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Flood brothers

Millions of years ago, apes were forced into an aquatic existence when the Rift Valley became semi-submerged by the Red Sea. The result? The human race.

Story: Simon Bearder

Question How do you upset a gathering of biological anthropologists?

Answer Just mention the words 'aquatic ape hypothesis'.

In all probability they will become highly animated and use words such as 'bunkum' and 'rubbish'. Yet most people, including many students of anthropology, have never heard of the idea, and so why does it arouse such hostility?

As a lecturer on human evolution for the past 21 years, I have had the opportunity to scrutinise a succession of textbooks on the subject, and not one of them mentions the aquatic hypothesis of human origins. Despite this, none of them can agree about what may have caused the evolution of apes into hominids and so into humans. Take, for example, the *Introduction to Physical Anthropology*, published in 1997, which states: "What caused these forms to come to the ground and embark on the unique way of life that would eventually lead to humans is still a mystery."

I and other proponents of the aquatic ape hypothesis would suggest that it may not be such a mystery. An idea first put forward by Max Westenhofer, and restated by Alister Hardy, has been developed and refined by Elaine Morgan over the past 28 years. It states that upright walking and a number of other characteristics that separate us from our closest living relatives the African great apes can be explained as the result of a semi-aquatic lifestyle adopted by our ancestors some six or more million years ago.

It seems strange that generations of anthropology students have been denied the opportunity to consider this theory because their textbooks and teachers have been unwilling to talk about it. It would be understandable if the ideas were unscientific but, as you will see, this is not the case. The time for a public debate on the issue is long overdue.

In 1972, when Morgan wrote her first book, *The Descent of Women*, she argued that most anthropologists at that time were men and most discussions about how humans evolved came from a largely male viewpoint. She took up the ideas of Alister Hardy, who, at the end of his career as a marine biologist, wrote an article in *New Scientist* which said that the logical way to explain bare skin and a layer of subcutaneous fat was as an adaptation to life in water.

Before that, nearly everyone had assumed that the earliest upright ancestors of humans had developed on the African savannahs. A number of theories were cited as to why these changes might have happened – it was an adaptation for hunting and gathering, for scavenging from the kills of lions and hyenas or for seed-eating on the grassy plains, or it enabled men to carry armloads of food back to women and children at the home base. It was even suggested that standing upright helped prevent overheating by exposing less surface area to the sun. But all other animals that live on the African savannah, including other primates such as baboons, vervets and patas monkeys, do not walk upright – or lose their hair or become fat for that matter.

Initially, Elaine Morgan took up the subject as a feminist critic of male-biased anthropology. Later, she realised that Hardy may have been right, and that most of what makes us different from apes could be a reflection of a past existence in close association with water. The phase we are asked to imagine may have lasted for about a million years, some 6-9 million years ago, at the time of the last common ancestor of humans and apes. These animals would have been ape-like in appearance, walking on all fours on the ground or swinging and climbing in trees of the forests of the East African Rift Valley. But then the Rift was flooded by water from the Red Sea, and some populations of these primates may have became isolated on forested islands. Undoubtedly, they would have been forced to wade or even swim in order to cross the channels separating these islands.

The new environment would have provided opportunities as well as obstacles. There would have been new sources of food, such as fish and shellfish, and those individuals that were best suited to exploit these resources, by using tools to crack open shellfish, for instance, would have flourished. Like other primates, they would have slept on dry land, probably in the safety of trees, but they gradually spent more of their time in water and eventually evolved a suite of characteristics that relate to an amphibious lifestyle. The result was a hominid – a fully upright primate with reduced canine teeth and a somewhat larger brain in relation to body size than even modern apes. The hominids, like the apes, diversified into a number of species, and some at least returned to dry land almost permanently to exploit a variety of niches worldwide. They took with them the benefits and limitations bestowed by their watery past.

