Human Evolution: the water theory.

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The crucial question about human evolution is why humans differ so strikingly from the African apes despite their close genetic relationship. Most Darwinists would agree that such differences are usually attributable to differing environmental pressures; and hence that our ancestors at some stage probably occupied a significantly different habitat from the ancestor of the gorilla and the chimpanzee. For the last half-century it has been generally assumed that it was a much drier habitat.

Alister Hardy's suggestion in 1960 that it might have been a much wetter one was intuitively and almost unanimously rejected. Primates were said to have an innate fear of water which many humans share, and the fossils of early hominids were found far inland, in arid sites on the African plains. Above all . Hardy's ideas were felt to be unnecessary. There was a tacit assumption that the main ape/human differences had been adequately accounted for in terms of a move by some populations of the last common ancestor from the forest to the savanna, and that any details still unexplained were well on the way to being solved.

That was a misconception. Consensus on the reasons for the emergence of the most salient distinguishing features of Homo - such as bipedalism, loss of body hair, subcutaneous fat, and the power of speech - is no nearer today than it was in Darwin's lifetime.

Bipedalism

Humans are so accustomed to erect locomotion that it takes a specialist to appreciate what a bizarre and costly adaptation it was. Owen Lovejoy commented: " "For any quadruped to get upon its hind legs in order to run is an insane thing to do. It's plain ridiculous." As a gait it is far more unstable than quadrupedalism; it takes very much longer to learn, greatly extending the period when the female is burdened with the task of carrying the infant; it is a deplorably ineffective defence posture, exposing the most vulnerable organs of the body to the risk of damage or evisceration; unlike in quadrupeds damage to one leg or foot can be crippling rather than a temporary inconvenience. For bipedalism to become as efficient as it is today required extensive remodelling of the body, affecting the cranium, spine, pelvis, legs, feet, and consequent adaptations in the muscles and other organs. After five million years of these modifications, the spine is still the first organ in our bodies to deteriorate due to wear and tear, and bipedalism is the direct cause of vascular disorders such as varicose veins and haemorrhoids, and of obstetric disorders that throughout most of history have been life-threatening.

In any cost/benefit analysis the advantages of erect locomotion must have been very great to outweigh these drawbacks. The aquatic model suggests that in a flooded habitat, bipedalism may have been resorted to under duress, the significant reward being the ability to breathe air. In terms of the savanna scenario the suggested benefits have been many and varied and no explanation has carried conviction for long. At first bipedalism was depicted as an improved method of covering long distances . But running on two legs is slower than on four, and consumes no less energy. It is true that at walking speeds a modern human consumes less energy than a chimpanzee, but it must have been millions of years before this benefit accrued. In one experiment, a human volunteer constrained by an orthopsis to adopt the bent-knee-bent -hip gait practised by the early hominids used twice as much energy as we do today.

Theories based on possible non-locomotor advantages have regularly been advanced and as regularly discarded. Sentinel behaviour was once a favourite hypothesis since many species stand erect to scan the horizon; however in non-human species this never develops from postural to locomotor bipedalism. A weapon-bearing scenario lost ground when bipedalism was found to have preceded any indication of the use of weapons. A food-carrying theory based on pair-bonding in the interests of the slow-developing young was weakened by the discovery that the slow-down of development post-dated

the advent of bipedalism. A thermoregulatory hypothesis suggesting that erect posture lessened the sun's mid-day heat load on a savanna primate became less credible once it was accepted that bipedalism preceded the emergence of savanna conditions. Picking fruit from low bushes has been observed to induce chimpanzees to stand up on two legs - but not to walk around on them. A study was published in 1994 based on 700 hours of observation of wild chimpanzees in a mosaic habitat. The open savanna was the place in which they were least likely to display bipedal behaviour, whether postural or locomotor. The net result of all the speculations is best reflected in a frank statement by two of the early theorists, Sherwood Washburn and Roger Lewin: "We have to admit being baffled about the origin of upright walking. Probably our thinking is being constrained by preconceived notions."

On the other hand, in recent years gorillas, chimpanzees, Japanese macaques and proboscis and other monkeys have been filmed or photographed exhibiting wading behaviour in the wild, either crossing streams, entering the sea, or wading into pools in search of succulent food items. There is some limited evidence that species most frequently obliged to wade through water, such as proboscis monkeys and bonobos in swamp forest areas, are likelier to stand erect and occasionally walk bipedally on land. It has thus transpired that choosing, or being obliged, to walk through water, is the only circumstance known to conduce to sustained erect bipedal locomotion in wild primates. If it had earlier been possible to make the same claim on respect of walking on the plain, it would have appeared to constitute a powerful piece of circumstantial evidence for the savanna scenario.

