The evolution of man : essays / by G. Elliot Smith.

Unable to display this page

THE EVOLUTION OF MAN

ESSAYS

BY

G. ELLIOT SMITH

M.A., M.D., LITT.D., D.Sc., F.R.C.P., F.R.S.

HUMPHREY MILFORD

OXFORD UNIVERSITY PRESS

London Edinburgh Glasgow Copenhagen

New York Toronto Melbourne Cape Town

Bombay Calcutta Madras Shanghai

1924

PRINTED IN ENGLAND
AT THE OXFORD UNIVERSITY PRESS
BY FREDERICK HALL

PREFACE

THE need for a book giving a consistent and coherent account of the essential factors in the Evolution of Man has been strongly impressed upon me for many years. When in 1912 I delivered the address (at the meeting of the British Association) that forms Chapter I of this book, I began to make more intensive investigations of the Spectral Tarsier, the structure of which provides such crucial evidence for the interpretation of Man's distinctive features. Some of the specimens of *Tarsius*, which my friend Dr. Charles Hose had sent me from Borneo, I handed over to my former assistant Dr. F. Wood Jones with the request that he should examine the reproductive organs; and four years later he published a remarkable book, *Arboreal Man* (1916), in which, starting from my Address of 1912, he amplified the argument and introduced certain modifications of his own. Two years later (1918) he emancipated himself more definitely from any influence my views may previously have had, and issued his remarkable speculations in the form of a brochure called *The Problem of Man's Ancestry*, in which he attempted to exclude all the Apes and Monkeys from Man's ancestry and to derive the Human Family directly from a *Tarsius*-like animal.

I refer to these facts, and the 'Discussion on *Tarsius*' (*Proceedings of the Zoological Society of London*, 1919) which arose out of the events I have mentioned, because they provide the reason why I had to abandon for a time my intention of getting a series of specialists to collaborate in studying the crucial stages in Man's ancestry, which is now being carried out by Dr. H. H.

Woollard and Mr. W. E. Le Gros Clark. When their investigations upon the Tarsier and the Tree Shrew are published, I hope to be in a position to prepare a fuller exposition of the Evolution of Man in the form of a text-book. During the last five years I have attempted to keep alive the interest in these studies by means of courses of lectures in many of the medical schools and colleges of the British Isles, as well as in Paris, Utrecht, and Gröningen; and am now about to develop this teaching still further in the University of California and as Herter Lectures in New York University and Johns Hopkins University.

But, above all, I should express particular gratitude to the Royal College of Surgeons in Ireland, and the Royal College of Physicians of Edinburgh, because the Montgomery Lectureship which I held in the former for three years, and the Morison Lectureship in the latter, provided the chief stimulus that impelled me to develop the views on the importance of the cultivation of vision in the evolution of Man's intellect, which is the essential theme of this book.

I have not yet been able to find the leisure to prepare these lectures for publication. But the demand on the part of students for some guidance in this subject has become so insistent that, pending the preparation of such a text-book as is needed, I have collected three addresses for issue in this little book. They will perhaps elucidate the general principles, without which most of the excellent works dealing with various aspects of the study of Man are apt to be very bewildering to the student.

At the present time there is no book that explains these general principles in the only logical way they

are susceptible of interpretation, namely, as an historical inquiry into the circumstances of Man's origin and descent. It is essential that the student should aim at understanding Man's pedigree : for until some clear conception of the sequence of changes through which the ancestors of the Human Family passed in their progress toward the attainment of Man's estate it is useless to attempt to understand how the distinctively human powers of intelligence emerged.

Hence in the Foreword I have attempted graphically to express the present state of our knowledge concerning the tentative grouping and degrees of kinship of the various genera and species of the Human Family, and in a second diagram to indicate the position of the Human Family in the Order Primates. In the Foreword I have also discussed the concrete example of a much-disputed member of the Order to illustrate the value of such schemata, tentative though they be, in helping us to define the issues, when we have to restore to its proper place in the Order or Family a long-lost member, whose former existence has been made known to us by a few fragmentary fossils. I refer to the status of the newly created genus *Hesperopithecus*, of which nothing is known except two teeth found in Pliocene beds in Nebraska.

For permission to reprint Chapter II I have to thank the Council of the British Academy, in whose *Proceedings* this address, delivered in 1916, was originally published. The reference to the Rhodesian skull in that Chapter is taken from an article that I wrote for *The Atlantic Monthly* (April 1922), the Editor of which has kindly permitted me to reproduce it here. The aim of Chapter II is to give a general survey of

what is known of the extinct members of the Human Family, and to guide the reader amidst the jungle of detailed information provided in the well-known works by Sollas, Osborn, Keith, Smith Woodward, and Boule. Elsewhere (in the article 'Anthropology' in the first of the three supplementary volumes to the *Encyclopaedia Britannica*, 1922) I have surveyed this field in a somewhat different manner and given fuller bibliographical references.

Chapter III is a discourse delivered at the Royal Institution on February 22, 1924, of which a slightly curtailed version was published in *Nature* (March 15). It aims at correlating the two lines of approach to the essential problem of the nature of Man's intellectual pre-eminence, the study of Man's pedigree and its implications discussed in Chapter I, and the nature of the Human Family and its achievements, which are examined in Chapter II.

In attempting to attain conciseness of expression I have used teleological phraseology in many places merely as a matter of convenience, and not from any idea of accepting Teleology.

The reissue of addresses upon essentially the same problem delivered under very different circumstances to such diverse audiences as the British Association, the British Academy, and the Royal Institution provide, makes a certain amount of repetition unavoidable; but a long experience of the ways of students has convinced me that it is not without its uses to repeat and re-emphasize important points in an argument.

G. E. S.

University College,
London,
March 31, 1924.

CONTENTS

LIST OF ILLUSTRATIONS

FOREWORD

MAN'S PEDIGREE

BEFORE we can attempt to discuss the factors that were responsible for the emergence of the distinctive characters of Man, it is essential that we should make some attempt to reconstruct his pedigree, for it is only when the relationships one to the other of the different races of men and the extinct members of the Human Family are defined that one can begin to consider what were the sequence of changes and what the essential conditions of progress within the Family. Moreover, without some definite scheme of the position in time and the relationship one to the other of the members of the Order Primates, to which Man belongs, it is impossible to form any idea as to the nature of the factors that determined the emergence of the qualities of mind and body that are distinctive of the Human Family.

I have therefore attempted to construct two diagrams to give graphic expression to the present state of our knowledge regarding these questions of pedigree. In the first figure the relationships of the Human Family itself have been tentatively plotted out. All of the existing members of the Human Family belong to the species *Homo sapiens*. The most primitive race now living is undoubtedly the Australian, which represents the survival with comparatively slight modifications of perhaps the primitive type of the species. Next in order comes the Negro Race, which is much later and, in some respects, more highly specialized, differing profoundly in many respects from the Australian, but sharing with it the black

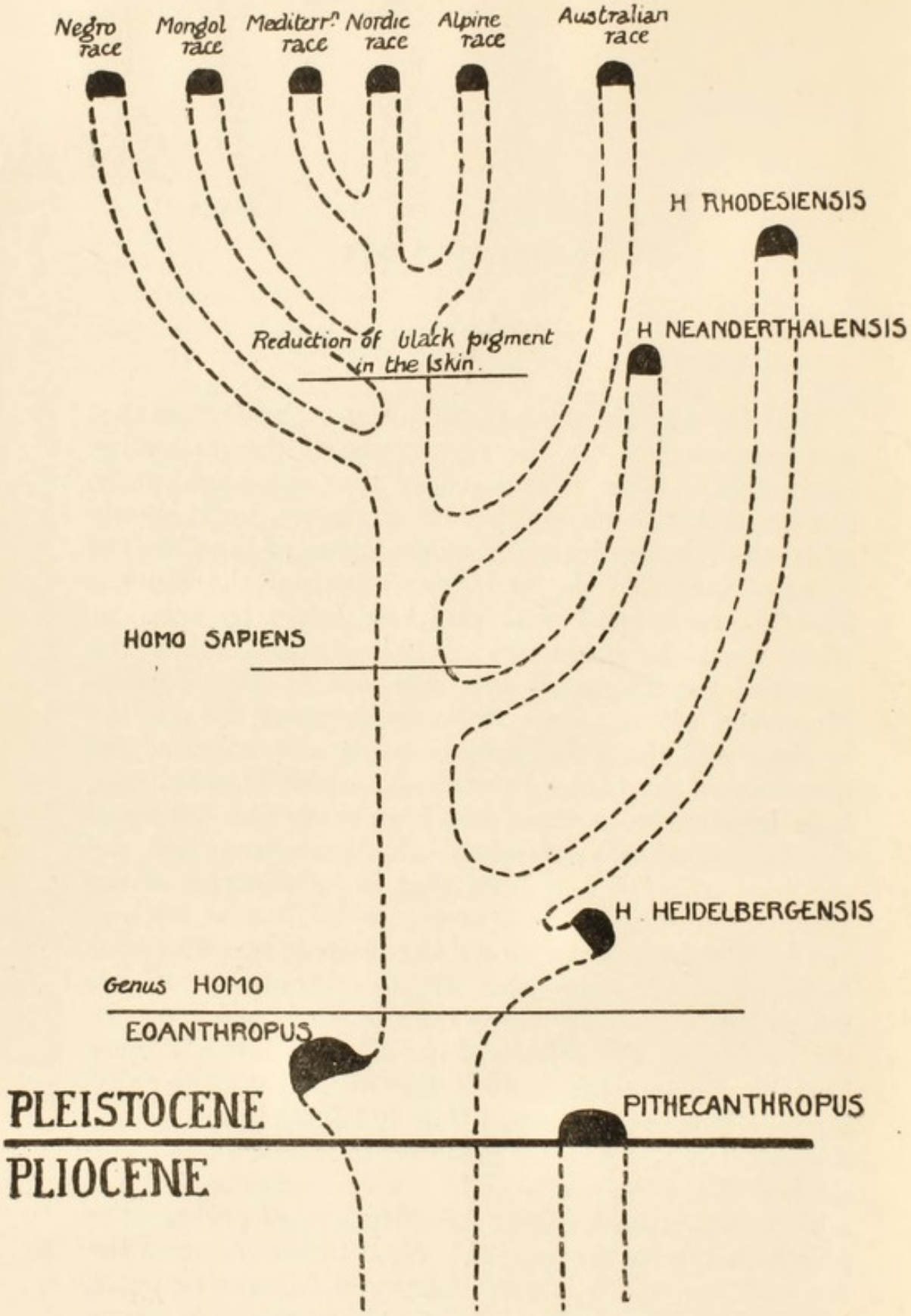

FIGURE 1. A tentative scheme of the relationships of the different genera, species, and races of the Human Family.

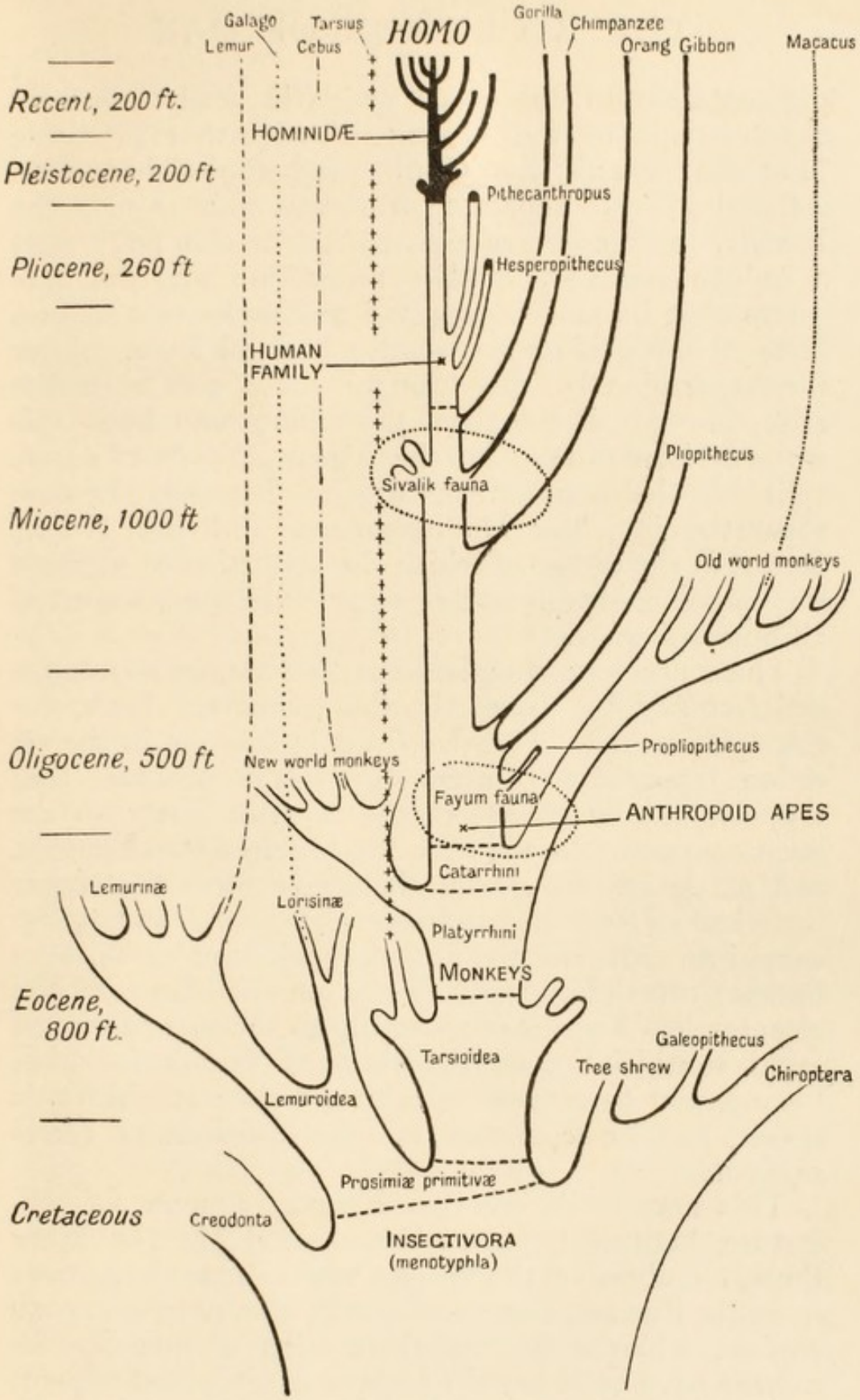

FIGURE 2. A tentative scheme of the relationships of the Order Primates.

pigmentation of the skin, which is really an early characteristic of the Human Family that primitive Man shares with the Gorilla and the Chimpanzee. After the Negro separated from the main stem of the Family, the amount of pigment in the skin underwent a sudden and very marked reduction; and the next group that became segregated and underwent its own distinctive specialization was the Mongol Race. After the separation of the Mongol there was a further reduction of pigment in the skin; and from this white division of mankind the Alpine Race first became split off the main stem, which ultimately became separated into the Mediterranean and the Nordic Races, in the latter of which the reduction of pigment was carried a stage further to produce the blondest of all human beings.

There are certain individuals that cannot at present satisfactorily be placed in this scheme. Such, for example, as the men who lived in Europe in the so-called Upper Palaeolithic Age. It is probable that they should be placed in the scheme partly on the stem common to the Nordic and Mediterranean people, and partly lower down at the place where the Negro branched off from the main stem. Before *Homo sapiens* came into existence the ancestors of Neanderthal Man became divergently specialized: in the diagram the attempt has been made roughly to locate in time the epoch to which the actual remains of Neanderthal Man belong, and to contrast it with the time at which this species became separated from the ancestors of *Homo sapiens*.

This necessarily involves a certain amount of conjecture, because it places Neanderthal Man, or rather those members of the species whose bones have been found in Europe, about midway up the stem of *Homo sapiens*, whereas no actual remains of the species *sapiens* have been found except at a period subsequent to the disappearance of Neanderthal Man in Europe. The fact that these earliest known members of our

species belong definitely to a higher type than the Australian and the Negro points clearly to the conclusion that these representatives belong to a comparatively late phase in the history of the species, and that they were immigrants into Europe when they displaced representatives of the Neanderthal species.

The skull found in Rhodesia in 1921 represents a species of the genus *Homo* which is definitely more primitive than that of Neanderthal Man, although the actual bones which were found in the Broken Hill Mine may be actually very much more recent in time than the bones of the Neanderthal species, which have been recovered in Europe. In the diagram the attempt has been made to represent these facts graphically, and to show how the ancestors of Rhodesian Man may have sprung from the main stem at a much earlier period than Neanderthal Man, but survived till a more recent period than the latter. This would not be surprising when one considers that in Africa there have been preserved until the present time representatives of much more ancient genera of mammals whose European representatives became extinct at a vastly more ancient time than that assigned in the diagram to the origin of Rhodesian Man.

In the diagram I have assigned the origin of Rhodesian Man to a place near to Heidelberg Man: but at present it is impossible to define the issue more closely, because the only fragment of Heidelberg Man that we possess consists of a lower jaw, whereas the lower jaw is missing in the case of Rhodesian Man, of whom we possess the skull and some of the limb bones. But the jaw from Heidelberg fits the Rhodesian skull so closely that I have ventured to put the origins of the two species in close apposition, and as we know the date of Heidelberg Man it suggests the time at which the Rhodesian species separated from the main stem of mankind. Heidelberg Man occupies a position at the base of the genus *Homo*. In fact, future discovery may possibly compel us to exclude the Heidelberg

remains from that genus, as Bonarelli suggested some years ago: but at present the available evidence favours the inclusion of these remains definitely within the genus *Homo*, and compels us to locate it right at the base of the stem. Apart from the genus *Homo* two other genera of the Human Family are known from the base of the Pleistocene. These are the Piltdown skull representing the genus *Eoanthropus*, which is very closely related to the main stream which eventually emerged as the genus *Homo*, and the earlier and more primitive, but also more highly specialized, Ape-Man of Java, *Pithecanthropus*, the date of which was formerly assigned to the Upper Pliocene, but is now generally believed to belong to the very commencement of the Pleistocene. So that, although we have no fossil bones generally admitted to be human that can be referred to a period earlier than the Pleistocene, the marked contrast between *Pithecanthropus* and *Eoanthropus*, a separation which is not only structural but geographical, makes it quite certain that Man must have existed in the Pliocene, and possibly earlier still.

