LECTURE 2

Human Evolution

Major Primate Discoveries

1851 Darwin's Origin of the Species

1856 The Neanderthal Man

1871 The Descent of Man : Darwin.

1891 Pithecanthropus or Java man or Homo Erectus: Eugene Dubois

1912 Piltdown Man : Dawson

1924 Taung Baby, Australopithecus Africanus: Raymond Dart, 2.0m BP

1936 Australopithecus Africanus: Sterkfontein : Robert Broom, 2.5–3.0 BP

1956 Australopithecus (Zinjanthropus) Boisei, Robust Australopithecus, "Nutcracker Man" : Louis Leakey: 1.75 BP

1964 Homo Habilis, Olduvai Gorge Tanzania : Louis Leakey

1972 1470: Homo Habilis : Richard Leakey, 1.9 BP

1977 Laetoli Footprints : Mary Leakey, 3.5–3.7m BP

1978 Australopithecus Afarensis, "Lucy", AL 288 : Don Johanson 3m BP

1984 Turkana Boy, Homo Erectus : Richard Leakey : 1.6m BP

NOTES

8 million years, ago major tectonic events created the African rift valley which separated the habitats of the ancestors of the African apes, the gorillas and the chimpanzees (Panidae), from our own ancestors (Hominidae). To the west of the rift, there was an uprising of mountains and a verdant tropical habitat was created. To the east, the broad savannas of East Africa were created. At the same time, the Himalayan mountains rose higher and the western rim of the Tibetan plateau created a barrier which disturbed the circulation of air and gave rise to the monsoon climate. This lead to the drying of East Africa.

We can postulate that humans shared a common ancestor with the chimpanzees as recently as 8 million years ago. However, there is very little fossil evidence to support this notion, and virtually nothing is know directly of the ancestry of gorillas and chimpanzees. Their habitat, which is the forest, is not conductive to the fossilisation of their remains. (It has been said that, were it not for the living species, we would be forced to conclude, from the evidence of fossils, that the African apes dwindled and became extinct in the late Miocene period ending 6 million years ago). However, we share 98 percent of our genetic makeup with the chimpanzees; and this fact alone points unequivocally to a recent common ancestor.

Genetic research has also shown that humans and chimpanzees are closer to each other than either is to the gorilla. Indeed, it has been proposed that there are really three species of chimpanzee—Pan pansiscus, which is the pygmy or Bonobo chimpanzee, Pan troglodytes, the chimpanzee of the circus, and Homo sapiens, ourselves.

The extent to which the chimpanzees and gorillas have adapted to their modified environments cannot be determined in the absence of a fossil record. However it is reasonable to suppose that some of their behaviour, such as knuckle walking, which both species share, and some of their physiognomy, represents recent adaptations. Their ancestors may have showed a more efficient bipedalism. Our own ancestors evolved in environments which were more stressful that those of the forest apes and which must have placed a premium upon rapid mobility. The Hominidae were forced to range over large areas of savanna to gather their food; and they also needed an enhanced mobility in order to escape from their predators.

Animals which live in stressful environments and which suffer high rates of mortality tend to adopt reproductive strategies which generate large numbers of offspring. By this means, they increase the chances of the survival of their species. Animals in less stressful environments tend to have lower rates of fertility. They tend to nurture their offspring and to establish territorial rights over their habitat. It is notable that the potential fertility of human

beings is much greater than that of the African apes; and this supports the supposition that the environment which created them was a more stressful one than that of the apes. Human beings living is stable and well-protected social environments need to limit their fertility to levels considerably below its biologically-determined potential. The consequence of failing to do so is the distress of overpopulation.

The early Hominidae, who developed in locations which are found throughout the length of East Africa, formed a complex group, and paleontologists continue to debate the classification of its members. The name given to this group is the Australopithecenes or southern apes. Their origins are thought to stretch back in time by 5 million years at least.

Amongst the representatives of the early, less specialised Australopithecenes, is the famous specimen of Australopithecus Afarensis know as Lucy which has been dated to 3 millions years ago. It was discovered by Don Johanson who proposed that Lucy was our direct ancestor. The consensus of recent opinion has moved away from this notion and has tended to put Lucy on a sideline. Lucy, who stood some four and a half feet tall, represents the gracile or lightly-built australopithecenes. She had relatively long arms, which makes some authorities imagine that she lead a semi-arboreal existence. Others propose that she was fully terrestrial. The features of her habitat may have been midway between those of the the forest and the open savanna.

Between 3.3 and 2.4 million years ago, the whole earth cooled and areas of African became drier. The climatic change was the consequence of an ice age. It led to a second adaptation of the Hominidiae who branched in two directions. On the one branch, there were the robust australopithecenes. They had a strong physique and massive jaws which could have to coped with a narrowly specialised vegetarian diet of roots and tubers. Many of the specimens are characterised by a prominent sagittal crest running along the top of the skull which served as an attachment for powerful jaw muscles. An example is provided by the specimen of Australopithecus Boisei, or Zinjanthropus, discovered in 1956 by Louis Leaky which, at the time, was named the Nutcracker man.