Genetic studies show that we are very closely related to the ▶

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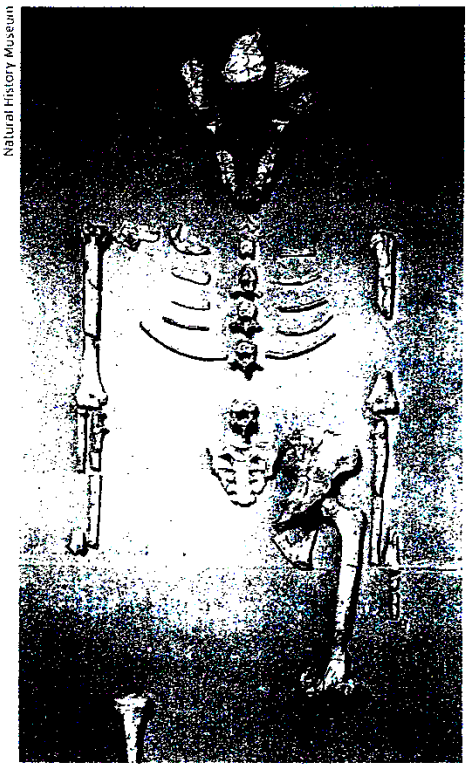
Even new-born babies are fat and naked, and they can swim and are

African great apes – the gorilla, chimpanzee and bonobo – with less than 1.5 per cent genetic distance between us, while they look more similar to the orang-utan, despite the fact that it is a more distant relative than we are, about 3 per cent genetic distance. How is this possible? Something dramatic must have happened to transform an animal that walked on all fours into an upright creature, something which involved a major reorganisation of the entire skeleton.

In trying to explain the differences between ourselves and our closest living relatives, Morgan draws extensively on the work of other authors and correspondents to build up a detailed argument that fits with the range of selection pressures imposed by a life in water. One problem is that there are no other fully upright species to act as possible models for these changes, with the exception of penguins (and they are not naked, do not have long hind legs and are clearly not closely related). The way around this in biology is to look for parallels for each particular difference. For example, if you want to know why some animals are white in colour, you look to see what most white-coloured species have in common. Polar bears, arctic foxes, ptarmigans and baby seals are all white (seasonally, in some cases), and they all seek camouflage against the snow. Among primates, this comparative method has been used to reconstruct the likely origin of forward facing eyes (found in most predators) and grasping hands and feet (found in fine branch climbers), indicating that the earliest primates may have hunted for insects on the smaller branches within tropical rainforests.



Natural History Museum

Skeleton key. This hominid – known as Lucy – walked upright and lived about 3.5 million years ago. Were her ancestors forced into bipedalism as a consequence of the flooding of the Rift Valley?

One characteristic that distinguishes humans from apes is bare skin and subcutaneous fat – we have both, apes neither. These features can be found in a variety of other species, including cetaceans, manatees, dugongs, pigs, hippos, rhinos and elephants. The function of these features can be seen by examining what these animals have in common – all are, or were, adapted to spending time in water, and even though pigs, hippos, rhinos and elephants are not fully aquatic, they all revert to water when they get the opportunity. True, aquatic mammals such as polar bears and seals have retained their fur. But hominids, like the other species with bare skin, evolved in warmer, tropical waters where fur could be dispensed with.

Even new-born babies are fat and naked, and they can swim and are at ease in water. Any other new-born primate would sink. Most primates dislike water, though there are a few species, such as the proboscis monkey and the bonobo, which have become accustomed to it and can even swim and dive. When in shallow water, they tend to walk upright.