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Loss of body hair.

The original assumption concerning human nakedness, that the hominids shed their body hair to avoid overheating, offered no valid reason why they would have been more at risk from overheating than other species sharing the same habitat. It ignored the fact that depilating an animal on the savanna raises its core temperature, rather than lowering it The argument that nakedness must have been a necessary concomitant of sweat-cooling is invalidated by the example of the thick-coated but efficiently sweat-cooling patas monkey. The

progressive shortening of body hairs until they were functionally useless was not an extrapolation of any existing primate trend. Russell Newman convincingly argued that hairlessness must have preceded the move to the savanna; but the feature is no more frequently encountered, and no more easily explained , in a forest habitat than on the open plains. Human skin also differs from that of primates in respect of its greater thickness and elasticity, a

radical transformation of the skin glands, and the way it is connected to a layer of fibrous tissue and a fat layer, described by John Napier as "one of humankind's greatest unsung hallmarks" and found elsewhere only in aquatic species. William Montagna after years of exhaustive research into all aspects of primate skin, reported in 1972 that the problem of human nakedness continued to defy solution.

Cross-species comparisons suggest that the loss of body hair in mammals, especially when combined with a high percentage of adipose tissue, correlates with an aquatic environment as closely as white or seasonally-white pelage correlates with an arctic one. In neither case is the correlation absolute, but in both it is strong and (except in the case of humans) normally unquestioned. It has been shown that in water, in mammals large enough to accommodate a fat layer of the requisite thickness, a naked fat-lined skin provides better insulation than a coat of fur.

Speech

The naïve teleological explanation of why we can speak and apes cannot is that our ancestors must have had a greater need to communicate, perhaps in order to pass on tool-making skills, or to gain insight into the motivation of conspecifics in a society putatively more complex than a chimpanzee's. .These examples do not explain why it was the vocal channel that was selected for enhancement, rather than the body-language mode in which the primate order was already pre-eminent. In demonstrating how to make a flint arrow-head, words are both inadequate and superfluous, and in divining the mental states of others, we are still apt to rely at least as much on our eyes as on their words. ("I could tell by his face that he was lying.")

While speech is unique to humans, the physical modifications that made it possible are not. Humans but not apes can consciously exert control over the volume of air they inhale, how long they hold it, and how quickly they exhale it. The only other mammals known to be capable of this are diving mammals. It was an essential precondition of speech and the lack of it in apes is an entirely sufficient explanation of why they cannot be taught to speak. Another feature found in adult humans but no other land mammal is the descended larynx which has lost all connection with the palate. This arrangement has several disadvantages and it has been persuasively argued that it is a main factor contributing to the phenomenon of SIDS (crib deaths). One possible advantage to an aquatic hominid could have been that it facilitates mouth-breathing and makes it possible to inhale large volumes of air very quickly. The theory that it evolved in order to make speech possible, or was a precondition of speech, has now been invalidated. Professor Tecumseh Fitch of M.I.T. in Boston has examined a little girl of four years old in whom the larynx has never descended, but her speech is indistinguishable from that of any other child of her age.

Fat.

Homo has been described as an obese species; even the slimmest human has the potential for obesity since humans inherit ten times as many adipocytes as would be expected in a mammal of our size. The percentage of fat in a human neonate is greater than that of any other newborn land mammal . It is more than in the harp seal or the sealion, and about six times as much as in a baboon. After birth the baby - despite the high energy requirements of its growing brain – continues to devote roughly 70% of its growth potential to increasing this fat deposit, reaching peak adiposity of around 25% of its body mass by the age of nine months. These facts would not be predicted. either as part of the inheritance from early arboreal ancestors nor as adaptations to a life on the plains of Africa.

One suggested explanation stressed the need of storing energy against possible food shortages, as in hibernating mammals. But the fat in humans is not seasonal, and it is hard to see why natural selection in the hominids would have given priority to food storage in a savanna habitat where speed seems to have been the prime requirement of most other animals whether predators or

prey. The other favourite hypothesis is thermoregulation, stressing the cold of the African nights as other thermoregulatory theories stress the heat of the African days. But in cross-species comparisons, measurements of the arrangements of white adipose tissue, as pointed out by Caroline Pond, "are not consistent with the long established theory that fat is adapted to thermal insulation or mechanical protection in terrestrial mammals." The kind of fat specifically adapted for rapidly raising body temperature is brown fat, and human babies are quite exceptional in having massive deposits of white adipose tissue which is not readily mobilised for heat production.