The consideration of this question brings us to the discussion of the remarkable tooth found in Nebraska in 1922, which is referred to the Lower Pliocene Period. This tooth, for the reception of which Professor Henry Fairfield Osborn has created a new genus, *Hesperopithecus*, is regarded by the American palaeontologists as a representative of a hitherto unknown Primate, but so far as its structure is concerned the tooth presents a closer approximation to that of *Pithecanthropus* than to the Anthropoid; and I regard the balance of probability as favouring its identification as a primitive member of the Human Family rather than a new genus of Anthropoid Apes.

The discovery of a single tooth may seem rather a frail and hazardous basis upon which to build such tremendous and unexpected conclusions; and many, if not most, scientists have grave doubts as to the

justification for such an interpretation. But the specimen was discovered by a geologist of wide experience, and its horizon has been satisfactorily established. Moreover, the determination of its affinities and its identification as one of the higher Primates closely akin to the Ape-Man of Java, *Pithecanthropus*, has been made by the most competent authorities on the specific characters of fossilized mammalian teeth,

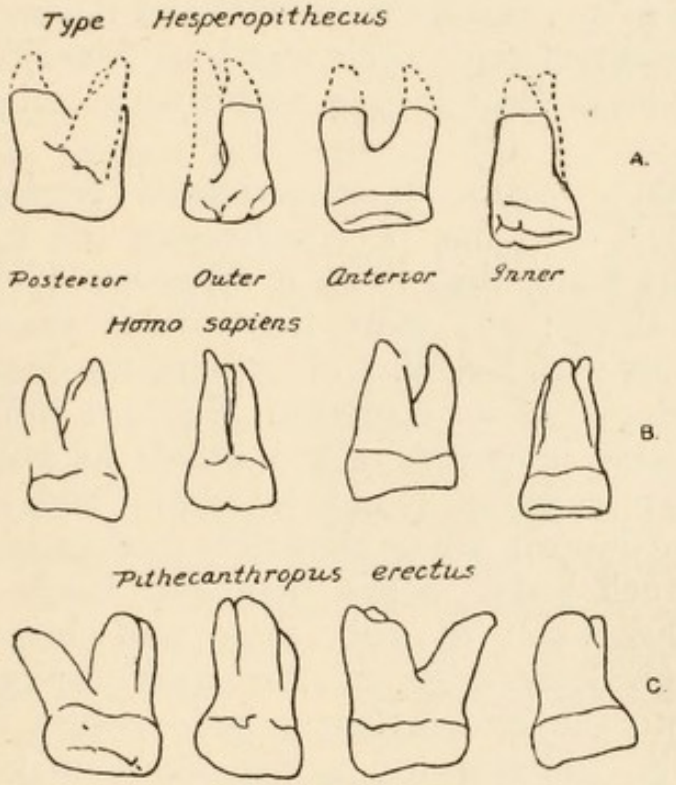

FIGURE 3. The Nebraska Tooth compared with those of *Homo sapiens* and *Pithecanthropus*.
(After Gregory.)

Professor Osborn and Drs. Matthew and Gregory, who not only have had a wider experience of such material than any other palaeontologists, but also are men of exact knowledge and sound judgement. I think the balance of probability is in favour of the view that the tooth found in the Pliocene beds of Nebraska is really that of a primitive member of the Human Family. *Hesperopithecus* is most nearly akin

to *Pithecanthropus*; and the fact that the latter was found in what, at the end of the Pliocene Period, was the south-eastern corner of Asia, and the former in North America, which was connected with Eastern Asia by a land bridge enjoying a genial climate, minimizes the difficulty of explaining an identification that at first sight seems to be wholly incredible. For the American palaeontologists have demonstrated that, at the time when the original owner of the Nebraska tooth was living, certain Antelopes and Rhinoceroses of Asiatic affinities made their way into America, and for this purpose a land bridge and a warm climate were essential.

For many years an experienced geologist, Mr. Harold J. Cook, has been collecting the remains of the extinct fauna that lived in Western Nebraska in Pliocene times; and more than fifteen years ago he collaborated with Dr. W. D. Matthew, the distinguished palaeontologist of the American Museum, and compiled a remarkable inventory of the wonderful collection of mammalian remains found by them and others in a Pliocene deposit, which they then distinguished as the Snake Creek beds. Since then Mr. Cook has continued the work of collecting, and has acquired a thorough knowledge of the stratigraphy and an insight into the circumstances under which fossils are discovered. Hence he is not likely to have been deceived as to the horizon in which a particular fragment was found. When, on February 25, 1922, he wrote to Professor Osborn, President of the American Museum in New York, to say that he had obtained from the Upper, or Hipparion phase, of the Snake Creek beds 'a molar tooth that very closely approaches the human type', the accuracy and reliability of Mr. Cook's identification of its geological age and provenance were not questioned. For he explained that 'it was found associated with the other typical fossils of the Snake Creek, and is mineralized in the same fashion as they are'. His claim that 'whatever

it is, it is certainly a contemporary fossil of the Upper Snake Creek horizon, and agrees far more closely with the anthropoid-human molar than that of any other mammal known', has been fully confirmed by the investigations of Professor Osborn and Drs. Matthew and Gregory, who have an unrivalled experience of the scientific study of mammalian fossilized teeth.

Dr. Gregory arrived at the important conclusion that 'on the whole we think its nearest resemblances are with *Pithecanthropus*, and with men rather than with apes'. This conclusion was based upon the study of the features of the tooth ; and the claim that it was human was further corroborated by the degree and kind of 'wear', which was unlike that found in any ape, but of the same nature as occurs in the different genera of the Human Family, and especially *Pithecanthropus*.

Elsewhere in this book, I shall have occasion to criticize Dr. Pilgrim's opinion that the form of the teeth of a long extinct Miocene Ape (*Sivapithecus*) found in India is adequate evidence for its inclusion in the Human Family. The ancestors of the Hominidae no doubt exhibited such human traits of teeth and body in the Miocene probably long before they acquired those distinctive characters of brain and mind that alone entitle their descendants to human rank. Hence, even if the resemblances of the teeth of *Sivapithecus* to those of Man were closer than they are, this would not justify the inclusion of the former in the Human Family. It would merely suggest its kinship to the ancestors of the Family.

The case of *Hesperopithecus* is somewhat different. It is much more recent, Pliocene instead of Miocene; and therefore much more definitely within the range of Man's possible existence. The tooth presents much closer affinities with those of the most primitive members of the Human Family. But the most important consideration of all, when the extreme susceptibility of the Anthropoid Apes to a cold climate and their depen-

dence upon forest conditions is considered,[1] is that a primitive human being is much more likely than an ape to have crossed to America by the northern Pacific bridge.

The full significance and character of this astounding discovery will become more intelligible if we try to put the newly discovered creature into its place in the Human Family, as I have attempted to do in Figure 2.

To the two extinct genera, *Pithecanthropus* and *Eoanthropus*, it is now proposed to add a third, *Hesperopithecus*, the Ape-Man of the Western World. This long-lost cousin is the most surprising member of the Family. For, if the suggestion of his right to human rank should be justified, not only is he the only human being so far discovered who lived in the remotely distant time of the Pliocene Period, but he or his forbears had already wandered so far from the original home of the Family (in Asia or Africa) as North America.

In the second diagram, which is an attempt to represent the position of the Human Family in the Order Primates, this tentative suggestion with reference to *Hesperopithecus* has been graphically expressed. It must, of course, be understood that with the scanty evidence at our disposal the idea expressed in this diagram is little more than conjecture. But in helping us to understand the nature of the problem at issue it is much more useful to make a concrete proposal that can be criticized and attacked, than merely to play for safety and repress the whole issue as something dangerous that ought to be avoided.

The first diagram, representing the hypothetical family tree of the Human Family, is so arranged as to represent the members that have become specialized as branching away from the main stream, which leads to the highest type, and to give graphic expression to the conception that the attainment of the supreme position is not inconsistent with the

[1] Henry Fairfield Osborn, *Nature*, August 26, 1922, p. 281.

retention of primitive characters. Those types which have diverged from the main current have all of them become more or less specialized in structure and lost one or other of their primitive characters. For example, the Negro has lost the primitive characters of the hair which the Nordic Race has preserved.

I should make some explanation of my reasons for putting the Nordic Race at the apex of the main stem. In doing so I am not subscribing to those extravagant claims, so popular at the present moment, in virtue of which blondness is regarded as a character which marks this race as supermen. All that is intended in this scheme is to suggest that those bleaching tendencies, of which several distinct phases are found within the Human Family, are carried furthest in the Nordic Race, which also presents a number of primitive traits that other of the human races have lost. On the other hand, the Mediterranean Race has preserved a number of other primitive characteristics, and especially primitive features of brain, which differentiate it from the Nordic Race. But I have separated it from the main stem mainly on the ground of pigmentation.

Another point I have endeavoured to express by putting upon the right-hand side those branches of the Family in which there is a great development of the eyebrow ridges or, at any rate, a definite tendency in that direction: whereas I have placed upon the left-hand side of the main stem those races which are distinguished either by an absence or a poor development of the eyebrow ridges. This emphasizes the fact that the development of the eyebrow ridge is not of much importance as an index of race. It is neither an exclusively primitive character nor a distinction of a higher race. It is found developed in *Pithecanthropus*, Rhodesian Man, Neanderthal Man, and in the Australian and Alpine Races, whereas a defective development of the ridge is characteristic of *Eoanthropus*, the Negro, the Mongol, and the Mediterranean Races, while the Nordic Race occupies a position between the two extremes.

The second diagram indicates the position of the Human Family in the Primate phylum, but is also intended to represent graphically the position and relations of the whole Order of Primates. Long before the beginning of the Tertiary Period a group of Insectivora had become separated from other mammals, from which they are distinguished by the preservation of features of an extremely primitive character very closely akin to those of the lowlier Marsupials of Australia and America. These creatures, represented to-day by the Jumping Shrews of Africa and the Tree Shrews of the Malay Archipelago, are known as the Menotyphla, and they are closely akin to the fossil group of Creodonta, from which the Carnivora were derived. On the other side they are closely related to the primitive flying mammal known as *Galeopithecus* and the Chiroptera, consisting of the Bats and the Flying Foxes.

The adoption by some of these Shrews of the habit of living in trees brought about profound changes in the relative proportions of the brain. The sense of vision became enhanced in importance, and the sense of smell correspondingly reduced: but in addition the senses of touch and hearing, and the power of agility of movement, were considerably enhanced. In one of these groups the importance of vision became still further increased, and the result of this was to bring into existence the Order Primates. This happened in the Upper Cretaceous, at the phase represented in the diagram by the Prosimiae primitivae.

Before the beginning of the Tertiary Period these primitive Lemuroids had split into two branches, the Lemuroidea and the Tarsioidea, the fundamental distinction between the two being a further enhancement of the importance of vision, which, in the Tarsioidea, became the dominant sense, definitely usurping the position occupied by smell as the chief guide to the animal, which is found not only in the primitive mammals, but is still retained even in the Lemurs. Of

the Tarsioidea one member has survived to the present day with comparatively slight change from the very beginning of the Eocene Period as the Spectral Tarsier which is still found in Borneo, Java, and the Philippines.

Before the close of the Eocene Period one of the Tarsioidea acquired the power of stereoscopic vision and became transformed into a primitive monkey with a very considerable increase in the size of the brain and an enormous enhancement of the power of skilled movement and of intelligence. At this stage in the evolution of the Primates, which occurred somewhere in the neighbourhood of Central America, representatives of all three branches, Lemurs, Tarsioids, and Monkeys, wandered across from the New World to the Old, across bridges which stretched from North America to Africa and Europe, and also from North America to Eastern Asia.

The Monkeys which wandered across the Atlantic seem to have undergone a profound change during their journey, for, at the beginning of the Oligocene, we find in the Egyptian Fayum representatives of two new types of monkeys, the tailed Catarrhines of the Old World, and the Anthropoid Apes, represented by a diminutive creature known as *Propliopithecus*. These Anthropoids wandered far and wide in Africa, Europe, and Asia, increasing in size as their power of adaptation increased, and in the middle of the Miocene Period in Northern India a great number of new varieties had come into existence, including the ancestors not only of the Giant Apes, but also of the Human Family.

The object of this diagram, like the previous one, is to indicate the fact that all of these Lemurs, Monkeys, and Apes, which have become specialized in one way or another, should be regarded as having departed from the main stream of development that leads straight up to Man, and by doing so lost something of the primitive structure and plasticity that were necessary for the attainment of the high powers of adaptation which

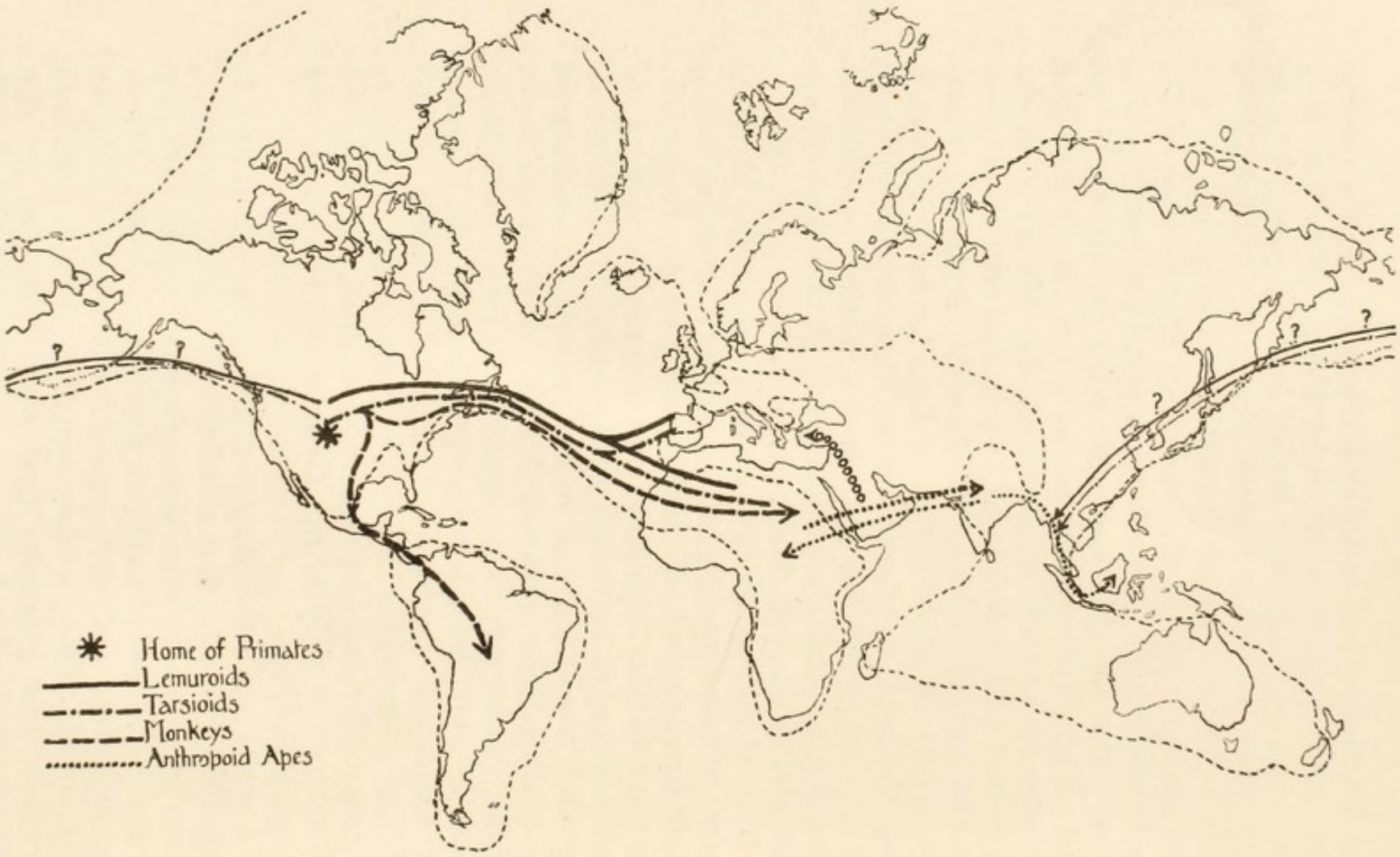

FIGURE 4. Map to illustrate the wanderings of the Primates. The Eocene land bridges are shown in accordance with information supplied by Professor D. M. S. Watson, F.R.S.

represent one of the most distinctive characteristics of the Human Family.

In the map some idea of the extensive wanderings of the Primates is suggested. Before the beginning of the Tertiary Period members of the Lemuroidea and Tarsioidea were living in North America. In the Eocene Period they wandered across the land bridge to south-western Europe and Africa, but not before some of the latter group had given birth to Platyrrhine monkeys, which found an asylum in South America, where they have persisted until the present day. Of the three groups that wandered across the Atlantic bridge to the Old World—Lemurs, Tarsioids, and Monkeys—the latter underwent the most profound change, and became split up into two divisions—the tailed Catarrhines and the tailless Anthropoid Apes, the diminutive representatives of which have been recovered from the Lower Oligocene beds of the Egyptian Fayum.

Some of the migrations indicated on the map occurred after the Eocene Period when new land connexions were established. The wanderings of Monkeys into South America and from Africa to India fall into this category.

CHAPTER I

THE EVOLUTION OF MAN [1]

The Scope of Evolution.