So, is it possible that human upright walking developed at a time when our ancestors were semi-aquatic? 'Lucy' – the hominid skeleton discovered at Hadar in what is now Ethiopia – is dated at roughly 3.5 million years old. Lucy, otherwise known as *Australopithecus afarensis*, was at least partially bipedal and lived and died in an area of flooded woodland and lakes. Found by her bones were crocodile and turtle eggs and crab claws. Could these have been her last meal? Whatever the truth, she was clearly at home in a semi-aquatic environment and she was capable of walking upright. Further evidence of bipedalism comes from the famous set of footprints discovered by Mary Leakey at Laetoli in the Rift Valley, which are dated at 3.6 million years old. They were made by a fully upright primate with feet like ours, as opposed to the grasping feet of chimps and gorillas. Artists' impressions of Lucy generally show her to be relatively skinny and hairy but she may have been plump and naked. Morgan points out that you cannot tell from the skeleton of an otter that it is semi-aquatic, and it follows that the same could be true of Lucy.

It is well known that events over millions of years can leave distinctive hallmarks on the biology of living species. For example, our hands are an obvious throwback to when our ancestors climbed trees, and the appendix is the remnant of a caecum in our leaf-eating forebears. If it is true that the reason for the divergence between the hominids and their ape-like (pongid) relatives was due to a long (more than a million years) semi-aquatic phase of history, then it follows that there should be many other modifications of the human body that fit such a lifestyle – remnants that Morgan calls the 'scars of evolution'. Such clues are masked by the changes that took place after hominids left the water and re-adapted to dry land (over the past five million years or so) but they can be seen through careful study. What follows are six of the most interesting 'aquatic scars'.

Brain size We already know that Lucy had a skeleton adapted for upright locomotion, but other fossil evidence of her lifestyle comes from her reduced canine teeth and the relative enlargement of her brain compared to other primates. If these differences had evolved in savannahs or forests, then they should be reflected in monkeys and apes that live in these habitats today. But this is not the case. No modern primate has a brain as large as the earliest hominids, once body size is taken into consideration, and none has lost the dagger-like canines. Marine mammals such as cetaceans, on the other hand, do have relatively large brains in relation to body size, and appropriate modifications to their teeth. They, of course, have gone a lot further than any hominid in adopting a fishy diet, but the harvesting of seafood may have represented a good starting point for brain enlargement and dental change in our ancestors. Added to this, seafood industries worldwide show how modern humans seek out this source of nutrients, sometimes to the exclusion of nearly all other foods. In addition, researchers have shown that long chain fatty acids present in seafood, and particularly fish oils, play a vital role in the development of human babies.

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Water As already mentioned, one of the possible throwbacks to the past is our love of swimming. If babies are allowed to swim from a very early age, they show no fear of water. Asthma sufferers – and particularly young children – seem to become liberated when immersed in water. We show obvious enjoyment of showers, baths and the seaside. Pearl divers illustrate the human capacity to stay under water for long periods and to exercise voluntary control of breathing. When in water, human heart rate and metabolic rate are lowered (the diving reflex), and the ability to stay under water improves with practice. All these attributes are similar to those of aquatic mammals, but are not shared by our closest-living relatives. Professor Robert Winston, remarking on the diving abilities of babies, has said, "The truth is, we don't even understand the origins of this unusual ability. For the moment, it remains a delightful mystery." He may agree that it is reasonable to suppose that it dates back to a phase in history when our habitat was very different from that of most other primates.

