunt for food, shell fish, sea-urchins, etc., in the shallow waters off the coast. I suppose that they were forced into the water just as we have seen happen in so many other groups of terrestrial animals. I am imagining this happening in the warmer parts of the world, in the tropical seas where Man could stand being in the water for relatively long periods, that is, several hours at a stretch. I imagine him wading, at first perhaps still crouching, almost on all fours, groping about in the water, digging for shell fish, but becoming gradually more adept at swimming. Then, in time, I see him becoming more and more of an aquatic animal going farther out from the shore; I see him diving for shell fish, prising out worms, burrow-



Left, hair tracts of the dorsal and ventral surfaces of the trunk of a human foetus. Above, hair tracts of the human face; above right, of the scalp; lower right, of the human head. From Man's Place among the Mammals, by Frederic Wood Jones (Edward Arnold & Co. Ltd.).

ing crabs and bivalves from the sands at the bottom of shallow seas, and breaking open sea-urchins, and then, with increasing skill, capturing fish with his hands.

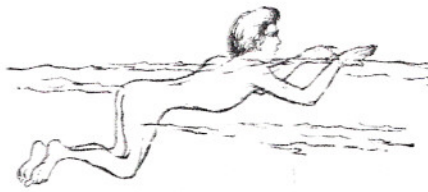
Let us now consider a number of points which such a conception might explain. First and foremost, perhaps, is the exceptional ability of Man to swim, to swim like a frog, and his great endurance at it. The fact that some men can swim the English Channel (albeit with training), indeed that they race across it, indicates to my mind that there must have been a long period of natural selection improving Man's qualities for such feats. Many animals can swim at the surface, but few terrestrial mammals can rival Man in swimming below the surface and gracefully turning this way and that in search of what he may be looking for. The extent to which sponge and pearl divers can hold their breath under water is perhaps another outcome of such past adaptation.

It may be objected that children have to be taught to swim: but the same is true of young otters, and I should regard them as more aquatic than Man has been. Further, I have been told that babies put into water before they have learnt to walk will, in fact, go through the motions of swimming at once, but not after they have walked.

Does the idea perhaps explain the satisfaction that so many people feel in going to the seaside, in bathing, and in indulging in various forms of aquatic sport? Does not the vogue of

the aqua-lung indicate a latent urge in Man to swim below the surface?

Whilst not invariably so, the loss of hair is a characteristic of a number of aquatic mammals; for example, the whales, the Sirenia (that is, the dugongs and manatees) and the hippopotamus. Aquatic mammals which come out of the water in cold and temperate climates have retained their fur for warmth on land, as have the seals, otters, beavers, etc. Man has lost his hair all except on the head, that part of him sticking out of the water as he swims; such hair is possibly retained as a guard against the rays of the tropical sun, and its loss from the face of the female is, of course, the result of sexual selection. Actually the apparent hairlessness of Man is not always due to an absence of hair: in the white races it is more apparent than real in that the hairs are there but are small and exceedingly reduced in thickness; in some of the black races, however, the hairs have actually gone, but in either case the effect is the same: that of reducing the resistance of the body in swimming. Hair, under water, naturally



In water, only the head needs protection from the rays of the tropical sun.

loses its original function of the body warm by acting as a conductor; that quality, of course, depends upon the air held between the spaces between the hairs. The principle adopted in Aertex is a fossil replica of the arrangement of hair with which in Man is an adaptation by the retention into adult life of an early embryonic condition; the unborn chimpanzee has hair on its head like Man, but little on its body.

Whilst discussing hair it is interesting to point out that what are called the "hair tracts"—the directions in which the hairs lie on different parts of the body—are different in Man from those in the apes; particularly to be noted are the hairs on the back, which are all pointing in lines to meet diagonally towards the mid-line, exactly as the streams of water would pass round the body and meet, when it is swimming forward like a frog. Such an arrangement of hair, offering less resistance, may have been a first step in aquatic adaptation before its loss.

The graceful shape of Man—or woman!—is most striking when compared with the clumsy form of the ape. All the curves of the human body have the beauty of a well-designed boat. Man is indeed streamlined.

These sweeping curves of the body are helped by the development of fat below the skin and, indeed, the presence of this subcutaneous fat is again a characteristic that distinguishes Man from the other primates. It was a note of this fact in the late Professor Wood Jones's book

WAS MAN MORE AQUATIC IN THE PAST? *continued*



The seals are well on their way to an almost completely aquatic future—

Place among the Mammals that set me thinking of the possibility of Man having a more aquatic past than I read it more than thirty years ago. I quote the paragraph as follows. "The peculiar relation of the skin to the underlying superficial fascia is a very real distinction, familiar enough to everyone who has repeatedly skinned both human subjects and any other members of the Primates. The bed of subcutaneous fat adherent to the skin, so conspicuous in Man, is possibly related to his apparent hair reduction; though it is difficult to see why, if no other factor is invoked, there should be such a basal difference between Man and the Chimpanzee."