In an address delivered at the University of Manchester some years ago Lord Morley [2] referred to 'evolution' as 'the most overworked word in all the language of the day'; nevertheless, he was constrained to admit that, even when discussing such a theme as history and modern politics, 'we cannot do without it'. But to anthropologists concerned with the problems of Man's nature and the gradual emergence of human structure, customs, and institutions, the facts of evolution form the very fabric the threads of which they are endeavouring to disentangle; and in such studies ideas of evolution find more obvious expression than most of us can detect in modern politics. In such circumstances there is a risk of 'overworking' not only the word 'evolution' but also the application of the idea of evolution to the material of their investigations.

In 1911 Dr. W. H. R. Rivers uttered a protest against the tendency, to which anthropologists of the present generation [3] seem to be peculiarly prone, to read so-called evolutionary ideas into many events in

[1] Address delivered at Dundee to the Anthropological Section of the British Association for the Advancement of Science in September, 1912. (*Nature*, London, September 26, 1912; and *Annual Report of the Smithsonian Institution*, 1912.)

[2] *History and Politics*, 1912.

[3] Presidential Address to the Anthropological Section of the British Association.

Man's history and the spread of his knowledge and culture, in reference to which careful investigation reveals no indubitable trace of any such influences having been at work.

I need offer no apology for repeating and emphasizing some of the points brought forward in Dr. Rivers's deeply instructive address ; for his lucid and convincing account of the circumstances that compelled him to change his attitude toward the main problems of the history of human society in Melanesia first brought home to me the fact, which I had not clearly realized until then, that in my own experience, working in a very different domain of anthropology on the opposite side of the world, I had passed through phases precisely analogous to those described so graphically by Dr. Rivers. He told us that in his first attempts to trace out 'the evolution of custom and institution' he started from the assumption that 'where similarities are found in different parts of the world they are due to independent origin and development, which in turn is ascribed to the fundamental similarity of the workings of the human mind all over the world. So that, given similar conditions, similar customs and institutions will come into existence and develop on the same lines'. But as he became more familiar with the materials of his research he found that such an attitude would not provide an adequate explanation of the facts, and he was forced to confess that he 'had ignored considerations arising from racial mixture and the blending of cultures'.

I recall these statements, not merely for the purpose of emphasizing the far-reaching significance of an address that is certain to be looked back upon as one of the most distinctive and influential utterances in the recent history of anthropology, nor yet with the object of recording how, in the course of my investigations upon the history of the people in the Nile Valley.[1] I also started out to search for evidences of evolution,

[1] *The Ancient Egyptians,* Harper Brothers, 1911.

but gradually came to realize that the facts of racial admixture and the blending of cultures were far more obtrusive and significant. My intention is rather to investigate the domain of anthropology in which unequivocal evolutionary factors have played a definite role; I refer to the study of Man's pedigree and the forces that determined the precise line of development his ancestors pursued and ultimately fashioned Man himself.

I suppose it is inevitable in these days that one trained in biological ways of thought should approach the problems of anthropology with the idea of independent development as his guiding principle. But the conviction must be reached, sooner or later, by every one who conscientiously, and with an open mind, seeks to answer most of the questions relating to Man's history and achievements—certainly the chapters in that history which come within the scope of the last sixty centuries—that evolution yields a surprisingly small contribution to the solution of the difficulties. Most of the factors that call for investigation concerning the history of Man and his works are unquestionably the direct effects of migrations and the intermingling of races and cultures.

But I would not have you misunderstand my meaning. Nothing could be further from my intention than to question the reality of evolution, as understood by Charles Darwin, and the tremendous influence it is still exerting upon mankind. In respect of certain perils Man may, perhaps, have protected himself from 'the general operation of that process of natural selection and survival of the fittest which up to his appearance had been the law of the living world' (Sir Ray Lankester); but it has been demonstrated quite definitely that Man, in virtue of these very heightened powers, which, to some observers, seem to have secured him an immunity from what Sir Ray Lankester calls 'nature's inexorable discipline of death', is constantly exposing himself to new conditions that favour

the operations of natural selection, as well as other forms of 'selection' to which his increased powers of intelligent choice and his subjection to the influences of fashion and tradition expose him.

It is not, however, with such contentious matters as the precise mode of operation of evolution at the present day that I propose to deal; nor yet with the discussion of when and how the races of mankind became specialized and differentiated the one from the other. It is the much older story of the origin of Man himself, and the first glimmerings of human characteristics amidst even the remotest of his ancestors, to which I invite you to give some consideration.

In their book, *Evolution*,[1] Professors J. A. Thomson and P. Geddes make the statement that 'the uncertainties as to man's pedigree and antiquity are still great, and it is undeniably difficult to discover the factors in his emergence and ascent'. There is undoubtedly the widest divergence of opinion as to the precise pedigree; nevertheless, there now seems to be ample evidence available to justify a tentative sketch of the genealogy of Man and to display the essential facts of his pedigree as far back as Eocene times—a matter of a million years or so—with at least as much certainty of detail and completeness as in the case of any other recent mammal. If all the factors in his emergence are not yet known, there is one unquestionable, tangible factor that we can seize hold of and examine—the steady and uniform development of the brain along a well-defined course throughout the Primates right up to Man—which must give us the fundamental reason for 'Man's emergence and ascent', whatever other factors may contribute toward that consummation.

What I propose to attempt is to put into serial order those vertebrates which we have reason to believe are the nearest relatives to Man's ancestors now available for examination and to determine what outstanding changes in the structure of the cerebral hemispheres

[1] 1912, p. 102

have taken place at each upward step that may help to explain the gradual acquirement of the distinctive intellectual powers, which, by immeasurably increasing the power of adaptation to varying circumstances and in all probability modifying the process of sexual selection, have made Man what he is at present.

The links in the chain of our ancestry supplied by palaeontology are few and of doubtful value if considered apart from the illumination of Comparative Anatomy.

Psychologists have formulated certain definite phases through which the evolution of intelligence must have passed in the process of the gradual building up of the structure of the mind. The brain in a sense is the incarnation of this mental structure. It therefore seemed to me that it would be instructive to employ the facts of the evolution of the brain as the cement to unite into one comprehensive story the accumulations of knowledge concerning the essential facts of Man's pedigree. We can thus combine the factors that have contributed to his emergence, which have been gathered by workers in such diverse departments of knowledge as zoology and comparative anatomy, geology and palaeontology, and physiology and psychology.

For it was the evolution of the brain and the ability to profit by experience, which such perfecting of the cerebral mechanism made possible, that led to the emergence of mammals, as I attempted to demonstrate in opening the discussion on the origin of mammals at the Portsmouth meeting of the British Association ;[1] and from the Mammalia, by a continuation of this process of building up the cerebral cortex, or, if you prefer it, the structure of the mind, was eventually formed the living creature that has attained the most extensive powers of discrimination, skill, and understanding.

[1] Discussion on the 'Origin of Mammals' at the meetings of Section D (*Brit. Assoc. Reports*, 1911, p. 424).

The study of the brain and mind, therefore, should have been the first care of the investigator of human origins. Charles Darwin, with his usual perspicuity, fully realized this ; but since his time the role of intelligence and its instruments has been almost wholly ignored in these discussions, or, when invoked at all, wholly irrelevant aspects of the problem have usually been considered. There can be no doubt that this neglect of the evidence revealed in the comparative anatomy of the brain is in large measure due to the discredit cast upon this branch of knowledge by the singularly futile pretensions of some of the foremost anatomists who opposed Darwin's views in the discussions which took place at the meetings of the British Association and elsewhere half a century ago. Many of you no doubt are familiar with Charles Kingsley's delightful ridicule of these learned discussions in the pages of *Water Babies*. The controversy excited by Sir Richard Owen's contention that the great distinctive feature of the human brain was the possession of a structure that used to be called the *hippocampus minor* was not unjustly the mark of his scathing satire.

> 'The professor had even got up at the British Association and declared that apes had hippopotamus majors in their brains, just as men have. Which was a shocking thing to say ; for, if it were so, what would become of the faith, hope, and charity of immortal millions ? You may think that there are other more important differences between you and an ape, such as being able to speak, and make machines, and know right from wrong, and say your prayers, and other little matters of that kind ; but that is only a child's fancy, my dear. Nothing is to be depended upon but the great hippopotamus test. If you have a hippopotamus major in your brain, you are no ape, though you had four hands, no feet, and were more apeish than the apes of all aperies. Always remember that the one true, certain, final,

and all-important difference between you and an ape is that you have a hippopotamus major in your brain and it has none. If a hippopotamus was discovered in an ape's brain, why, it would not be one, you know, but something else.'

The measure of the futility of the contention thus held up to scorn can be more justly realized now; for some years ago I discovered that the feature referred to in Kingsley's burlesque phrase, 'hippopotamus major', which Owen claimed to be distinctive of the human brain, and Huxley maintained was present also in apes, is quite a primitive characteristic, and the common property of the Mammalia in general. Moreover, the claim made by Owen had not even the merit of novelty: for the French anatomist Serres had disposed of it thirty years before Owen revived it in 1857.

This illustration of the nature of the discussions which distracted attention from the real problems, although the most notorious one, is unfortunately characteristic of the state of affairs that prevailed when prejudice blinded men's eyes to the obvious facts that were calling so urgently for calm investigation.

Man's Pedigree.

Any one who is familiar with the anatomy of Man and the Apes must admit that no hypothesis other than that of close kinship affords a reasonable or credible explanation of the extraordinarily exact identity of structure that obtains in most parts of the bodies of Man and Gorilla. To deny the validity of this evidence of near kinship is tantamount to a confession of the utter uselessness of the facts of comparative anatomy as indications of genetic relationships, and a reversion to the obscurantism of the Dark Ages of biology. But if any one still harbours an honest doubt in the face of this overwhelming testimony from mere structure, the reactions of the blood will confirm

the teaching of anatomy; and the susceptibility of the Anthropoid Apes to the infection of human diseases, from which other Apes and mammals in general are immune, should complete and clinch the proof for all who are willing to be convinced.

Nor can any one who, with an open mind, applies similar tests to the Gibbon refuse to admit that it is a true, if very primitive, Anthropoid Ape, nearly related to the common ancestor of Man, the Gorilla, and the Chimpanzee. Moreover, its structure reveals indubitable evidence of its derivation from some primitive Old World, or Catarrhine, monkey akin to the ancestor of the Langur, the Sacred Monkey of India. It is equally certain that the Catarrhine apes were derived from some primitive Platyrrhine ape; the other, less modified, descendants of which we recognize in the South American Monkeys of the present day; and that the common ancestor of all these Primates was a Lemuroid nearly akin to the curious little Spectral Tarsier, which still haunts the forests of Borneo, Java, and the neighbouring islands, and awakens in the minds of the peoples of those lands a superstitious dread—a sort of instinctive horror at the sight of the ghost-like representative of their remote Primate ancestor!

This much of Man's pedigree will, I think, be admitted by the great majority of zoologists who are familiar with the facts; but I believe we can push the line of ancestry still further back, beyond the most primitive Primate into Haeckel's suborder Menotyphla, which most zoologists regard as constituting two families of Insectivora. I need not stop to give the evidence for this opinion, for most of the data and arguments in support of it have been summarized most excellently by Dr. W. K. Gregory.[1]

This group includes the Oriental Tree Shrews and the African Jumping Shrews. The latter (Macrosceli-

[1] 'The Orders of Mammals', *Bull. Amer. Mus. Nat. Hist.*, vol. xxvii, 1910, p. 321.

didae), living in the original South African home of the Mammalia, present extraordinarily primitive features linking them by close bonds of affinity to the Marsupials. The Tree Shrews (Tupaiidae), however, which range from India to Java, while presenting very definite evidence of kinship to their humble African cousins, also display in the structure of their bodies positive evidence of relationship to the stem of the aristocratic Primate phylum.

Quite apart from the striking similarities produced by identical habits and habitats, there are many structural identities in the Tree Shrews and Lemuroids, not directly associated with such habits, which can be interpreted only as evidences of affinity.

The Neopallium and its Relation to the Ability of Learning by Experience.

Having now sketched the broad lines of Man's pedigree right back to the most primitive mammals, let us next consider the outstanding factors that determined the course of his ancestor's progressive evolution.

The class Mammalia, to which Man belongs, is distinguished in structure from all other vertebrates mainly by the high development of the brain, and, as regards the behaviour of its members, by the fact that they are able in immeasurably greater degree than all other animals, not excluding even birds, to profit by individual experience. The behaviour of most, or perhaps it would be more correct to say all, animals, however complex and nicely adapted to their circumstances it may seem, is essentially instinctive; and the main problem we have to solve, in attempting to explain the emergence of the distinctive attributes of the creature that in greater measure than any other has succeeded in subordinating its instincts to reason, is the means by which it has become possible for the

effects of individual experience to be brought to bear upon conduct.

The ability to learn by experience necessarily implies the development, somewhere in the brain, of a something which can act not only as a receptive organ for impressions of the senses and a means for securing that their influence will find expression in modifying behaviour, but also serve in a sense as a recording apparatus for storing such impressions, so that they may be revived in memory at some future time in association with other impressions received simultaneously, the state of consciousness they evoked, and the response they called forth.

Such an organ of associative memory is actually found in the brain of mammals. It is the cortical area for the exact designation of which I invented the term 'neopallium'.[1] Into it pathways lead from all the sense organs; and each of its territories which receives a definite kind of stimulus, visual, acoustic, tactile, or any other, is linked by the most intimate bonds with all the others. In spite of the disapproval of the psychologists, we can indeed regard the neopallium as fulfilling all the conditions of the *sensorium commune*, which Aristotle and many generations of philosophers have sought during more than twenty centuries; for it is unquestionably a 'unitary organ the physical processes of which might be regarded as corresponding to the unity of consciousness' (Wm. MacDougall).

Nothing that happens in this area in the course of its enormous expansion and differentiation in the higher mammals materially affects this fundamental purpose of the neopallium, which continues to remain a unifying organ that acts as a whole, though each part is favourably placed to receive and transmit the rest of its special quota to the sum total of what we may call the materials of conscious life.

[1] 'The Natural Subdivision of the Cerebral Hemisphere', *Journ. Anat. and Phys.*, vol. xxxv, 1901, p. 431; Arris and Gale Lectures on the Evolution of the Brain, *Lancet*, January 15, 1910, p. 153.

The power of discrimination which resides, so to speak, in this neopallium, and is fed by the continual stream of sensory impressions pouring into it and awakening memories of past experiences, can express itself directly in the behaviour of the animal through the intermediation of a part of the neopallium itself, the so-called motor area. That area is not only kept in intimate relation with the muscles, tendons, and skin by sensory impressions, but controls the voluntary responses of the muscles of the opposite side of the body.

The Differentiation of Mammals and the Effects of Specialization.

The possession of this higher type of brain enormously widened the scope for the conscious and intelligent adaptation of the animal to varying surroundings. In the exercise of this newly acquired power of discrimination and ability to learn from individual experience, and so appreciate the possibilities of fresh sources of food supply and new modes of life, the way was opened for an infinite series of adaptations to varying environments, entailing structural modifications in which the enhanced plasticity of the new type of animal found expression.

Nature tried innumerable experiments with the new type of brain almost as soon as the humble Therapsid-[1] like mammal felt the impetus of its new-found power of adaptation. In turn the Prototherian and Metatherian types of brain were tried before the more adaptable scheme of the Eutherian brain was evolved.

The new breed of intelligent creatures rapidly spread throughout the whole world and exploited every mode of livelihood. The power of adaptation to the particular kind of life each group chose to pursue soon came to be expressed in a bewildering variety of

[1] The primitive reptilian ancestor of the mammals, whose fossilized remains are found in South Africa.

specializations in structure, some for living on the earth or burrowing in it, others for living in trees or even for flight; others, again, for an aquatic existence. Some mammals became fleet of foot and developed limbs specially adapted to enhance their powers of rapid movement. They attained an early pre-eminence and were able to grow to large dimensions in the slow-moving world at the dawn of the Age of Mammals. Others developed limbs specially adapted for swift attack and habits of stealth successfully to prey upon their defenceless relatives.

Most of these groups attained the immediate success that often follows upon early specialization, but they also paid the inevitable penalty. They became definitely committed to one particular kind of life, and in so doing they sacrificed their primitive simplicity and plasticity of structure, and in great measure also their adaptability to new conditions. The retention of primitive characters, which so many writers upon biological subjects, and especially upon anthropology, assume to be a sign of degradation, is not really an indication of lowliness. We should rather look upon high specialization of limbs and the narrowing of the manner of living to one particular groove as confessions of weakness, the renunciation of a wider life for one more sharply circumscribed.

The stock from which Man eventually emerged played a very humble role for long ages after many other Mammalian orders had waxed great and strong. But the race is not always to the swift. The lowly group of mammals that took advantage of its insignificance to develop its powers evenly and very gradually without sacrificing in narrow specialization any of its possibilities of future achievement, eventually gave birth to the most dominant and most intelligent of all living creatures.

The Tree Shrews (Tupaiidae) are small squirrel-like animals which feed on 'insects and fruit, which they usually seek in trees, but also occasionally on

FIG. 5

Spectral Tarsier (*Tarsius*), from Sarawak, Borneo.
A full-grown female and her infant seated on a human hand.
(From a photograph lent by Mr. W. E. Le Gros Clark, F.R.C.S.)

FIG. 6

Tree Shrew (*Tupaia*), from Sarawak.
(From a photograph lent by Mr. W. E. Le Gros Clark, F.R.C.S.)

the ground. When feeding, they often sit on their haunches, holding the food, after the manner of squirrels, in their fore paws'.[1] They are of 'lively disposition and great agility'.[2] These vivacious large-brained little insectivores, linked by manifold bonds of relationship to some of the lowliest and most primitive mammals, present in the structure of their skull, teeth, and limbs undoubted evidence of kinship, remote though none the less sure, with their compatriots the Malaysian Lemuroids, and it is singularly fortunate for us in this inquiry that side by side there should have been preserved from a remote period before the Tertiary Period these Insectivores, which had almost become Primates, and a little primitive lemuroid, the Spectral Tarsier, which had only just assumed the characters of the Primate stock, when Nature fixed their types and preserved them throughout the ages, with relatively slight change, for us to study at the present day.