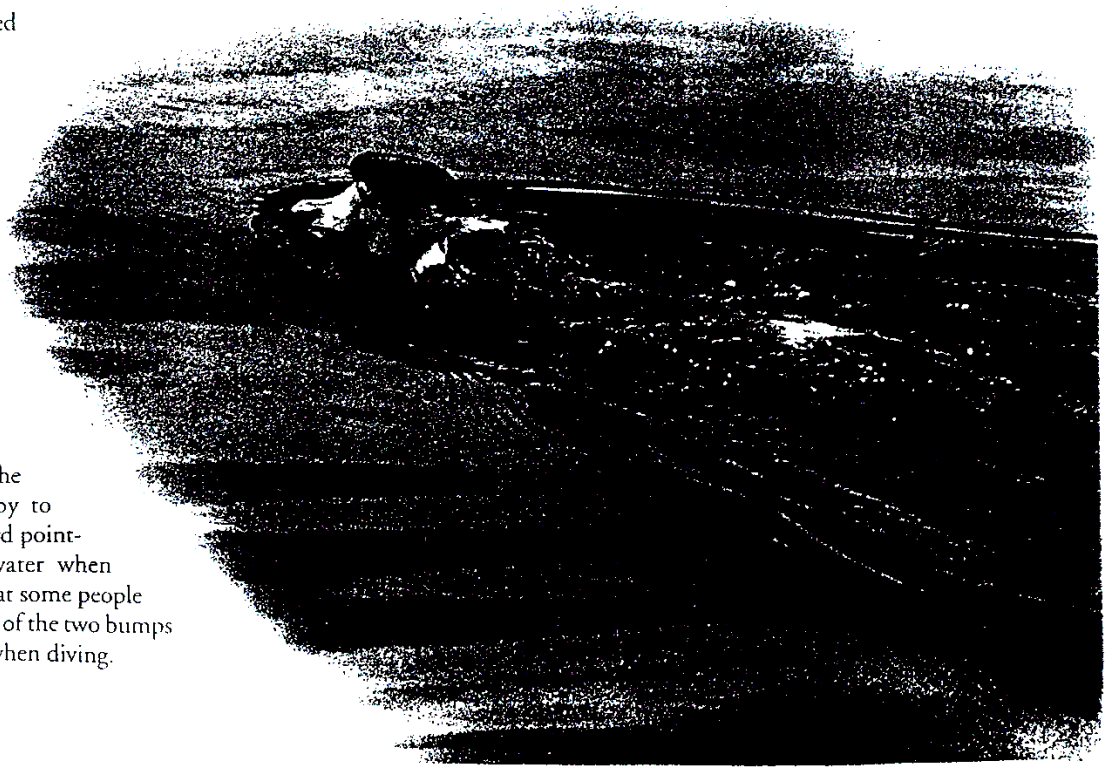
The lowered larynx In human babies, as in all other primates and non-marine mammals, the windpipe is quite separate from the oesophagus, and they can therefore breathe and swallow at the same time. As the child develops, this arrangement changes. The larynx descends in the throat until the windpipe and foodpipe are lying side by side. In the past, anthropologists have linked this to the evolution of speech but now most of them agree that this explanation is unlikely. In fact, a similar arrangement can be found in sealions and walruses, and its purpose from an evolutionary point of view is that it allows them – and us – to inhale great lungfuls of air through the mouth. Apes, which breathe almost entirely through their nose, cannot do this. The advantage of the lowered larynx for a creature which was evolving to cope with a semi-aquatic lifestyle is that it would have been able to take deeper breaths and therefore stay under water for long periods. This theory is far more likely than the largely discredited idea that speech itself somehow caused a dramatic rearrangement of the larynx.

The nose Another difference between humans and other primates is, literally, under our noses – the shape of our nostrils and the upper lip. Morgan argues that a downward pointing nose, such as ours, is peculiar since it impedes direct entry of air into the lungs. The nostrils of all other primates open directly onto the face, with the exception of the proboscis monkey, which is happy to wade or swim in water. A downward pointing nose reduces the entry of water when swimming, and it is noteworthy that some people can even seal their nostrils by means of the two bumps on the upper lip – a trick they use when diving.

Hair A watery past would also go some way towards explaining the distribution of hair on our bodies. Hair on the head provides insulation from the sun when swimming or wading. The hairs on the chest and face of males are important signals which attract members of the opposite sex. In this regard, it is interesting that women, unlike female apes, have developed breasts as a part of their sexual attraction. In both men and women, these secondary sexual characteristics would have been visible when standing in shallow water. With primates, sexual signals are at the rear end, more in keeping with their more typical position of being on all fours.