On the other branch, which contains our own ancestry, the recourse was to develop a larger brain and to depend upon a wide-ranging and opportunistic diet. This diet comprised meat obtained partly by scavenging the remains of the prey of other carnivores and partly, no doubt, by preying directly on other animals. The large-brained Hominidae, who have been named Homo Habilis, must have lived alongside the robust Australopithecenes, and may have preyed upon them. Homo Habilis was no doubt responsible, in one way or another, for the demise of the robust Australopithecenes who survived until one million years ago.

The development of the brain entails a host of parallel developments which together account for the peculiar nature of humankind. One of the problems which has to be faced by a large-brained animal is the difficulty that the head poses in childbirth. The head has to pass through the pelvic girdle; and the human head can only do so by a process of temporary deformation which entails the compression of the skull which, in the newborn infant, is still unclosed. The smaller and the less mature is the infant, the easier is its birth. The difficulties of childbirth must have favoured the birth of increasingly immature infants; and the concomitant of this was a retardation of the processes of growth and maturation.

The delay of the onset of maturity necessitates enhanced child-care and, at the same time, it provides increased opportunities for education and intellectual development. Such retardation is uncommon amongst higher mammals which tend, in comparison with less developed mammals, to give birth to relatively mature offspring. The tendency to retardation appears to have characterised the development of the Hominidae ever since they separated from the African apes. It is notable that the skull of the human resembles far more closely that of the foetal ape than that of the adult ape.

The beautiful specimen of Australopithecus Africanus know as the Taung baby, which was discovered by Raymond Dart in 1924, is of an infant which lacks the eyebrow ridges and the prognathus face of the adult. Consequently it has an appearance which did much to convince popular opinion of its status as a human ancestor. The experts of the time, who were more mindful of the phenomenon of neoteny, which is the tendency of the adult individuals of a developed species to resemble the juveniles of their progenitors, were less convinced.

The brain is a organ which, in metabolic terms is extremely, expensive to maintain. The human brain consumes some 30 percent of the available energy which is roughly equivalent to the output of a 20-watt light bulb. Amongst other requirements, it necessitates a complex system of temperature regulation which is dependent upon a large supply of blood. Such costs can only be supported if the brain pays is way by enabling compensating reductions to be made in the metabolic demands of other parts of the human body. A clear example is provided by the human stomach. This is much smaller and therefore far less energy-demanding than the stomach of any other mammal of comparable size and energy. In effect, the culinary skills of human beings have allowed their stomachs to atrophy. Since the preparation of our food depends so largely upon cooking, it is of considerable interest to discover at what stage mankind mastered the use of fire.

The successor of Homo Habilis was Homo Erectus. The species is represented by a spectacular specimen know as the Lake Turkana Boy which was

discovered by the team of Richard Leaky, the son of Louis Leakey and the bitter rival of Don Johanson, the discoverer of Lucy. Homo Erectus, it seems, was the first of the Hominidae to emerge from Africa. Specimens have been found across the breadth of Southern Asia including finds from China and Indonesia. Various names have been applied to Homo Erectus including Java man and Pithecanthopus. Both of these names relate to the discoveries in the late nineteenth century of the Belgian anthropologist Eugene Dubois who was an employee, in Java, of the Dutch East-India company.

The name Pithecanthropus, which means ape-man, has fallen into disuse since it is now commonly regarded as misleading and inappropriate. In particular, it seems to disparage the intelligence of Homo Erectus. The only way to assess the intelligence of these ancestors is in terms of their artifacts and other traces of their activities. In many cases, the remains of Homo Erectus have been discovered in association with stone tools; and, in the case of the Chinese specimens from the cave site of Zhoukoudian, there is clear evidence of the use of fire.

Modern Humans are thought to have originated in Africa and to have emerged from there to colonise the rest of the world some time between 150,000 and 100,000 years ago. A few paleontologists persist in thinking that the transition from Homo erectus to Homo sapiens took place on a broad front and that it occurred simultaneously in several places. This is the essence of the multiregional hypotheses which maintains that mankind has remained as a single genetic entity since the advent of Homo erectus. However, the consensus of opinion in now in favour of the notion that all modern humans are descendants of an original African population of archaic Homo sapiens. This is the so called out-of-Africa hypothesis.

The out-of-Africa hypothesis receives strong support from the evidence of molecular genetics. Most genetic studies focus on the DNA of the chromosomes in the nucleus of the cell. However, there is another class of extra-nuclear genetic material which is to be found in structures know as the mitochondria. The mitochondria, which are involved in the metabolic processes of the cell, are inherited exclusively from the mother and not from both parents equally, as is the case with the nuclear DNA. This exta-nuclear DNA has a rapid and regular rate of mutation. By assessing the extent of generic differences in their mitochondrial DNA, we can asses how recently two individuals might have shared a common ancestor. It appears that all moderns humans share a common ancestor who lived between 150,000 and 100,000 years ago. The putative ancestor has acquired the name of the Mitochondrial Eve.

One of the implications of these dates is that modern humans cannot be the lineal descendants of the other branch of Homo sapiens know as the Neanderthal men. These people had a presence which lasted from 230,000 year ago to 32,000

years ago. Their morphology was well established long before the emergence of modern humans; and they survived in Europe in a relatively unchanged form until they were displaced and became extinct.

The seemingly wide variety of the living races of mankind represents minor adaptations which have occurred within a short time span. The assertion that we are all the same people under the skin seems to be confirmed by recent discoveries in both archaeology and genetics.

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