Thus we are able to investigate the influence of an arboreal mode of life in stimulating the progressive development of a primitive mammal, and to appreciate precisely what changes were necessary to convert the lively, agile Ptilocercus-like[3] ancestor of the Primates into a real Primate.

In the forerunners of the Mammalia the cerebral hemisphere was predominantly olfactory in function, and even when the true mammal emerged and all the other senses received due representation in the neopallium the animal's behaviour was still influenced to a much greater extent by smell impressions than by those of the other senses. This was due not only to the fact that the sense of smell had already installed its instruments in and taken possession, so to speak, of the cerebral hemisphere long before the advent in this dominant part

[1] Flower and Lydekker, *Mammals, Living and Extinct*, 1891, p. 618.

[2] W. K. Gregory, *op. cit.*, p. 269, and pp. 279, 280.

[3] One of the Tree Shrews.

of the brain of any adequate representation of the other senses, but also, and chiefly, because to a small land-grubbing animal the guidance of smell impressions, whether in the search for food or as a means of recognition of friends or enemies, sexual mates or rivals, was much more serviceable than all the other senses. Thus the small creature's mental life was lived essentially in an atmosphere of odours; and every object in the outside world was judged primarily and predominantly by its smell. The senses of touch, vision, and hearing were merely auxiliary to the compelling influence of smell.

Once such a creature left the ground and took to an arboreal life all this was changed; for the guidance of the olfactory sense lost much of its usefulness. Life amidst the branches of trees limits the usefulness of olfactory organs; but it is favourable to the high development of vision, touch, and hearing. Moreover, it demands an agility and quickness of movement that necessitates an efficient motor cortex to control and co-ordinate such actions as an arboreal mode of life demands (and secures, by the survival only of those so fitted) and also a well-developed muscular sensitivity to enable such acts to be carried out with precision and quickness. In the struggle for existence, therefore, all arboreal mammals, such as the Tree Shrews, suffer a marked diminution of their olfactory apparatus and develop a considerable neopallium, in which relatively large areas are given up to visual, tactile, acoustic, kinaesthetic, and motor functions, as well as to the purpose of providing a mechanism for mutually blending in consciousness the effects of the impressions pouring in through the avenues of the different senses.

Thus a more equable balance of the representation of the senses is brought about in the large brain of the arboreal animal, and its mode of life encourages and makes indispensable the acquisition of agility. Moreover, these modifications do not interfere with

the primitive characters of limb and body. These small arboreal creatures were thus free to develop their brains and maintain all the plasticity of a generalized structure, which eventually enabled them to go so far in the process of adaptation to almost any circumstances that presented themselves.

Amongst the members of this group, as in all the other mammalian phyla, the potency of the forces of natural selection was immensely enhanced by the fact that the inquisitiveness of an animal which can learn by experience—i. e. is endowed with intelligence—was leading these adaptable Insectivores into all kinds of situations that were favourable for the operation of selection. Various members of the group became specialized in different ways. Of such specialized strains the one of chief interest to us is that in which the sense of vision became especially sharpened.

The Origin of Primates.

Toward the close of the Cretaceous period some small arboreal shrew-like creature took another step in advance, which was fraught with the most far-reaching consequences, for it marked the birth of the Primates and the definite branching off from the other mammals of the line of Man's ancestry. Thus the most primitive of the Prosimiae came into being.

A noteworthy further reduction in the size of the olfactory parts of the brain, such as is seen in that of *Tarsius*,[1] quite emancipated the creature from the dominating influence of olfactory impressions, the sway of which was already shaken, but not quite overcome when its Tupaioid ancestor took to an arboreal life. This change was associated with an enormous development of the visual cortex in the neopallium, which not

[1] 'On the Morphology of the Brain in the Mammalia, with special reference to that of the Lemurs, Recent and Extinct', *Trans. Linn. Soc. Lond.*, second series; *Zoology*, vol. viii, part 10, February, 1903.

only increased in extent so far as to exceed that of *Tupaia* (the Tree Shrew), but also became more highly specialized in structure. Thus, in *Tarsius*, vision entirely usurped the controlling place once occupied by smell; but the significance of this change is not to be measured merely as the substitution of one sense for another. The visual areas of cortex, unlike the olfactory, is part of the neopallium; and when its importance thus became enhanced the whole of the neopallium felt the influence of the changed conditions. The sense of touch also shared in the effects, for tactile impressions and the related kinaesthetic sensibility, the importance of which to an agile tree-living animal is obvious, assist vision in the conscious appreciation of the nature and the various properties of the things seen, and in learning to perform agile actions which are guided by vision.

An arboreal life also added to the importance of the sense of hearing; and the cortical representation of this sense exhibits a noteworthy increase in the Primates, the significance of which it would be difficult to exaggerate in the later stages, when the simian are giving place to the distinctively human characteristics.

The high specialization of the sense of sight awakened in the creature the curiosity to examine the objects around it with closer minuteness and supplied guidance to the hands in executing more precise and more skilled movements than any that the Tree Shrew attempts. Such habits not only tended to develop the motor cortex itself, trained the tactile and kinaesthetic senses, and linked up their cortical areas in bonds of more intimate associations with the visual cortex, but they stimulated the process of specialization within or alongside the motor cortex of a mechanism for regulating the action of that cortex itself. Thus arose an organ of attention which co-ordinated with the activities of the whole neopallium so as the more efficiently to regulate the various centres controlling the muscles of the whole body. In this way not only is the guidance of all the

senses secured, but the way opened for all the muscles of the body to act harmoniously so as to permit the concentration of their action for the performance of delicate and finely adjusted movement.

In some such way as this there was evolved from the motor area itself, in the form of an outgrowth placed at first immediately in front of it, a formation that attains much larger dimensions and a greater specialization of structure in the Primates than in any other Order. It is the germ of the great prefrontal area of the human brain, which is said to be 'concerned with attention and the general orderly co-ordination of psychic processes'.[1] This area, in far greater measure than any other part of the brain, deserves of being regarded as the seat of the higher mental faculties and the crowning glory and distinction of the human fabric. [See Chapter III.]

By means of the land connexions during Tertiary times, the Eocene series of which are shown in Figure 4, Man's ancestors were able to wander from continent to continent until they completed the circuit of the globe: at each stage in the migrations of menotyphlous, prosimian, platyrrhine, catarrhine, and anthropoid forerunners, the unprogressive members remained in the neighbourhood of the home of their immediate ancestors, whereas those which wandered into new surroundings had to struggle for their footing, and by this striving attained a higher rank.

In this series of Primates there was a steady development of the brain—expansion and differentiation of the visual, tactile, and auditory centres, and development of the motor areas, and the power of skilled movements, especially of the hands and fingers; and a regular expansion of the prefrontal area—along the lines marked out once for all when the first Primate was formed from some menotyphlous progenitor.

[1] J. S. Bolton, 'The Functions of the Frontal Lobes', *Brain*, 1903.

Thus the outstanding feature in the evolution of the Primate brain is a growth and differentiation of precisely those cortical areas which took on an enhanced importance in the earliest Primates.

So far I have been delving into the extremely remote, rather than the nearer, ancestry of Man, because I believe that the germs of his intellectual pre-eminence were sown at the very dawn of the Tertiary Period, when the first Anaptomorphid [1] began to rely upon vision rather than smell as its guiding sense. In all the succeeding ages the fuller cultivation of the means of profiting by experience, which the Tarsioid had adopted, led to the steady upward progression of the Primates. From time to time many individuals, finding themselves amidst surroundings which were thoroughly congenial and called for no effort, lagged behind; and in *Tarsius* and the Lemurs, the New World Monkeys, the Old World Monkeys, and the Anthropoid Apes we find preserved a series of these laggards, which turned aside from the highway which led to Man's estate.

The Primates at first were a small and humble folk, who led a quiet life, unobtrusive and safe in the branches of trees, taking small part in the fierce competition for size and supremacy that was being waged upon the earth beneath them by their carnivorous, ungulate, and other brethren. But all the time they were cultivating the equable development of all their senses and limbs, and the special development of the more intellectually useful faculties of the mind that, in the long run, were to make them the progenitors of the dominant Mammal —the Mammal destined to obtain the supremacy over all others, while still retaining much of the primitive structure of limb that his competitors had sacrificed. It is important, then, to keep in mind the fact that the retention of primitive characters is often to be looked upon as a token that their possessor has not been compelled to turn aside from the straight path and adopt

[1] Fossil Tarsioid of the Eocene Period.

protective specializations, but has been able to preserve some of the plasticity associated with his primitiveness, precisely because he has not succumbed or fallen away in the struggle for supremacy. It is the wider triumph of the individual who specializes late, after benefiting by the many-sided experience of early life, over him who in youth becomes tied to one narrow calling.

In many respects Man retains more of the primitive characteristics—for example, in his hands—than his nearest simian relatives; and in the supreme race of mankind many traits, such as abundance of hair, persist to suggest pithecoid affinities, which have been lost by the more specialized Negro and other races. Those anthropologists who use the retention of primitive features in the European as an argument to exalt the Negro to equality with him are neglecting the near teaching of comparative anatomy, that the persistence of primitive traits is often a sign of strength rather than of weakness. This factor runs through the history of the whole animal kingdom.[1] Man is the ultimate product of that line of ancestry which was never compelled to turn aside and adopt protective specialization, either of structure or mode of life, which would be fatal to its plasticity and power of further development.

Having examined the nature of the factors that have made a Primate of an Insectivore, and transformed a Tarsioid prosimian into an Ape, let us turn to consider how Man himself was fashioned.

The Origin of Man.

It is the last stage in the evolution of Man that has always excited chief interest and has been the subject of much speculation.

These discussions usually resolve themselves into

[1] 'The Brain in the Edentata', *Trans. Linn. Soc.*, 1899.

the consideration of such questions as whether it was the growth of the brain, the acquisition of the power of speech, or the assumption of the erect attitude that came first and transformed an ape into a human being. The case for the erect attitude was ably put by Dr. Munro in 1893.[1] He argued that the liberation of the hands and the cultivation of their skill lay at the root of man's mental supremacy.

If the erect attitude is to explain all, why did not the Gibbon become a man in Miocene times or earlier? The whole of my argument has aimed at demonstrating that it is the steady growth and specialization of the brain that has been the fundamental factor in leading Man's ancestors step by step upward from the lowly Insectivore status, and through every earlier phase in the evolution of Mammals—for Man's brain represents the consummation of precisely those factors which throughout the Vertebrata have brought their possessors to the crest of the wave of progress. But such advances as the assumption of the erect attitude are brought about simply because the brain has made skilled movements of the hands possible and of definite use in the struggle for existence. Yet once such a stage had been attained, the very act of liberating the hands for the performance of more delicate movements opened the way for a further advance in brain development to make the most of the more favourable conditions and the greater potentialities of the hands.

It is a fact beyond dispute that the divergent specialization of the human limbs—one pair for progression and the other for prehension—and the more delicately adjusted skilled action, has played a large part in preparing the way for the emergence of the distinctly human characteristics; but it would be a fatal mistake unduly to magnify the influence of these developments. Such a primitive member of the Primates as the Spectral Tarsier can assume the erect

[1] Munro, 'Address to the British Association'.

attitude and use its hands for prehension rather than progression, and many other Lemurs, such as the Indrisinae of Madagascar, can and do walk erect.

In the remote Oligocene, a Catarrhine ape, nearly akin to the ancestors of the Indian sacred monkey, *Semnopithecus*, became definitely specialized in structure in adaptation for the assumption of the erect attitude. This type of early anthropoid has persisted with relatively slight modifications in the Gibbon of the present day. But if the earliest Gibbons were already able to walk upright, how is it, one might ask, that they did not begin to use their hands, thus freed from the work of progression on the earth, for skilled work, and at once become men ? The obvious reason is that the brain had not yet attained a sufficiently high stage of development to provide skilled work, apart from the tree climbing, of biological usefulness for these competent hands to do.

The Ape is tied down absolutely to his experience, and has only a very limited ability to anticipate the results even of relatively simple actions, because so large a proportion of his neopallium is under the dominating influence of the senses. Without a fuller appreciation of the consequences of its actions than the Gibbon is capable of, the animal is not competent to make full use of the skill it undoubtedly possesses. What is implied in acquiring this fuller appreciation of the meaning of events taking place around the animal ? The state of consciousness awakened by a simple sensory stimulation is not merely an appreciation of the physical properties of the object that supplies the stimulus ; the object simply serves to bring to consciousness the results of similar or contrasted experiences in the past, as well as the feelings aroused by or associated with them, and the acts such feelings excited. This mental enrichment of a mere sensation so that it acquires a very precise and complex meaning is possible only because the individual has this extensive experience to fall back upon ; and

the faculty of acquiring such experience implies the possession of large neopallial areas for recording, so to speak, these sensation factors and the feelings associated with them. The 'meaning' which each creature can attach to a sensory impression presumably depends, not on its experience only, but more especially upon the neopallial provision in its brain for recording the fruits of past experience.

Judged by this standard, the human brain bears ample witness, in the expansion of the great temporo-parietal area, which so obviously has been evolved from the regions into which visual, auditory, and tactile impulses are poured, to the perfection of the physical counterpart of the enrichment of mental structure, which is the fundamental characteristic of the human mind.

The second factor that came into operation in the evolution of the human brain is merely the culmination of a process which has been steadily operating throughout the Primates. I refer to the high state of perfection of the cortical regulation of skilled movements, many of which are acquired by each individual in response to a compelling instinct that forces every normal human being to work out his own salvation by perpetually striving to acquire such manual dexterity.

This brings us to the consideration of the nature of the factors that have led to the wide differentiation of Man from the Gorilla. Why is it that these two Primates, structurally so similar and derived simultaneously from common parents, should have become separated by such an enormous chasm, so far as their mental abilities are concerned ?

There can be no doubt that this process of differentiation is of the same nature as those which led one branch of the Eocene Tarsioids to become monkeys, while the other remained Prosimae ; advanced one group of primitive monkeys to the Catarrhine status,

while the rest remained Platyrrhine; converted one division of the Old World Apes into Anthropoids, while the others retained their old status. Put into this form as an obvious truism, the conclusion is suggested that the changes which have taken place in the brain to convert an Ape into Man are of the same nature as, and may be looked upon merely as a continuation of, those processes of evolution which we have been examining in the lowlier members of the Primate series. It was not the adoption of the erect attitude that made Man from an Ape, but the gradual perfecting of the brain and the slow upbuilding of the mental structure, of which erectness of carriage is one of the incidental manifestations.

The ability to perform skilled movements is conducive to a marked enrichment of the mind's structure and the high development of the neopallium, which is the material expression of that enrichment. There are several reasons why this should be so. The mere process of learning to execute any act of skill necessarily involves the cultivation, not only of the muscles which produce the movement, and the cortical area which excites the actions of these muscles, but in even greater measure the sensory mechanisms in the neopallium which are receiving impressions from the skin, the muscles, and the eyes, to control the movements at the moment, and incidentally are educating these cortical areas, stimulating their growth, and enriching the mental structure with new elements of experience. Out of the experience gained in constantly performing acts of skill the knowledge of cause and effect is eventually acquired. Thus the high specialization of the motor area, which made complicated actions possible, and the great expansion of the temporo-parietal area, which enabled the Ape-Man to realize the 'meaning' of events occurring around it, reacted one upon the other, so that the creature came to understand that a particular act would entail certain consequences. In

other words, it gradually acquired the faculty of shaping its conduct in anticipation of results.

Long ages ago, possibly in the Miocene (see Figure 2), the ancestors common to Man, Gorilla, and Chimpanzee became separated into groups. The different conditions to which they became exposed after they parted company were in the main responsible for the contrasts in their fate. In one group the distinctively Primate process of growth and specialization of the brain, which had been going on in their ancestors for many thousands, even millions, of years, reached a stage when the more venturesome members of the group—stimulated perhaps by some local failure of the customary food, or maybe led forth by a curiosity bred of their growing realization of the possibilities of the unknown world beyond the trees, which hitherto had been their home—were impelled to issue forth from their forests, and seek new sources of food and new surroundings on hill and plain, wherever they could obtain the sustenance they needed. The other group, perhaps because they happened to be more favourably situated or attuned to their surroundings, living in a land of plenty, which encouraged indolence in habit and stagnation of effort and growth, were free from this glorious unrest, and remained apes, continuing to lead very much the same kind of life (as Gorillas and Chimpanzees) as their ancestors since the Miocene or even earlier times. That both of these unenterprising relatives of Man happen to live in the forests of tropical Africa has always seemed to me to be a strong argument in favour of Darwin's view that Africa was the original home of the first creatures definitely committed to the human career; for while Man was evolved amidst the strife with adverse conditions, the ancestors of the Gorilla and Chimpanzee gave up the struggle for mental supremacy because they were satisfied with their circumstances; and it is more likely than not that they did not change their habitat.

The erect attitude, infinitely more ancient than man himself, is not the real cause of Man's emergence from the simian stage ; but it is one of the factors made use of by the expanding brain as a prop still further to extend its growing dominion, and by fixing and establishing in a more decided way this erectness it liberated the hand to become the chief instrument of Man's further progress.

In learning to execute movements of a degree of delicacy and precision to which no ape could ever attain—and the primitive Ape-Man could only attempt once his arm was completely emancipated from the necessity of being an instrument of progression—the cortical area that is pre-eminently concerned with the phenomena of attention [1] became enhanced in importance. Hence the prefrontal region, where the activities of the cortex as a whole are, as it were, focused and regulated, began to grow until eventually it became the most distinctive characteristic of the human brain, gradually filling out the front of the cranium and producing the distinctively human forehead. In the diminutive prefrontal area of *Pithecanthropus* [2] and, to a less marked degree, Neanderthal Man,[3] we see illustrations of lower human types, bearing the impress of their lowly state in receding foreheads and great brow ridges. However large the brain may be in *Homo neanderthalensis*, his small prefrontal region is sufficient evidence of his lowly state of intelligence and reason for his failure in the competition with the rest of mankind.