Glands A final category of differences between ourselves and the African apes concerns contrasts in the composition of skin glands and our consequent dependence on water and salt. Many animals that have evolved outside tropical forests have developed the ability to drink only rarely, and some obtain all necessary water from their diet alone. Humans produce salty sweat and tears, which is wasteful of water and makes us highly dependent on salt. This would make sense if our ancestors lived in or by the sea, but not if they were savannah-adapted. Human skin also differs from the skin of other primates by having numerous sebaceous glands producing an oily covering. Again, an oily skin is most useful in a watery environment, and this ties in with the unique greasy layer that sometimes covers the bodies of new-born infants (the vernix). Yet again, these characteristics seem to make sense if our ancestors had, at some stage, spent much of their time in water.

So, is it really true that the ancient causes of our unique way of life are still a mystery? Or is it more of a mystery why the ideas of Elaine Morgan and others have often been systematically ignored by professional anthropologists? Why are



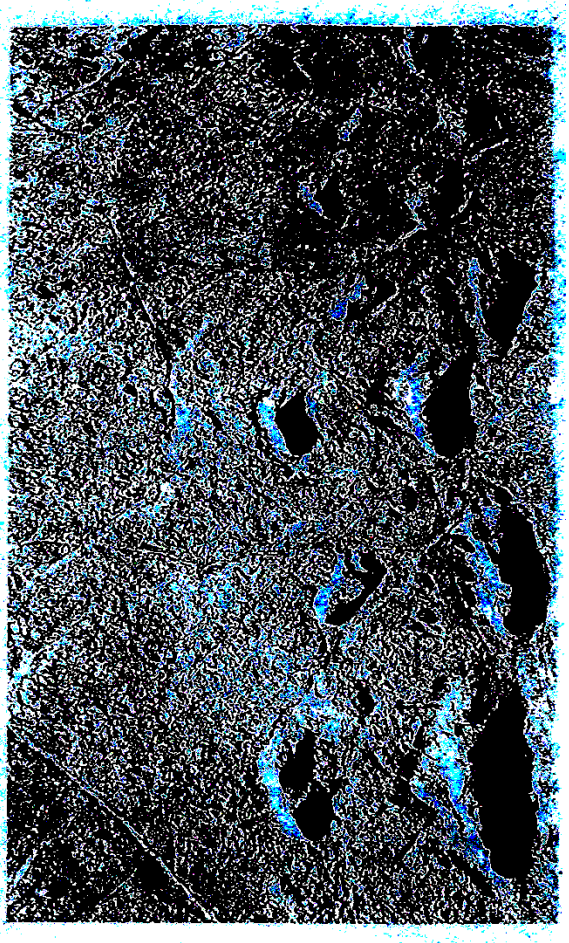
In the swim. Proboscis monkeys (the only other primate with downward pointing noses) often wade or swim across stretches of water.

the possibilities of an amphibious origin not subjected to rational debate, scrutiny and research? These questions are hard to answer without concluding that prejudice and dogma have reigned for far too long. Those with a more open mind might be surprised by the quality of Morgan's latest book, *The Aquatic Ape Hypothesis*, published in 1997, which presents a balanced view of the evidence, extending the outline presented here and providing interesting zoological insights on the possibilities of how and why we became different. It is a challenge for future generations of anthropologists to expose these ideas to research and analysis to see if they survive close scrutiny, rather than continuing the denial of their predecessors and pretending there is no case to answer.

ONLINE There are numerous websites arguing both for and against the aquatic ape theory. Aquatic ape: www.primate.wisc.edu/pin/aquatic.html and AAT the counterarguments: huizen.dds.nl/~seismo/antiaat.html

The writings of Elaine Morgan

The Descent of Woman (ISBN 0285627007, £8.99)
The Aquatic Ape (1982) (ISBN 0285630334, £20)
The Scars of Evolution (ISBN 0285629964, £12.95)
The Descent of the Child (ISBN 0285632124, £14.99)
The Aquatic Ape Hypothesis (ISBN 0285635182, £9.99)
All published by Souvenir Press.



Walk of life. These footprints, which date from around the time of Lucy, confirm that hominids at the time walked erect.