The attribute of fat to which least attention has been paid is that it provides buoyancy. The amount of fat in diving mammals is liable to vary according to whether they are surface feeders, or deep divers for whom too much buoyancy would be an embarrassment. It is worth noting that a human baby – apart from adapting happily to the water if introduced to it early enough – will float, whereas a chimpanzee or gorilla infant would sink.

Reactions to the water theory.

Nearly forty years after Hardy published his idea,, though Professor Tobias has called for a new paradigm to replace the savanna one and Professor Dennett has publicly queried why the aquatic hypothesis continues to be rejected out of hand, no professional journal has published an objective appraisal of its claims or invited a debate on the subject. The arguments against it have tended to be in general terms, representing it as vague and unparsimonious, and a typical example of the kind of pseudo-scientific fringe theory which is often dreamed up by laymen, tailored to appeal to disaffected minorities . and/or claiming to solve an unrealistically wide swathe of the mysteries of life, the universe, and everything.

In fact it was conceived twice, independently, both times by professional scientists (Professor Max Westenhofer of the University of Berlin and Professor Sir Alister Hardy, D.Sc., F.R.S. of Oxford). It is as void of political implications as the Third Law of Thermodynamics; and it seeks to explain a cluster of anomalous species-specific human physical anomalies hitherto not satisfactorily accounted for. It is not wildly unrealistic to explore the possibility that some common factor may have been involved in all of them.

As the first person after Hardy to publish anything in support of his idea, I hasten to admit that my first contribution was not of a kind likely to inspire confidence. But that was in 1972; the data and the arguments as now presented are of professional standard. The *ad hominem* strictures and the UFO comparisons based on *The Descent of Woman* are quite inappropriate and twenty-seven years out of date.

As for vagueness, the theory makes no claim to be specific about times and places. The onset of an aquatic phase, if it contributed to the separation between ape and human lineages, could not have been later than 5-6mya There is nothing in the fossil record either to confirm or to disprove the possibility of an aquatic or semi-aquatic or flooded-forest habitat for the earliest hominids. Taphonomic bias may or may not be the only reason why hominid fossils are usually found in conjunction with remains of aquatic species, and their skeletal anatomy is no more capable of unambiguously determining how much time they spent in the water than how much time they still spent in the trees. It is frequently pointed out that the different features cited above – naked skin, bipedalism, the fat layer, the respiratory changes – may not all have evolved at the same time. That is quite true. In the case of speech, it seems likely that millions of years may have elapsed between the acquiring of conscious breath control and the use of that asset for purposes of communication. The other features too may have emerged serially – the bipedalism before the nakedness, and so on. But. significantly, it has not proved any easier to produce convincing non-aquatic explanations of any of them merely by postulating that they may have arisen at long intervals and for different reasons.

The charge of lack of parsimony is based on the null hypothesis: that since we know the common ancestors lived in the trees and their human descendants today live on the land, it is obligatory to conclude that they moved from trees to land with no intervening stage. Such rules of thumb can be useful aids to clear thinking, other things being equal. But if too slavishly adhered to they can hamper the imagination and cause speculation to get permanently bogged down in dead-end lines of enquiry.

The savanna scenario is defunct; the mosaic scenario has produced no new insights; the aquatic theory is to many unacceptable. This position has led to

the tentative suggestion that the human anomalies may not be niche-related at all, but merely the result of genetic drift, like the slightly varying pattern of stripes on different species of zebra. This is not comparing like with like. Apes and humans are genetically no further apart than horses and zebras, or populations of the same species of gopher found on opposite sides of the Colorado canyon and indistinguishable to the naked eye. But in humans that slight difference is accompanied by a series of phenetic modifications of a degree and diversity unknown in any other instance of comparable genetic relatedness. That seems to indicate that human ancestors at one time occupied a niche which was not only different from that of the apes, but strikingly different.

Conclusion.

Hardy's aquatic hypothesis, although highly speculative, is based on Darwinian assumptions.. It outlines a scenario which could conceivably account for a number of hitherto unexplained human characteristics. Attempts to depict it as on a par with pseudo-scientific fringe fantasies are misconceived.

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