The growth in intelligence and in the powers of discrimination no doubt led to a definite cultivation of the aesthetic sense, which, operating through sexual

[1] In a later chapter this will be further elucidated.

[2] Eug. Dubois, ' Remarks upon the Brain-cast of *Pithecanthropus* ', *Proc. Fourth Internat. Cong. Zool.*, August 1898, published in Cambridge, 1899, p. 81.

[3] Boule and Anthony, ' L'encephale de l'homme fossile de la Chapelle-aux-Saints ', *L'Anthropologie*, tome 22, No. 2, 1911, p. 50.

selection, brought about a gradual refinement of the features, added grace to the general build of the body, and demolished the greater part of its hairy covering. It also led to an intensification of the sexual distinctions, especially by developing in the female localized deposits of fatty tissue, not found in the apes, which produced profound alterations in the general form of the body.

Right-handedness.

To one who considers what precisely it means to fix the attention and attempt the performance of some delicately adjusted and precise action, it must be evident that one hand only can be usefully employed in executing the consciously skilled part in any given movement. The other hand, like the rest of the muscles of the whole body, can be only auxiliary to it, assisting, under the influence of attention, either passively or actively, in steadying the body or helping the dominant hand. Moreover, it is clear that if one hand is constantly employed for doing the more skilled work, it will learn to perform it more precisely and more successfully than either would if both were trained, in spite of what ambidextral enthusiasts may say. Hence it happened that when Nature was fashioning Man the forces of natural selection made one hand more apt to perform skilled movements than the other. Why precisely it was the right hand that was chosen in the majority of mankind we do not know, though scores of anatomists and others are ready with explanations. But probably some slight mechanical advantage in the circumstances of the limb, or perhaps even some factor affecting the motor area of the left side of the brain that controls its movements, may have inclined the balance in favour of the right arm ; and the forces of heredity have continued to perpetuate a tendency long ago imprinted in Man's structure when first he became human.

The fact that a certain proportion of mankind is left-handed, and that such a tendency is transmitted to some only of the descendants of a left-handed person, might perhaps suggest that one half of mankind was originally left-handed and the other right-handed, and that the former condition was recessive in the Mendelian sense, or that some infinitesimal advantage may have accrued to the right-handed part of the original community, which in time of stress spared them in preference to left-handed individuals; but the whole problem of why right-handedness should be much more common than left-handedness is still quite obscure. The superiority of one hand is as old as mankind, and is one of the factors incidental to the evolution of Man.

It is easily comprehensible why one hand should become more expert than the other, as I have attempted to show; and the fact remains that it is the right hand, controlled by the left cerebral hemisphere, which is specially favoured in this respect. This heightened educability of the (left) motor centre (for the right hand) has an important influence upon the adjoining areas of the left motor cortex. When the Ape-Man attained a sufficient degree of intelligence to wish to communicate with his fellows other than merely by instinctive emotional cries and grimaces, such as all social groups of animals employ, the more cunning right hand would naturally play an important part in such gestures and signs; and, although the muscles on both sides of the face would be called into action in such movements of the features as were intended to convey information to another (and not merely to express the personal feelings of the individual) such bilateral movements would certainly be controlled by the left side of the brain, because it was already more highly educated.

The Origin of Speech.

This argument will be further elaborated later on in this book to explain the origin of speech. The increasing ability to perform actions demanding skill and delicacy received a great impetus when the hands were liberated for the exclusive cultivation of such skill ; this perfection of cerebral control over muscular actions made it possible for the Ape-Man to learn to imitate the sounds around him, for the art of learning is a training not only of the motor centres and the muscles concerned, but also of the attention, and the benefits that accrued from educating the hands added to the power of controlling other muscles, such as those concerned with articulate speech.

The usefulness of such power of imitating sounds could be fully realized in Primitive Man, not only because he had developed the parts of the brain which made the acquisition of such skill possible, but also because he had acquired, in virtue of the development of other cortical areas, the ability to realize the significance and learn the meaning of the sounds heard.

I do not propose to discuss the tremendous impetus that the invention of speech must have given in the accumulation of information to stimulate intellectual development. It enabled the knowledge acquired by each individual to become the property of the community and be handed on to future generations. It provided in words the very symbols and the indispensable elements of the higher mental process.

We are apt to forget the immensity of the heritage that has come down to us from former generations of men, until we begin dimly to realize that for the vast majority of mankind almost the sum total of their mental activities consists of imitation or acquiring and using the common stock of beliefs. For this accumulation of knowledge and its transmission to our generation we are almost wholly indebted to the use of speech. In our forgetfulness of these facts we marvel

at the apparent dullness of Early Man in being content to use the most roughly chipped flints for many thousands of years before he learned to polish them, and eventually to employ materials better suited for the manufacture of implements and weapons. But when we consider how slowly and laboriously Man acquires new ideas, and how such ideas—even those which seem childishly simple and obvious to us—were treasured as priceless possessions and handed on from tribe to tribe, it becomes increasingly difficult to believe in the possibility of the independent evolution of similar customs and inventions of any degree of complexity.

The hypothesis of the 'fundamental similarity of the working of the human mind' is no more potent to explain the identity of customs in widely different parts of the world—e.g. the distribution of megalithic monuments, or the appearance of metals in America—than it is to shake our belief that one Man originally realized in practice the idea of the mechanical use to which steam could be applied, or that the electric battery was not independently evolved in each of the countries where it is now in use.

In this chapter I have attempted to deal with old problems in the light of newly acquired evidence; to emphasize the undoubted fact that the evolution of the Primates and the emergence of the distinctively human type of intelligence are to be explained primarily by a steady growth and specialization of certain parts of the brain; that such development could have occurred only in the Mammalia because they are the only plastic class of animals with a true organ of intelligence; that an arboreal mode of life started Man's ancestors on the way to pre-eminence, for it gave them the agility; and the specialization of the higher parts of the brain incidental to such a life gave them the seeing eye, and in course of time also the understanding ear; and that all the rest followed in the train of this high development of vision working on a brain which controlled ever-increasingly agile limbs.

If, in pursuing these objects, I may have seemed to wander far from the beaten paths of anthropology, as the word is usually understood, and perhaps encroached upon the domains of zoology, my aim has been to demonstrate that the solution of these problems of human origins, which have frequently engaged the attention of anthropologists, is not to be sought merely in comparisons of Man and the Anthropoid Apes. Man has emerged not by the sudden intrusion of some new element into the ape's physical structure or the fabric of his mind, but by the culmination of those processes which have been operating in the same way in a long line of ancestors ever since the beginning of the Tertiary Period.

CHAPTER II

PRIMITIVE MAN[1]

We may now turn to the history of Man himself, and in doing so I may remind you of the opinion recently expressed by an American historian that 'the widening outlook of both anthropologists and historians, as well as the requirements of science, demands the co-ordination of these two phases of humanistic inquiry'.[1]

Professor Teggart becomes more explicit when he claims that 'by insensible degrees the historian has come to see that there is no hard and fast boundary between "historic" and "prehistoric" times, between "historical" and "unhistorical" peoples; the history of Man includes man everywhere and at all times'.

Approaching the same question from the anthropological side, biologists who have examined the remains of Early Man, and studied the elements of culture found in association with them, have arrived at the same conclusion. For, as Professor Henry Fairfield Osborn has recently expressed it, such investigations reveal 'the great antiquity of the spirit of man and the fundamental similarity between the great steps of prehistory and history'.[2]

But the term 'prehistoric', and especially the unpardonable word 'prehistory', must be renounced, or used only in the most general sense, by all who value clearness of thought and precision of statement.

[1] Frederick J. Teggart, *Prolegomena to History*, University of California Publications in History, vol. iv, No. 3, 1916, p. 124.

[2] *Men of the Old Stone Age*, 1915, p. 501.

When the adjective first came into use there was a vast break of unknown extent between the history of Man as preserved in written documents and the complementary story as recorded in what was then the less legible palimpsest of bones, implements, and potsherds. With the accumulation of further information and the acquisition of a fuller insight into the meaning of the latter kind of evidence, not only has the gap between the historical and the so-called 'prehistoric' been to a large extent bridged, and by evidence of contact between neighbouring peoples the two 'ages' been shown to overlap, but the unwritten records preserved in the bones and cultural remains have become more and more comprehensible, and have given us perhaps a fuller and more truthful history of certain phases of man's activities than the written documents, which are often coloured and distorted by the personal bias of their authors, though it has been the custom to regard them as the only sources of real history.

One has only to recall the recently acquired knowledge of the archaeology of Crete and Nubia, for example, to realize the vastness and the accuracy of the body of history that has been recovered from sources other than literary records. Not only have such researches revealed a very extensive chapter of positive history, but they have shed a new light upon the hitherto accepted interpretation of the written documents and forced a considerable reorientation of the ideas which they had provided of the growth of civilization.

With the widening of outlook and the growth of the conception of continuity in history, the term 'prehistoric' has, in fact, lost much of its usefulness. It has now become a hindrance rather than a help to those who are striving to obtain a clear view and a right perspective of Man's history as a closely interrelated whole and of the essential unity of civilization. Hence, except perhaps in the case of some small

localized area, it would be a distinct advantage if the word 'prehistoric', and all the misleading and confusing glamour that has grown up in association with it,[1] were relegated to the oblivion of the past to which it naturally belongs.

Once these obstructions are cleared away we can get back to the view expressed by Diodorus and the Stoics, that 'all men living, or who once lived, belong to the common Human Family, though divided from one another by time and space' (Bury's translation), and regard history as including 'not alone every manifestation of political activity among men, but the entire range of human experience' (Teggart).

The term 'Primitive', which I have ventured to use in the title of this chapter, is also open to grave objection, unless it is definitely restricted to those classes of beings and events to which it can be applied without obvious ambiguity. While it is legitimate to employ it with reference to really early types of mankind and to survivals of practices and beliefs which have come down from the very childhood of the human race—and that is the sense which I had in mind when I selected 'Primitive Man' as the title of this chapter—it is necessary to protest against the common misuse of this expression, of which modern ethnologists in particular are guilty. For instance, it has become a practice to refer to all the customs and traditions of such peoples as the aboriginal Australians and the Bushmen of South Africa as 'primitive',

[1] The influence of this confusion is repeatedly shown in the writings of modern scholars, who are perfectly familiar with the fact that the so-called 'prehistoric' culture of Western Europe endured for several millennia after the inauguration of the 'historical' period in the Eastern Mediterranean. Yet the bias created by the employment of the word 'prehistoric' with reference to the former often leads writers to invert the course of history, and refer to crude elements of 'prehistoric' Western European culture that were unquestionably derived from the earlier and more perfect institutions of the 'historical' East as the parents instead of the offspring of the latter.

although it is patent that many of these elements of culture, and especially those which are most often used as illustrations of 'primitive' beliefs and practices, and labelled as such, have been borrowed in relatively recent times from more advanced and alien civilizations.

It is very questionable whether any pure strains of mankind exist at the present time. During its wanderings in past ages every people has certainly come into more or less intimate contact with alien races and mingled with them. But even though, so far as mere physical structure is concerned, several races may seem relatively uniform in type and appear to be really primitive and unmixed, their customs and beliefs reveal the more obtrusive influence of contact with and borrowing from other peoples.

But in this chapter I am concerned mainly with those earlier types of mankind which are really primitive, and I shall refer to modern man and his works only to emphasize the fact that the human spirit has ever remained the same. Even when it becomes encrusted with the influences, good and bad, of traditions which have been accumulating and affecting Man's outlook ever since he first emerged from the simian stage of complete individualism, human nature is based upon the same primitive instincts and emotions.

The objection may be raised that the investigation of a few fragments of fossilized bone cannot shed any light upon human behaviour and history. But it must be remembered that these human remains have been found in association with evidence of Man's handiwork. It has been necessary to study the two kinds of evidence in correlation the one with the other before it became possible to form an adequate conception either of the nature of the men themselves and the times in which they lived or of the real significance of their industries. Hence the investigation of these primitive men's motives and capabilities came to form a necessary and integral part of the task of interpreting

the meaning of the bodily remains. In reading such documents, even though they are seen darkly through the glass of untold ages, the inquirer is really reading historical records. Moreover, they are records of real facts, uncoloured by the emotions and the prejudices of a partisan interpreter. For the actions and the motives of these primitive men are known by their works, and not merely second-hand from the often ill-founded scribblings of some partial scribe, who may have had some conscious reason for distorting the facts, or in any case was not fully competent to escape the influence of those unconscious phenomena that warp the judgement of all men, however conscientious.

But even though only the smallest scraps of evidence have been preserved to illuminate the working of the mind of Primitive Man, they shed a very clear light upon the ways of mankind as a whole. For they reveal his manner of thought and action, stripped of much of the confusion which the accumulations of traditions and stereotyped ideas have created to obscure one's vision of modern men's motives.

In spite of their obvious differences in physical structure and intellectual achievement, all the living races of mankind are regarded merely as varieties of one species, *Homo sapiens*. It is less than seventy years since there first came to light the remains of a type of mankind so vastly older than and so different in structure from all the then known varieties of men, living or extinct, as to be regarded by many recent writers as the representative of another species, for which Falconer, in 1868, suggested the name *Homo calficus*, in reference to Gibraltar, the ancient Calphe. But the real significance of the Gibraltar skull was not appreciated at the time of its discovery. In fact it is only during the last decade that scientists have begun to realize how momentous was the new era in our knowledge of Man which was inaugurated when

Lieutenant Flint found this fossilized skull near the Forbes Quarry at Gibraltar in 1848.

But before this specimen had come to the knowledge of any one capable of appreciating the fact that it was an important discovery, the remains of another individual, possibly of the same race, but certainly of the same species, came to light in a Neanderthal cave near Düsseldorf in 1856. These fragments included the upper part of a human skull, the more obtrusive features of which (for it was a man's, while the Gibraltar specimen was a woman's skull), no less than the fact that it came at once into the hands of a competent anatomist (Professor Schaafhausen), at once riveted attention upon it as the relic of a hitherto unknown type of the Human Family, which afterwards received the name *Homo neanderthalensis*. As this designation was suggested by Professor King of Galway in 1864, some years before Dr. Falconer proposed the specific name *calficus* for the Gibraltar skull, the former takes precedence to and excludes the latter, if it be admitted that the Neanderthal and Gibraltar remains belong to the same group, and that the latter is really of specific rank. It is a difficult question to decide whether or not there is sufficient justification for the creation of this new species of the genus *Homo*; but on the whole I think the balance of evidence is in favour of such a course.

But whether or not the Neanderthal race represents a distinct species which was succeeded in Europe by *Homo sapiens*, there can be no doubt that the advent of the latter more modern type of men in Europe represents on the cultural side the most momentous event in its history.

One of my chief aims in this chapter will be to consider the significance of this great step forward in the history of mankind, when there are revealed for the first time men of essentially the same type as ourselves, endowed with the same intellectual qualities and artistic aptitude.

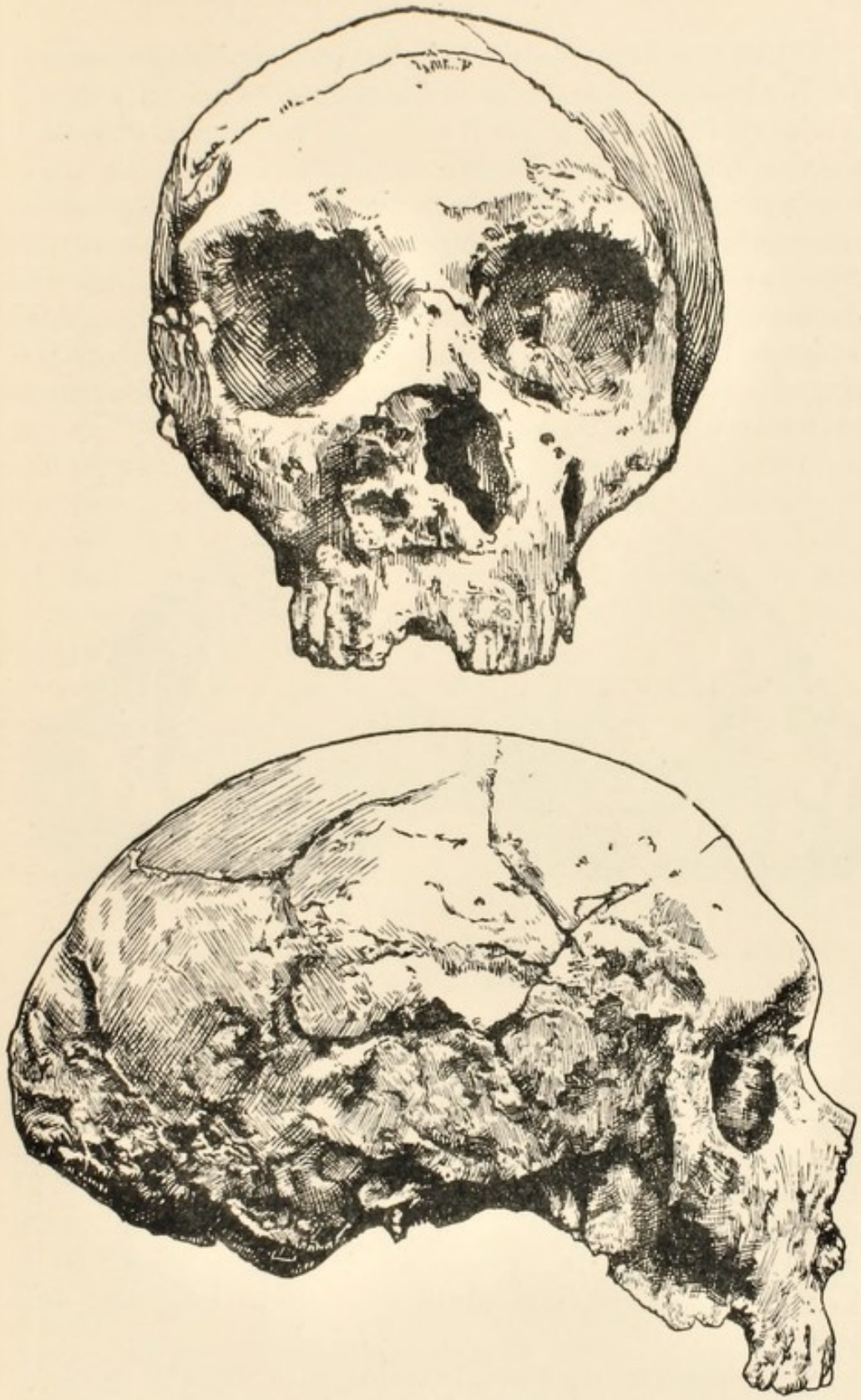

FIGURE 7. Drawings of the front and right side of the Gibraltar skull, by T. L. Poulton.