I read this in 1929 when I had recently returned from an Antarctic expedition where the layers of blubber of whales, seals and penguins were such a feature of these examples of aquatic life; such layers of fat are found in other water animals as well; and at once I thought perhaps Man had been aquatic too. In warm-blooded water animals such layers of fat act as insulating layers to prevent heat loss; in fact, in function they replace the hair. Man, having lost his hair, must, before he acquired the use of clothing, have been subjected to great contrasts of temperature out of water; in this connection it is interesting to note the experiments carried out at Oxford by Dr. J. S. Weiner, who showed what an exceptional range of temperature change in

air Man can stand, compared with other mammals. Man's great number of sweat glands enable him to stand a tropical climate and still retain a large layer of fat necessary for aquatic life.

This idea of an aquatic past might also help to solve another puzzle which Professor Wood Jones stressed so forcibly, that of understanding how Man obtained his erect posture, and also kept his hands in the primitive, unspecialized, vertebrate condition; for long periods, the hands could not have been used in support of the body as they are in the modern apes, which have never mastered the complete upright position. The chimpanzee slouches forward with his body partly supported by his long arms and with his hands bent up, to take the weight on the knuckles. Man must have left the trees much earlier; in all the modern apes the length of the arm is much longer than that of the leg. In Man it is the reverse. The puzzle is: how in fact did Man come to have the perfect erect posture that he has—enabling him to run with such ease and balance? Some have supposed that he could actually have achieved it by such running, or perhaps by leaping, but this does not seem likely. Let me again quote from Wood Jones, this time from his book *The Hallmarks of Mankind*, 1948, p. 78:

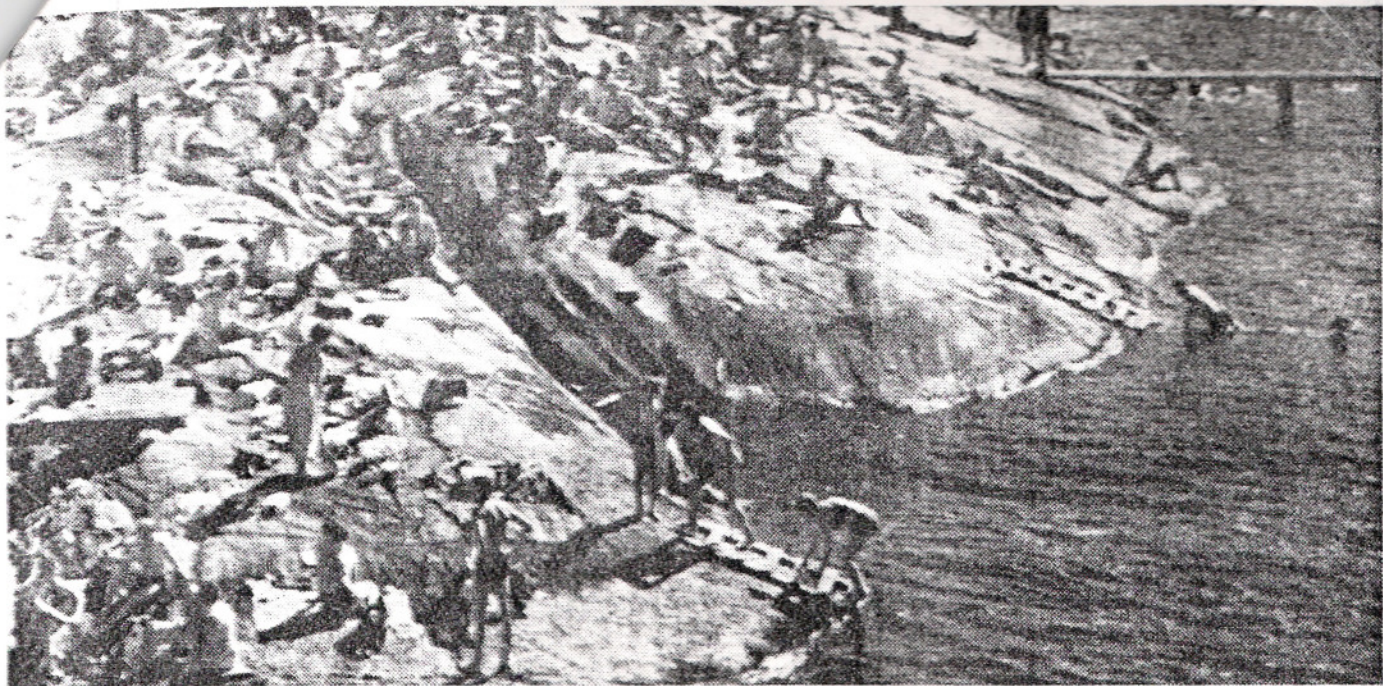
"Almost equal certainty may be attached to the rejection of the possibility that he ever served an apprenticeship as a specialized leaper or a

specialized runner in open spaces. But it is by no means so easy to reject the supposition that he commenced his career of bipedal orthograde progression as what might be termed a toddler, somewhat after the fashion followed in some degree by the bears."