When the Neanderthal skeleton came into the hands of Professor Schaafhausen he claimed that 'the extraordinary form of the skull was due to a natural conformation hitherto not known to exist, even in the most barbarous races', and that the 'human relics were traceable to a period at which the latest animals of the diluvium still existed'. Subsequent research and the discovery of much more material bearing upon the points at issue have proved beyond all possibility of error the soundness of these conclusions. But for years after these statements were made a lively controversy raged around

FIGURE 8. Drawing of the right side of the Neanderthal skull, by T. L. Poulton.

this skull, and in course of time, with the addition of the inflammable material supplied by Charles Darwin's classical works, a great conflagration developed. As Huxley remarked, many years afterwards: 'It was suggested that the Neanderthal skeleton was that of a stray idiot: that the characters of the skull were the result of early synostosis or of late gout: and, in fact, any stick was good enough to beat the dog withal.'

Since then many more remains of a variety of early types of mankind have come to light, as well as a great deal of information relating to the handiwork and

achievements of these primitive men, the animals they hunted, and the conditions under which they lived. But as this mass of facts has gradually increased there has also grown up in connexion with them a body of theory which has become so systematized as to make it extremely difficult to view the results impartially. Part of my aim is to strip away much of this speculative obstruction. In the days when only a very few fragments of bone and chipped flint provided all the information available for the study of Primitive Man, a scaffolding of hypothesis was necessary in order to make any sort of edifice of such broken and scanty debris. But now that so much more material is available it is possible to build up a structure capable of standing by itself. Hence this scaffolding is not only no longer necessary, but it interferes with the view of the building.

Almost every new discovery has started afresh such disputes as followed the finding of the Neanderthal skull, and history has repeated itself with remarkable consistency. The recent disputes concerning the significance of the fossil skull found by the late Mr. Charles Dawson near Piltdown in 1912 are true to type.

It has been said of the fossil jaw found in the Mauer sands near Heidelberg in 1908 that it was remarkable in many respects, and not least because it was the only fossilized fragment of a human being the discovery of which had not excited a violent controversy. But fortunately many further instances can be recorded since 1908 of the calm and dispassionate discussion of the problems arising out of fresh discoveries.

Long before the discovery of these actual fragments of the Man of the Old Stone Age, archaeologists had become aware of his former existence by finding implements of human workmanship in caves and in ancient gravels, often in association with the bones of extinct Mammals. But it was not until the year 1887 that the Belgian scientists, Fraipont and Lohest, made the

discovery at Spy, one of the most important and fundamental in the whole history of the growth of our knowledge of Early Man, that the Neanderthal people were the makers of the type of stone implements which are now called Mousterian, and that they were contemporaneous with the Woolly Mammoth, the Woolly Rhinoceros, the Cave Bear, and the Cave Hyena in Western Europe.

This clearer vision of Mousterian Man (*Homo neanderthalensis*) in his natural surroundings stimulated further inquiries; and as the result of a long series of remarkable discoveries, no less than of the intensive investigation of the known material, especially by Schwalbe and Boule among many others, one has gained a surprisingly full view of the physical characters and the achievements of this peculiarly distinctive type of mankind, which occupied Europe many thousands of years ago.

The information that has been accumulating has illuminated not merely the Mousterian phase of industry and Neanderthal Man, but has revealed also a long succession of later cultural phases and waves of varied types of mankind, all of which, however, differ from the men of the so-called 'Lower Palaeolithic Age' in conforming much more nearly to the modern type.

In fact, however much uncertainty there may be as to whether or not the Neanderthal race really represents a distinct species, most authorities are agreed that all the races of the so-called 'Upper Palaeolithic' phase were merely varieties of the species *Homo sapiens*. In France there was a series of phases of culture associated with at least three successive waves of immigration into Western Europe during this period. These have been distinguished by the names of the places where the particular industries were first recognized: Aurignacian (from the small grotto of Aurignac, Haute-Garonne), Solutrean (from the station of Solutré, Saône-et-Loire), and Magdalenian (from the rock-shelter of La Madeleine, on the bank of the Vézère). Although the racial char-

acters of these successive waves of immigrants were probably quite distinct the one from the other, it is often convenient to refer to them collectively, for the purpose of contrast with the races of men who went before or came after them. In such cases some writers refer to these people of the so-called 'Upper Palaeolithic' Period as Crô-Magnon men, from the place-name given to the first known representative of one of these

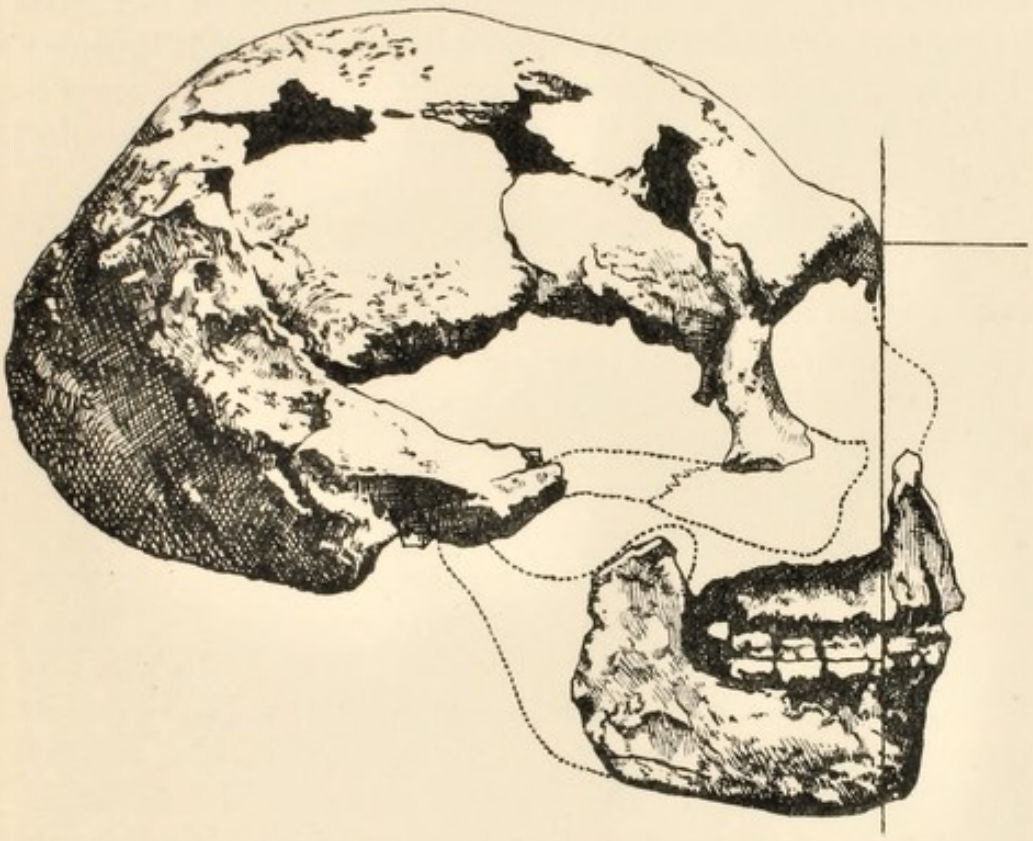

FIGURE 9. Drawing of the right side of one of the Spy skulls, by T. L. Poulton.

races. In using this expression, however, the reservation must always be borne in mind that it covers a variety of racial types, of which the real Crô-Magnon Man is only one.

The last quarter of a century has also brought to light the fragments of three divergent and much more primitive members of the Human Family: the genus *Pithecanthropus*, found in Java in 1894 by Dr. Eugen

Dubois; the Heidelberg jaw, found in the Mauer sands by Dr. Schoetensack in 1908, which Bonarelli regards as the remains of a special genus, *Palaeanthropus*; and the genus *Eoanthropus*, found by the late Mr. Charles Dawson near Piltdown in Sussex in 1912.

The small fragments of these three most primitive members of the Human Family afford us tantalizingly imperfect glimpses of Man in the making, and have, not unnaturally, supplied the material for some of the most lively controversies in the whole history of anthropology. There are still wide divergences of opinion in respect to almost every aspect of the problems raised for discussion by these relics.

Recent years have witnessed the extinction of the bitter animosities which, in the sixties and seventies of last century, were inevitably excited by the mere suggestion that Man was descended from the Apes. The fact of Man's descent is no longer questioned; but the intense theological emotions of fifty years ago have now given place to profound differences of opinion concerning the interpretation of the details of the technical evidence as to how Man and human institutions were evolved. Every human fragment and scrap of Man's handiwork that has been preserved to us from the Old Stone Age has become a nucleus around which the liveliest discussions have centred. The anatomist who investigates the features of the human remains, the archaeologist who explains the significance of the implements and culture, the zoologist and palaeontologist who deal with the associated fauna, and the geologist who interprets the circumstances under which the remains are found, all take their share in these discussions; and as the conclusion arrived at by each of these investigators has an intimate bearing upon the results obtained by workers in the other fields, there is ample scope for differences of opinion to arise. Perhaps the most difficult problems of all are those which have been raised by the attempts to determine the changes of temperature and climate and the comings and goings

of the various mammals, and to associate them with Man in the different stages of his chequered career in Europe.

This is not the place for the discussion of these technical controversies. What I propose to do is to set forth in general terms such conclusions as, I think, most scientists would be willing to admit, and then consider their wider bearing upon some of the fundamental problems of human history.

No human remains have yet come to light that can be referred with certainty to a time earlier than the Pleistocene. There are very definite reasons for including the Javan fossil *Pithecanthropus* within the Human Family, and also for regarding it as the most primitive member of that Family, though probably not on the direct line of ancestry of the higher races of men. In making this statement I should add that several leading palaeontologists, such as Professors Boule and Obermaier, still maintain that *Pithecanthropus* was really an Ape. Dr. Smith Woodward, who has examined their arguments,[1] comes to the conclusion that ' there is thus some reason to suspect that man himself lived in Java with *Pithecanthropus*, and that the latter was really a gigantic and precocious Gibbon '.

But in 1898[2] Professor Dubois clearly demonstrated that for a Gibbon to acquire a cranial capacity such as is found in the Java skull, it would indeed require, if it remained a true Gibbon, to be truly gigantic. For to attain a cranial capacity of 855 c.c. it would need to be four times the stature of a Man. So far from this estimate of size being realized, the femur of *Pithecanthropus* indicates that the creature was not quite so big as an average Man. But it is not only the mere

[1] ' Early Man ', *Geological Magazine*, January, 1917.

[2] ' Remarks on the Brain-cast of *Pithecanthropus erectus* ', *Proceedings of the Fourth International Congress of Zoology*, Cambridge, 1898, p. 91.

capacity of the brain-case, but also the form of its interior that reveals the right of *Pithecanthropus* to be included within the Human Family. For the cranial cast reveals a special expansion of that area in the temporal region of the brain which recent research has led physicians to associate with the distinctively human faculty of speech. For these and other reasons I think that *Pithecanthropus* is really a member, if a very lowly one, of the Human Family.

Most authorities now assign its age to the Early Pleistocene; but some recent writers, without definitely denying this possibility, are inclined to agree with Dubois's original claim that it belongs to the Uppermost Pliocene. One of the reasons for this view is that the fossil elephants which occur in Java along with *Pithecanthropus* are also found twenty-five hundred miles away in the foot-hills of the Himalayas of India, where they are regarded as of the Uppermost Pliocene Age. But, as allied species did not arrive in Europe until Early Pleistocene times, there is the possibility that the animals whose remains have been found in Java may also not have wandered east before then. Thus it can be said, without the possibility of contradiction, that the earliest known representative of the Human Family can be referred approximately to the commencement of the Pleistocene Period, with the possibility that it may have been a little earlier. It is so ape-like that, as I have already remarked, some leading authorities still maintain that it is an Ape. Hence it is necessary to assume, until more precise evidence is forthcoming to invalidate the conclusion, that at the close of the Pliocene Period Man was still 'in the making'. The claim that real men were in existence in Pliocene and Miocene times must be regarded as a mere hypothesis unsupported as yet by any tangible evidence.

In making this statement I have not forgotten the extremely interesting fragments of jaw and teeth recently found in the Siwalik Hills by Dr. G. E. Pilgrim, who has created the new genus and species *Siva-*

pithecus indicus for its reception.[1] Although Dr. Pilgrim regards this Miocene creature as a member of the Human Family, I agree with the opinion expressed by Professor Boule[2] that the evidence afforded by these fragments is altogether inadequate to justify such far-reaching conclusions. The distinctive features of the Human Family can be provided only by the brain-case and the limb-bones, which underwent the characteristic changes long before the jaws and face and rest of the body lost their simian characters. For in the process of the evolution of Man it was the brain which first acquired what can be called the human status. The earliest members of the Human Family must have been merely Apes with an overgrown brain, and probably the first bodily changes that occurred were the modifications of the legs for the new methods of progression, which were in the main the outcome of this higher development of brain. The simian features of the skin and hair, teeth and face, and the general configuration of the body, no doubt persisted for long ages after the changes in the brain and the legs had been established.

Thus, as I have already explained in the Foreword, it cannot be claimed that the characters of the teeth of any Miocene Ape reveal the existence of the Human Family at so remote a period of time. For the distinctive criteria of the earliest types of the Human Family can be provided only by the brain-case. The teeth and jaws can, however, give indications of human affinities. Anatomical peculiarities may point to the fact that certain Miocene Apes were more nearly related than other Apes by direct affiliation to Man's ancestors. But this does not convert the former into members

[1] 'New Siwalik Primates and their Bearing on the question of the Evolution of Man and the Anthropoidea', *Records of the Geological Survey of India*, vol. xlv, part I, 1915.

[2] 'Les Singes fossiles de l'Inde d'après M. Pilgrim', *L'Anthropologie*, t. xxvi, 1915, p. 409.

of the Hominidae, even if they are on the direct line of ancestry.

In his admirable review of Dr. Pilgrim's memoir Professor Boule refers to the fact of first importance that is revealed by the new discoveries in India. During Miocene times Asia was inhabited by very numerous Anthropoid Apes exhibiting characters diverging in all kinds of directions, and even, as in *Sivapithecus*, in the direction of Man.

> 'Il y a là un mouvement de vie chez les Primates tout à fait extraordinaire, et l'on a, pour la première fois, la sensation que l'Asie était, à ce moment, le laboratoire où devait s'élaborer la différenciation des ancêtres des Hominiens.' (*Op. cit.*, p. 410.)

In the foot-hills of the Himalayas in Miocene times were found Apes akin to the Orangs and the Chimpanzees, to the Gorillas and Man, as well as many other Phyla which afterwards became extinct, after wandering east and west. The domain of the Anthropoid Apes extended as far west as Spain and Africa and as far east as Borneo. Within this widespread area these Apes, including Man's ancestors, roamed about for vast ages before Man himself appeared upon the scene. And the wanderings did not cease when real men appeared. Man's heightened powers of discrimination and adaptation made it possible for him to extend his wanderings into all kinds of country and climate, whereas the Apes were tied down to forests and tropical temperatures. When or where the Human Family came into existence is quite unknown. Man's nearest simian kindred are represented probably by the Gorillas and Chimpanzees, now restricted to Africa. But their allies ranged in Miocene and Early Pliocene times also from Europe to India.

The earliest known member of the Hominidae is *Pithecanthropus*, whose ancestors wandered east to Java as the Orangs and Gibbons had probably done before them. But a review of all the facts suggests as the more probable interpretation that this Ape-Man was

not the original parent of the Hominidae nor Java their home, but that it was aberrant alike in structure and habitat.

The earliest fossilized remains of an Anthropoid Ape, *Propliopithecus*, were found in Oligocene beds in the Egyptian Fayum.[1]

But in virtue of those changes which converted the Ape into Man, his powers of adaptation to changes of country, climate, and food were enormously increased, so that he was able to spread abroad more quickly and roam into climates and into lands which were closed to the tropical forest-dwelling Anthropoid Apes. Thus Man was able to make his way into every region of the earth. It is important not to forget that Man has been a wanderer ever since he came into existence, and that a diffusion of culture has been effected by this means ever since he set out from his original tropical home.

I have already insisted upon the fact that the primary and fundamental distinction between Man and the Apes was due to the growth of the brain. If one analyses the nature of the changes which the brain has undergone in its passage from the stage represented in the Chimpanzee and Gorilla to the most primitive human condition, the outstanding factor will be found to be primarily a great expansion of the region of the cerebral cortex that is interposed between the areas into which impulses from the visual, auditory, and tactile organs are poured.

This means presumably that a greatly enhanced power of recording the impressions of these senses and of profiting by experience—in other words, an enormous expansion of the powers of discrimination based upon acquired knowledge—is the fundamental distinction between Primitive Man and the Apes. If we test this assumption by comparing with the behaviour of Chimpanzees the actions of those small isolated groups of primitive men who for one reason or another

[1] See Chapter I.

have been shielded from the effects of contact with the more progressive peoples, it becomes clear that, so far as his instincts and emotions are concerned, there is little essential difference between Man and the Apes. But in virtue of his enormously heightened powers of discrimination and his ability to profit by experience, Man has learned to control his instincts and the expressions of his emotions to a greater degree than the rest of the Mammals.

So far as one can judge, there has been no far-reaching and progressive modification of the instincts and emotions since Man came into existence, beyond the acquisition of the necessary innate power of using the more complex cerebral apparatus which he has to employ.

Perhaps the most significant result of Man's enhanced powers of discrimination was the realization of his ability to communicate with his fellows by means of speech. While still in the simian stage of development Man's ancestors were already equipped with all the specialized muscles needed for articulate speech and the cerebral apparatus for controlling their movements, and for acquiring the skill to learn new methods of action. All that was needed to put this complicated machinery to the new purpose was Man's enhanced powers of discrimination to appreciate the usefulness of communicating more intimately with his fellows and to devise the necessary symbolism. That this is not wholly idle speculation is revealed by the fact that even in the primitive and aberrant *Pithecanthropus* there was already a noteworthy and highly significant overgrowth of the area of its cerebral cortex corresponding to the part of the modern human brain, interference with which leads to a disturbance or a loss of the power of the meaning of the arbitrary auditory symbols of spoken language. The same feature is revealed in a more pronounced form in the Piltdown endocranial cast, as also in those obtained from skulls of the Neanderthal race. But its presence in the

earliest and most primitive member of the Human Family implies that it was one of the factors which played a significant part in the early development of Man. In fact, I think it not unlikely that the acquisition of such fuller means of communication with his fellows by vocal symbols may have been one of the essential factors in converting Man's ultimate simian ancestor into a real man. The outstanding distinctive feature of mankind is, in fact, this enormously enhanced power of conveying information to and learning from his fellows, and especially of handing on the accumulated products of the experience of one generation to those who succeed them. But it is not only the results of actual experience that are thus transmitted, but also the outcome of the attempts to explain and interpret such experiences. Thus during the long history of mankind there has grown up a cloud of traditions and beliefs, to the influence of which every human being is exposed from the day of his birth and throughout his life. It is this almost wholly artificial intellectual and moral atmosphere which colours his outlook on life and provides him with the ready-made apparatus for interpreting his own real experiences. The range of true judgement is in fact extremely limited in the vast majority of human beings. Emotions and the unconscious influence of the environment in which an individual has grown up play an enormous part in all his decisions, even though he may give a rational explanation of the motives for many of his actions without realizing that they were inspired by causes utterly alien to those which he has given—and given without any intention of dishonesty—in explanation of them.[1]

I have discussed these elementary psychological principles for the purpose of emphasizing the fact that Man's mental and moral attitude is, in a large measure,

[1] A fuller discussion of this fundamental question will be found in Elliot Smith and Pear's *Shell Shock and its Lessons*, 1917, chap. iii.

determined by those primitive instincts and emotions which he shares with his simian ancestors, but also by the influence, conscious and unconscious, of the atmosphere of traditions amidst which he has grown up. At no stage of his career has he acquired highly complex and specialized instincts which impelled him, without any prompting from other peoples, to build megalithic monuments or to invent the story of the deluge, independently of other people who do the same arbitrary things, as modern speculations would have us believe.

It would ill become me as a biologist to attempt to minimize the vast role played by heredity in determining the physical structure and the mental and moral aptitudes of every individual, and the variations in the average levels of attainment to which these hereditary qualities are subject in different races. But it is necessary to emphasize the fact that, so far as innate mental and moral characteristics are concerned, it is merely a vaguely defined and more or less generalized aptitude that is inherited, and not any special kind of ability or congenital propensity towards good or evil behaviour.

The musical genius, however great his aptitude may be to appreciate the subtle symbolism of sound and to acquire the mechanical skill in giving appropriate expression to his knowledge and feelings, could not become a musician unless he was provided with the opportunities for learning the arbitrary conventions of music which obtain in the community where he happens to live.

The discovery of the remains of the Piltdown Man is perhaps the most remarkable episode in the whole history of anthropology. For it is a very singular coincidence that this wonderful skull should have come to light in the county of Sussex, within a few miles of the place where Huxley spent the last days of a life which was largely devoted to the task of convincing

his fellows that some such creature must have existed in the distant past. It represents the most primitive member of the Human Family, excepting only the ape-like Javan fossil *Pithecanthropus*, which, as I have already mentioned, some leading palaeontologists still regard, not as one of the Hominidae, but as a giant Ape. But, for the reasons which I have explained above, *Pithecanthropus* was truly a member of our family. It was provided with a brain of very small dimensions, which nevertheless was much too large to have been an Ape's.

The 'Dawn Man' of Piltdown, however, was provided with a brain that, though small, comes definitely within the range of variation in size found in modern Man. But there are clear indications that mere volume of brain is not the only criterion of mental superiority. Those parts of the organ which develop latest in ourselves were singularly defective in *Eoanthropus*. Associated with the essentially human brain-case was a jaw which at first sight seemed to be as definitely simian. In fact certain palaeontologists still persist in claiming that the jaw is a chimpanzee's and did not belong to the human skull with which it was found. But this claim ignores, not merely the improbability of such a chance association on the same spot of the remains of a hitherto unknown man-like Ape and an equally unknown ape-like Man, one of which left his skull without the jaw and the other the jaw without the skull, but also the large series of anatomical peculiarities of the jaw and teeth which prove the jaw to be, not a chimpanzee's, but that of a primitive human being—no doubt a part of the same individual whose skull was deposited alongside it. The outstanding interest of the Piltdown skull is the confirmation it affords of the view that in the evolution of Man the brain led the way. It is the veriest truism that Man has emerged from the simian state in virtue of the enrichment of the structure of his mind. It is singular that so much biological speculation has neglected to

give adequate recognition to this cardinal fact. The brain attained what may be termed the human rank at a time when the jaws and face, and no doubt the body also, still retained much of the uncouthness of Man's simian ancestors. In other words, Man at first,

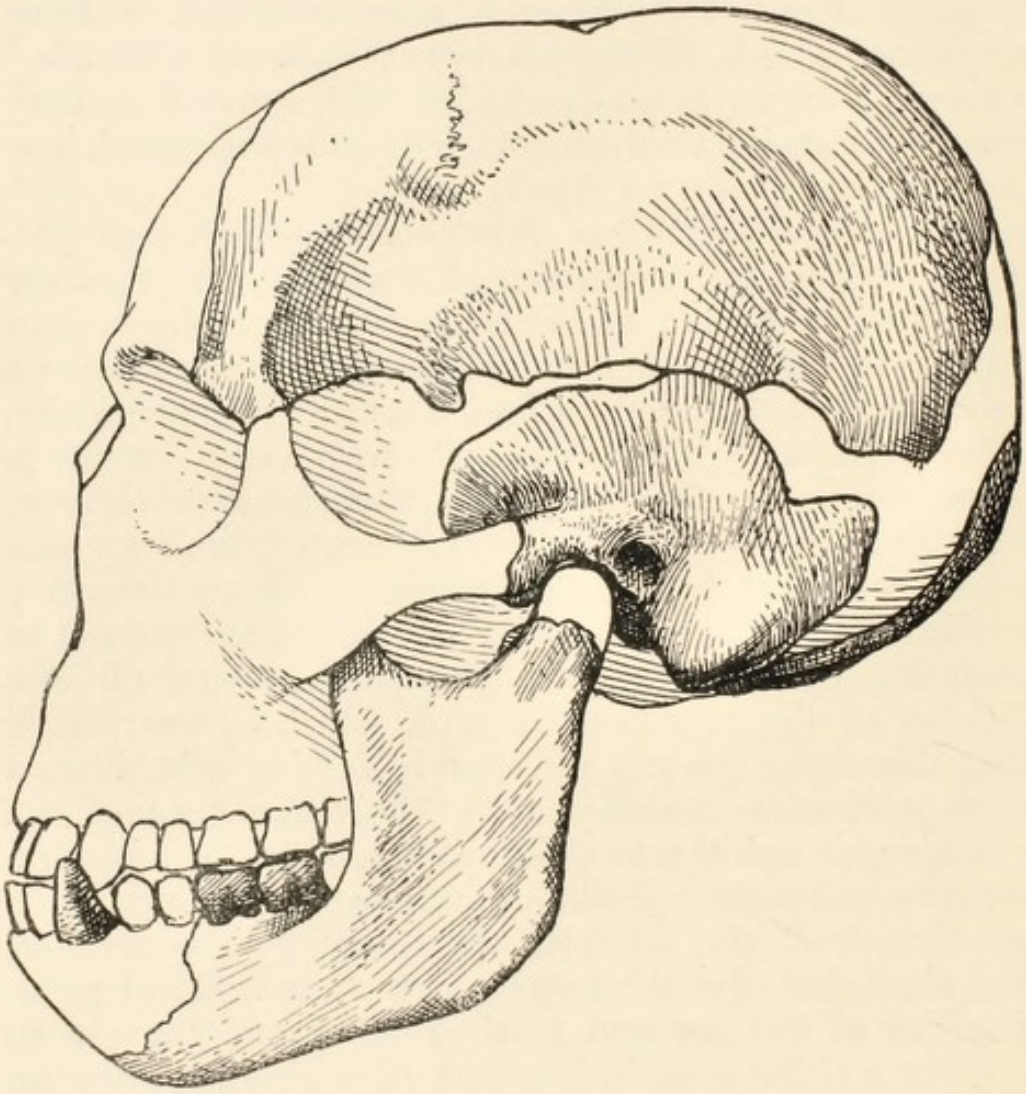

FIGURE 10. Drawing of the left side of Professor John I. Hunter's reconstruction of the Piltdown skull, by L. T. Poulton.

so far as his general appearance and 'build' are concerned, was merely an Ape with an overgrown brain. The importance of the Piltdown skull lies in the fact that it affords tangible confirmation of these inferences.

Not long after the Piltdown race made its way into

England—or according to some writers even before it did so—another member of the Hominidae invaded Germany. All that is known of it is the massive brutal jaw found in the Mauer Sands near Heidelberg. In spite of its antiquity and its large proportions, the form of this mandible, and especially the teeth lodged in it, approximate much more closely to the recognized human standard than do those of *Eoanthropus*.

For a vast span of time after these two divergent human genera left their bodily remains respectively near Piltdown and Heidelberg, nothing whatever is known of the history of mankind except the evidence supplied by innumerable flint implements. When the curtain is rung up again we find Europe in the occupation of the genus *Homo*, though not of our species. For Neanderthal Man was now in possession. What was the fate of *Eoanthropus* and Heidelberg Man is quite unknown. It is claimed by some writers that Neanderthal Man is merely the modified descendant of Heidelberg Man, but the reasons given for this belief are unsubstantial and unconvincing.

It is highly probable that the Neanderthal race entered Europe from Africa by way of the Iberian peninsula.

Somewhere in Africa or Asia it was evolved from the common stock which also gave birth to the men of Piltdown and Heidelberg at a much earlier period.

The large series of skeletal remains that have now been recovered, and in particular the skeleton [1] found in 1908 in a grotto near La Chapelle-aux-Saints by the Abbés A. and J. Bouyssonnie, affords a clear-cut picture of the uncouth and repellent Neanderthal Man. His short, thick-set, and coarsely built body was carried in a half-stooping slouch upon short, powerful, and half-

[1] A masterly account of these remains and their significance has been given by Professor Marcellin Boule in the *Annales de Paléontologie*, 1911, 1912, and 1913. See also his book *Fossil Men* (English translation of *Les Hommes fossiles*), London, 1923.

flexed legs of peculiarly ungraceful form. His thick neck sloped forward from the broad shoulders to support the massive flattened head, which protruded forward, so as to form an unbroken curve of neck and back, in place of the alternation of curves which is one of the graces of the truly erect *Homo sapiens*. The heavy overhanging eyebrow-ridges and retreating forehead, the great coarse face with its large eye-sockets, broad nose, and receding chin, combined to complete the picture of unattractiveness, which it is more probable than not was still further emphasized by a shaggy covering of hair over most of the body. The arms were relatively short, and the exceptionally large hands lacked the delicacy and the nicely balanced co-operation of thumb and fingers which is regarded as one of the most distinctive of human characteristics.

The contemplation of all these features emphasizes the reality of the fact that the Neanderthal Man belongs to some other species than *Homo sapiens*.

Many recent writers have been puzzled to account for the great size of his brain, seeing that the average capacity of the Neanderthal cranium exceeds that of modern Europeans. But, as I shall have occasion to point out later on, the development of the brain of Neanderthal Man was partial and unequal. That part of the organ which plays the outstanding part in determining mental superiority was not only relatively, but actually, much smaller than it is in *Homo sapiens*. The large size of the Neanderthal brain was due to a great development of that region which was probably concerned primarily with the mere recording of the fruits of experience, rather than with the acquisition of great skill in the use of the hand and the attainment of the sort of knowledge that comes from manual experiment.

The discovery of this species thus revealed the former existence of a type of mankind which, in spite of its great size of brain, is clearly on a lower plane than its successors whom it is customary to include within the genus *sapiens*.

The discovery in 1921, at the Broken Hill mine in Northern Rhodesia, of a hitherto unknown species of Man is an event of peculiar importance to the student of the early history of the Human Family and its wanderings. The addition of one more to the two or three species of the genus *Homo* with which we were previously acquainted is in itself a noteworthy incident; but its interest is enormously enhanced by the bizarre features of the newly discovered member of our family, and the fact that the continent of Africa, famous among the ancients as the purveyor of surprises—*semper aliquid novi ex Africa*—has at last begun to reveal some of the secrets of her extinct types of mankind, which she has so closely guarded in the past.

The Broken Hill of Northern Rhodesia has attracted considerable attention during the last fifteen years, in spite of the inaccessibility of the locality, which is some 300 miles north of the Zambezi. Mr. Arthur E. V. Zealley gave an interesting account of the mine and its history to the South African Association for the Advancement of Science in 1912, from which I quote the following statement: 'Few localities in the world can be of such interest to the mineralogist as these remarkable deposits of lead, zinc, and vanadium. The variety and the extreme beauty, no less than the rarity, of several of the minerals render its study immensely attractive, and the unique association of mineralized bones, the implements, and other evidences of human occupation of the caves in the deposit further increase the interest in the mines that have been opened up.'

Nearly fifteen years ago Messrs. F. P. Mennell, E. C. Chubb, and Franklin White called attention in several journals[1] to the evidence of early human occupation afforded by the stone implements and the broken and worked animal bones in the caves. But although hundreds of tons of animal bones had been removed from the mine since then, no human bones were seen

[1] See especially *Geological Magazine* for October 1907, p. 443.

until last summer, when parts of the skeletons of two human beings were found.

Before mining operations began at Broken Hill there stood, on the spot where the open quarry-like excavation is now found, what the Dutch colonists call a kopje (or hillock), nearly sixty feet high, tunnelled from west to east by a natural cave more than 120 feet long, the walls and roof of which consisted of dolomite and silicate of zinc; while on the floor was piled up, to a height varying from four to twelve feet, a vast collection of animal bones, so strongly impregnated with the salts of zinc and lead as to be worth mining. Many hundreds of tons of these bones had been taken out of what for fifteen years has been famous as the 'Bone Cave', and put into the smelters, along with the mineral deposits found in the kopje itself, which has now been demolished; and the excavations had been carried down 90 feet below ground-level. In the course of this work the blind end of the Bone Cave was reached last summer and the human remains found.

If it were not for the fact that originally there had been a cleft in the roof of the cave just above the place where the skull was found, we might have drawn the conclusion that the men or women whose bones were found in the depths of the cave had already met their death before the Hyenas made it a dining-hall and began the accumulation of the vast collection of animal bones, which represents the work of, perhaps, many centuries. But the cleft does leave open the possibility of the human beings having fallen into the cave at a more recent period. However, the fact that all the bones which have been examined represent animals of species that are still alive in Africa shuts out any possibility of determining the age of the human remains. In addition to this, the incrustation of the surface of the human bones with salts of zinc and lead has protected them from the action of the soil, so that, in the strict sense of the term, they are not fossilized. Although the bones are not mineralized or, strictly,

fossilized, the custom of human palaeontologists makes it not incorrect to refer to these bones as 'fossils'. If the investigator is grateful for this protection of the texture of the bony remains, he has to lament the absence of even the slightest indication of their age, which the state of fossilization might have afforded, had the circumstances been other than they were.

The upshot of all this is that the condition of the human remains and the remarkable circumstances under which they were found do not give us a scrap of information as to the date, either absolutely or relatively to other human fossils, when the Rhodesian species of Man lived and became extinct. To determine his place in the Human Family, we are thus thrown back entirely on inferences from the anatomy of the remains themselves.

The bones that have been recovered consist of the almost complete skull (without the lower jaw), a sacral bone and tibia, and the two ends of a femur, and a small fragment of the upper jaw of a second individual of the same type. According to Mr. William L. Harris, a metallurgical chemist employed at the mine, who saw the human remains when they were first brought to light and photographed them in the place where they were found, practically the whole skeleton was discovered, and was encased in a metallic cast of the surface of the body; but the Negro miners destroyed most of the bones and broke up the cast, which would have been a unique and invaluable record of the actual bodily form and proportions of an extinct type of mankind. The skull is that of a comparatively young adult who had suffered severely from dental caries. The form of the sacrum suggests that it formed part of a female skeleton.

It was Mr. Harris, whose account of the Bone Cave and kopje I have quoted above, who communicated to the *Sunday Times* of Johannesburg the first account (September 25, 1921) of the finding of the Rhodesian Man. He also sent to a well-known European Press

Agency his collection of photographs of the skull, and a very lucid and intelligent account of their significance: but it is a dramatic illustration of the lack of knowledge and appreciation of simple anthropological facts, that even so startling an object as the grotesque face of this fossil made no impression on the mind of one of the leading disseminators of information to the world at large; for he returned Mr. Harris's manuscript and photographs, with the comment that he had no use for them.

I have referred especially to this remarkable incident because it helps us to understand the dangers to which priceless remains of early types of Man are exposed, unless by happy chance some enlightened man is on the spot to save them from destruction. For this reason, it is incumbent on those who appreciate the tremendous significance of such relics to neglect no opportunity of educating the public to realize the meaning of human palaeontology, and to understand the importance of rescuing the rare fragments of extinct forms of the Human Family, which may be found by accident, and through ignorance be lost again for ever.