It seems indeed possible that his mastery of the erect posture arose by such toddling, but performed in the water, like children at the seaside. Wading about, at first paddling and toddling along the shores in the shallows, hunting for shellfish, Man gradually went farther and farther into deeper water, swimming for a time, but having at intervals to rest—resting with his feet on the bottom and his head out of the surface: in fact, standing erect with the water supporting his weight. He would have to raise his head out of the water to feed; with his hands full of spoil he could do so better standing than floating. It seems to me likely that Man learnt to stand erect first in the water and then, as his balance improved, he found he became better equipped for standing up on the shore when he came out, and indeed also for running. He would naturally have to return to the beach to sleep and to get water to drink; actually I imagine him to have spent at least half his time on the land.

Tied up with his method of assuming the erect position is the problem of the human hand. Let me quote again from Wood Jones (*ibid.*, p. 80):

"In the first place, it seems to be



while Man's enjoyment of the sea may be a link with an aquatic past.

perfectly clear that the human orthograde habit must have been established so early in the mammalian story that a hand of primitive vertebrate simplicity was preserved, with all its initial potentialities, by reason of its being emancipated from any office of mere bodily support. Perhaps the extreme structural primitiveness of the human hand is a thing that can only be appreciated fully by the comparative anatomist, but some reflection on the subject will convince anyone that its very perfections, which at first sight might appear to be specializations, are all the outcome of its being a hand unaltered for any of the diverse uses to which the manus of most of the "lower" mammals is put. Man's primitive hand must have been set free to perform the functions that it now subserves at a period very early indeed in the mammalian story."

Man's hand has all the characters of a sensitive, exploring device, continually feeling with its tentacle-like fingers over the sea-bed: using them to clutch hold of crabs and other crustaceans, to prise out bivalves from the sand and to break them open, to turn over stones to find the worms and other creatures sheltering underneath. There are fish which have finger-like processes on their fins, such as the gurnards; they are just such sensitive feeling organs, hunting for food, and they, too, have been known to turn over stones with them while looking for it.

It seems likely that Man learnt his tool-making on the shore. One of the few non-human mammals to use a tool is the Californian sea-otter, which dives to the bottom, brings up a large sea-urchin in one hand and a stone in the other, and then, whilst it floats on its back at the surface, breaks the sea-urchin against its chest with the stone, and swallows the rich contents. Man no doubt first saw the possibilities of using stones, lying ready at hand on the beach, to crack open the enshelled "packages" of food which were otherwise tantalizingly out of his reach; so in far-off days he smashed the shells of the sea-urchins and crushed lobsters' claws to get out the delicacies that we so much enjoy today. From the use of such natural stones it was but a step to split flints into more efficient tools and then into instruments for the chase. Having done this, and learnt how to strike together flints to make fires, perhaps with dried seaweed, on the sea-shore, Man, now erect and a fast runner, was equipped for the conquest of the continents, the vast open spaces with their herds of grazing game. Whilst he became a great hunter, we know from the middens of mesolithic Man that shell fish for long remained a favourite food.

In such a brief treatment I cannot deal with all the aspects of the subject; I shall later do so at greater length and in more detail in a full-scale study of the problem. I will just here mention

one more point. The students of the fossil record have for so long been perturbed by the apparent sudden appearance of Man. Where are the fossil remains that linked the Hominidae with their more ape-like ancestors? The recent finds in South Africa of *Australopithecus* seem to carry us a good step nearer to our common origin with the ape stock, but before then there is a gap. Is it possible that the gap is due to the period when Man struggled and died in the sea? Perhaps his remains became the food of powerful sea creatures which crushed his bones out of recognition, or could his bones have been dissolved, eroded away in the tropical seas? Perhaps, in time, some expedition to investigate tropical Pliocene (coastal) deposits may yet reveal these missing links.

It is interesting to note that the Miocene fossil *Proconsul*, which may perhaps represent approximately the kind of ape giving rise to the human stock, has an arm and hand of a very unspecialized form: much more human than that of the modern ape. It is in the gap of some ten million years, or more, between *Proconsul* and *Australopithecus* that I suppose Man to have been cradled in the sea.

My thesis is, of course, only a speculation—an hypothesis to be discussed and tested against further lines of evidence. Such ideas are useful only if they stimulate fresh inquiries which may bring us nearer the truth.