I have already explained that the circumstances under which the Rhodesian remains were found afford no indication, not the merest hint, of their age or the place of their possessor in the Human Family. Any inference that attempts to settle these problems must, therefore, be based upon the features of the bones themselves.

The obtrusive fact, which no one can fail to notice, is the appearance of the face, revealing as it does a form that has never been seen before. It is certainly the most primitive type of face that is known among members of the Human Family. But in making this statement I must guard against a misunderstanding that has repeatedly arisen in the discussion of the Rhodesian skull during the last few weeks. In referring

to it as the most primitive human *face* at present known, I do not mean to suggest that the Rhodesian *skull* is the most primitive type of human being so far recovered. Two members of the Human Family are known from fossilized remains, found in Java and England respectively, which are vastly older than the Rhodesian Man, and so profoundly different from all other members of the family that they are not included in the genus *Homo*—the new genera, *Pithecanthropus* (Dubois) and *Eoanthropus* (Smith Woodward), respectively, having to be instituted for their reception. But the face of neither of these fossils has been recovered, although the possession of the lower jaw of *Eoanthropus* makes it possible for us to restore with confidence the general form of the face.

This, however, does not affect the accuracy of the statement that the Rhodesian skull provides us with the most primitive example of an actual human face—and a most remarkable one it is. It is more definitely primitive and brutal than that of any other human being, living or extinct, that is at present known. The enormous eyebrow ridges are bigger, even, than those of the most archaic member of the Human Family, the Javan Ape-Man; and in the extent and form of their lateral extensions they recall the condition found in Man's nearest simian relative, the Gorilla.

There is no groove at the side of the nose, to indicate the boundary between it and the face, such as one finds in all races of modern men, even in such flat-nosed individuals as the Negro, the Mongol, and the aboriginal Australian. This merging of the nose in the face, to form what, in other animals, would be called a snout, is a peculiarly significant mark of the beast, which is known elsewhere in the Human Family only in the extinct fossil species from Europe known as Neanderthal Man. But the nose of the Rhodesian Man was definitely more ape-like than that of Neanderthal Man. The lateral margins of the nasal aperture extend vertically downward, toward the teeth, as

happens also in the Gorilla, in which this arrangement is associated with the widely outsplayed margins of the nostrils that is so distinctive a feature of Man's nearest simian relative. Perhaps also the Rhodesian Man had a wide nose, in comparison with which the Negro's or the Tasmanian's would seem narrow. Yet the presence of a nasal spine on the Rhodesian jaw indicates that, in spite of the simian resemblances in the nose, it had the distinctively human features of a horizontal edge of the nasal septum and a definite tip to the nose.

Another remarkable feature of the enormous facial skeleton is the vast size of the palate and teeth, and especially the extent of the interval between the nose and the margin of the upper jaw. Although the jaw is so extensive and the teeth so large, the canine teeth did not project in the ape-like manner of those of Piltdown Man (*Eoanthropus*) and the fossilized proto-Australian found at Talgai in Queensland.

The form of the brain-case and the peculiarly distinctive features of the brain that it once contained corroborate the inferences drawn from the face, that the Rhodesian species was the most primitive member of the genus *Homo* at present known, but not the most primitive of the Human Family, which of course includes the vastly more ancient and lowlier genera, *Pithecanthropus* and *Eoanthropus*. The long straight shin-bone and the fragments of the femur afford a very clear demonstration of the fact that Rhodesian Man is separated by a very considerable hiatus from his nearest relative, the extinct European Neanderthal Man. But I must defer the reference to this until a later page.

The bones found in Rhodesia, however, have a far wider and deeper significance to the student of mankind than these statements suggest. The recovery of a long-lost and strangely exotic cousin is an experience that excites our curiosity; and the opening-up of a new

continent for the human palaeontologist awakens visions of what this ancient domain of the Human Family may provide for future anthropologists. But the immediate problems that the study of the features of the skull and limb bones brings up for discussion involve comparisons with all the other types of mankind, and a comprehensive testing of the opinions previously put forward to interpret the significance of all the fossil remains of Man and their bearing on the history and migrations of the Human Family.

A newly discovered species comes to have value and importance only when the effort is made to put it in its proper position in its family, and to determine the part it played and the light its structure and associations throw upon mankind as a whole. In an attempt such as this to interpret the significance of the new discovery, it is necessary, above all else, to define this setting — our present knowledge of the family circle of the *Hominidae* into which a long-lost cousin has to be introduced and assigned his appropriate place. Hence the discussion of the significance of the newly found fossil must inevitably involve some reference to the history of mankind as a whole.

The few broken fragments of these extinct members of the Human Family which have so far been recovered probably represent only a small minority of the many experimental types discarded by Nature before she succeeded in fashioning the supreme species capable of outstripping the rest in the competition for intellectual supremacy. Without undue modesty, we who belong to that species have labelled it *sapiens*.

The vast continents of Africa and Asia represented (or perhaps it would be more correct to say that one or both of them included) the domain of Primitive Man during the early history of the Human Family, and the laboratory in which, for untold ages, Nature was making her great experiments to achieve the transmutation of the base substance of some brutal Ape into the divine

form of Man. Until the Rhodesian remains came to light, no fragment of an extinct type of Man had come from Africa; and Asia had provided, from Java—which, at the end of the Pliocene Period, was the extreme south-eastern corner of the vast continent—the fragments of one skeleton, *Pithecanthropus*, the most archaic member of the Human Family. But no trace whatever of human remains has yet been found in the central Afro-Asiatic area, the real cradle of the family.

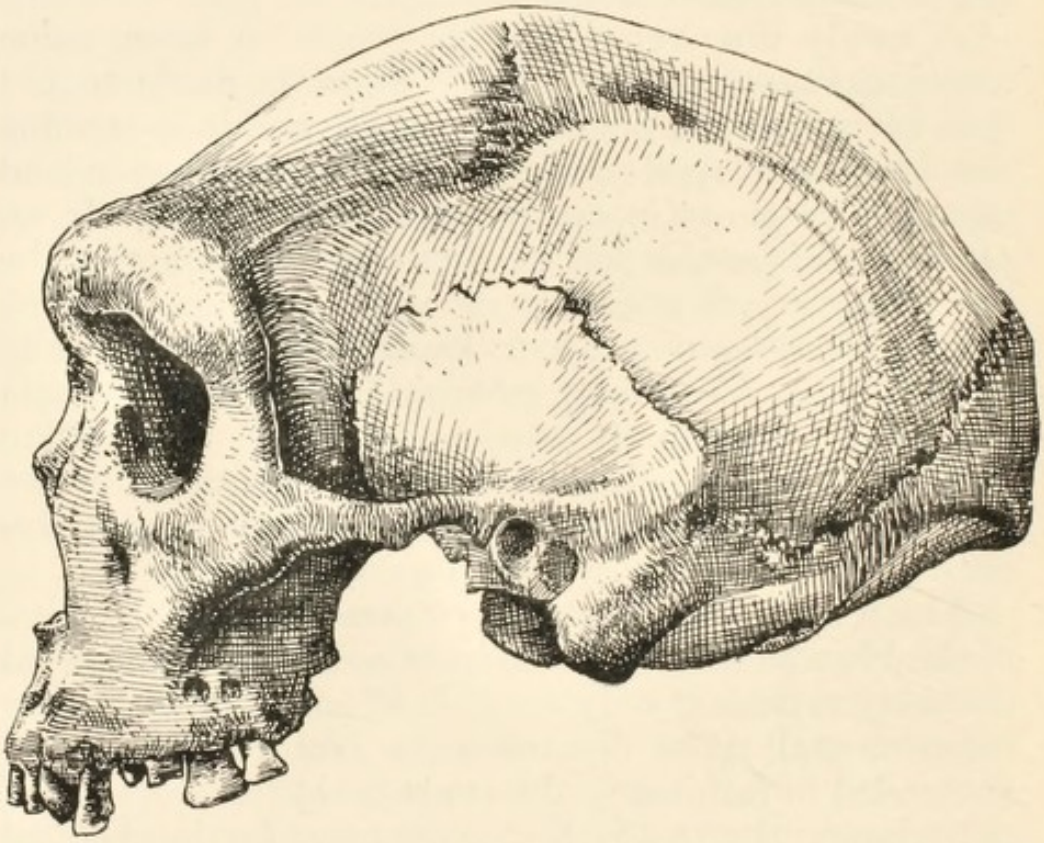

FIGURE 11. Left side of Rhodesian skull, drawn by T. L. Poulton.

Only the broken fragments swept out to its periphery, Far-Eastern Asia, South Africa, and Western Europe, have so far been recovered, to give us some slight clues as to what was happening in the really vital spot.

The vast geographical area that separates Java from Europe, and the incalculable span of time that intervened between the epochs of *Pithecanthropus* and the fossil men of Europe, represent a tremendous hiatus in the early history of the Human Family. Behind the veil

of all these hidden centuries, it is well within the bounds of reasonable conjecture to picture the wide stretch of Southern Asia and Africa as peopled by a variety of weird caricatures of mankind, roaming far and wide to satisfy their appetites and avoid extinction. In this competition, the distinctive characters of Man were fashioned in the hard school of experience. All that we can learn of the tremendous drama that was being enacted in this laboratory of mankind is based on inferences from a skull-cap and femur from Java, a skull and tibia from Rhodesia, and an assortment of bones from Western Europe!

But if we know nothing of the wonderful story of Man's journeyings toward his ultimate goal, beyond what we can infer from the flotsam and jetsam thrown upon the periphery of his ancient domain, it is essential, in attempting to interpret the meaning of these fragments, not to forget the great events that were happening in the more vitally important central area—say from India to Africa—and whenever a new specimen is thrown up, to appraise its significance from what we imagine to have been happening elsewhere, and from the evidence it affords of the wider history of Man's ceaseless struggle to achieve his destiny.

Nature has always been reluctant to give up to Man the secrets of his own early history, or, perhaps, unduly considerate of his vanity in sparing him the full knowledge of these less attractive members of his family, who too obviously retained the mark of the beast.

Thus, during the thousands of years after the members of our species came into being, they remained in ignorance of the fact that, before the species *sapiens* emerged, the earth was occupied by other species and other genera of mankind. In fact it is only seventy-six years since the first fragment of one of these other species was found at Gibraltar; and not until many years afterward was the momentous significance of this discovery appreciated.

The recovery at La Quina of a female skull, not only

of the same species, but also of the same race, as the Man from the Neanderthal cave, shows that the difference between the La Quina and the Gibraltar women is something more than a mere sexual distinction. For there is a marked contrast between the forms of the two female skulls from La Quina and Gibraltar respectively, and the latter is definitely the more primitive of the two. But there is no justification for reviving the old and discarded name *Homo calficus*, suggested by Falconer, or for following the Italian anthropologist, Sera, in regarding the Gibraltar woman as the sole representative of a species distinct from (and more primitive than) the true Neanderthal species. It is more in accordance with the evidence to regard the Gibraltar fossil as a member of the Neanderthal species, but as belonging to a different and more primitive race (the Calfic) of that species.

I have entered into this question because the fact of the discovery of the most primitive member of the Neanderthal species at the very threshold of Europe, near the chief gateway from Africa, is not without significance in the discussion of the Rhodesian skull, the possible affinities of which to the Neanderthal species is now the subject of controversy among anthropologists.

The outstanding feature of the Rhodesian Man's traits is the suggestion of a half-developed Neanderthal Man, with some of his peculiarities grossly exaggerated, while others are lacking, or replaced by primitive features that more nearly approach the type of modern man.

When Charles Darwin discussed the evolution of Man, he was inclined to regard Africa as the likeliest place for the original home of mankind. It is generally recognized that the two African Anthropoid Apes, the Gorilla and the Chimpanzee, are more closely akin to the Human Family than the other anthropoids, the Orang and the Gibbon, whose geographical domain is now restricted to the Far East; and it seemed to be

more likely than not that, in the migrations of Man's nearest relatives from their birthplace, perhaps in Northern India, ancestors of the Human Family may have accompanied those of the Gorilla and Chimpanzee when they made tropical Africa their home. These, however, are mere conjectures which future discoveries may or may not confirm. But with regard to the Anthropoid Apes themselves, the fossil remains of the little *Propliopithecus*, found in the Egyptian Fayum ten years ago, reveal the fact that, ever since the Anthropoid Apes first came into existence (probably at the end of the Eocene Period), Africa has been a part of their domain, if it was not their original home.

I call attention to these considerations, to suggest that the evidence now at our disposal affords some slight justification for the speculation that Africa may have been the area of characterization, or, to use a more homely phrase, the cradle, both of the Anthropoid Apes and of the Human Family. In any case, it is probable that Africa played an important part in the early history of Man and his ancestors.

But hitherto no fossilized remains of early types of Man have come to light in Africa, to substantiate these assumptions. Some months before the declaration of war in 1914, the announcement was made of the finding of a fossil human skull at Oldoway, in what was then German East Africa ; but from the imperfect accounts that have so far been given it seems that this type of Man does not differ from the African Negroes of the present time. A much more important discovery of fossilized human remains was made a year earlier (in 1913) at Boskop in the Transvaal. The Boskop Man cannot be regarded as a member of any of the races still living in Africa ; but he belongs quite definitely to the species *Homo sapiens*, and in some respects is akin to the earliest members of that species found in Europe, often called the Crô-Magnon race.

Investigation of the extinct peoples of Europe has directed attention to the probability that the earliest

members of the Human Family found in Western Europe must have come there from Africa.

For various reasons, in addition to the fact that the Bushmen, Hottentots, Pygmies, and other Negroes are among the most lowly races of mankind, Africa is eminently the place where one might expect to discover the remains of still more primitive types of the Human Family.

The peculiarities of the Rhodesian discovery are not exhausted by the statements that the skull reveals a hitherto unknown type of face and skull, and represents the first traces of a species other than *Homo sapiens* from Africa. For the circumstances under which they were found, and the condition of the remains, are altogether different from those of any of the other famous discoveries of fossilized remains of Man. The peculiarities of these circumstances I have already explained.

The claim that Rhodesian Man is more primitive than Neanderthal Man does not necessarily imply that the individual whose remains were found at the Broken Hill mine was alive in the remote times of the Glacial Epoch in Europe or had not survived to a period ages later than the period of the fossil men of Gibraltar, Neanderthal, and the Dordogne Valley. The animals with which Neanderthal Man was associated in Europe became extinct there when that type of Man disappeared from Europe: but many animals closely akin to them are still living in Africa; and it is quite conceivable that an early type of Man also may have survived in Africa, as the Elephants, Rhinoceroses, Hippopotamuses, and Hyenas have done, for many centuries after their European relatives had been wiped out of existence. It may have happened that the Rhodesian species lived on in South Africa, free from human competition, until the Boskop race, or the ancestors of the Bushmen, made their way down the Dark Continent.

So far, I have referred only to the face of Rhodesian Man, and the very positive evidence it affords of the primitive (that is, definitely pre-Neanderthal) type. It has been claimed that such an inference is rendered untenable by the characters of the brain-case and the leg bones. Let us consider the question thus raised for discussion.

In many respects the features of the skull more closely resemble those found in *Homo sapiens* than those of *Homo neanderthalensis*. Hence certain distinguished authorities have suggested that Rhodesian Man is later than Neanderthal Man, and intermediate in type between the other two species. Even if the primitive characters of the face of the Rhodesian skull were not fatal to such an argument, it would not be convincing, because it does not take into account the fact that, in many respects, the skull of Neanderthal Man is highly specialized and farther removed from the primitive condition than modern Man's skull is. The particular features of resemblance of the Rhodesian and modern skulls are precisely those primitive features which the Neanderthal Man lost through too early specialization. Just as the Gorilla and the other Apes became differentiated from Man's ancestors by too hastily adopting specializations of habit and structure, which destroyed many primitive features retained in the living members of the Human Family, so the dominant species of the latter has retained many primitive characters that were modified or lost by his unsuccessful Neanderthal cousins. But the possession of such traits by the more primitive members of the family does not mean that the latter are post-Neanderthal in time and development. Its significance is quite the reverse : these primitive characters have been lost by Neanderthal Man, never to return, either in them or any forms derived from them.

But, quite apart from this consideration, the brain-case of the Rhodesian skull does retain a number of characters definitely more primitive than those of either *Homo sapiens* or *Homo neanderthalensis*. This is

not the place to discuss the technical details of these anatomical features, which are most strikingly displayed in the architecture of the base of the skull. But there is one aspect of the study of the brain-case to which attention must be called, because it is of fundamental importance in the interpretation of Rhodesian Man's peculiar significance. The skull provides precise information concerning the size and general form of the brain and its various parts, which has a very direct bearing on the determination of the rank of its possessor in the hierarchy of the Human Family.

No one who has seen the cast of the interior of the brain-case, and is capable of interpreting its obtrusive peculiarities of form and proportions, could have any hesitation in deciding that *Pithecanthropus* was truly a member of the Human Family, if a very lowly one. The capacity of the brain-case of the Javan specimen was probably about 950 cubic centimetres (that is, about 100 cubic centimetres greater than Professor Dubois's estimate), which brings it within the range of variation even of *Homo sapiens*; whereas 650 cubic centimetres is the biggest record for an Ape, even of a Gorilla twice the body-weight of a human being.

The endocranial cast of *Pithecanthropus* reveals a localized and precocious expansion of those areas of the brain which we associate with the power of articulate speech, that is, ability to appreciate, in a far greater degree than other animals are capable of, the auditory symbolism of sounds, and to reproduce them as a means of communication with its fellows, not merely as signals expressive of emotional states, such as most animals can impress upon one another, but also as the means for transmitting information and ideas, and attaining the communion of knowledge and belief that is Man's exclusive prerogative. There are grounds for believing that the acquisition of true articulate speech was one of the essential factors in the emergence of Man's distinctive characters; and the form of the endocranial cast of *Pithecanthropus* suggests that the

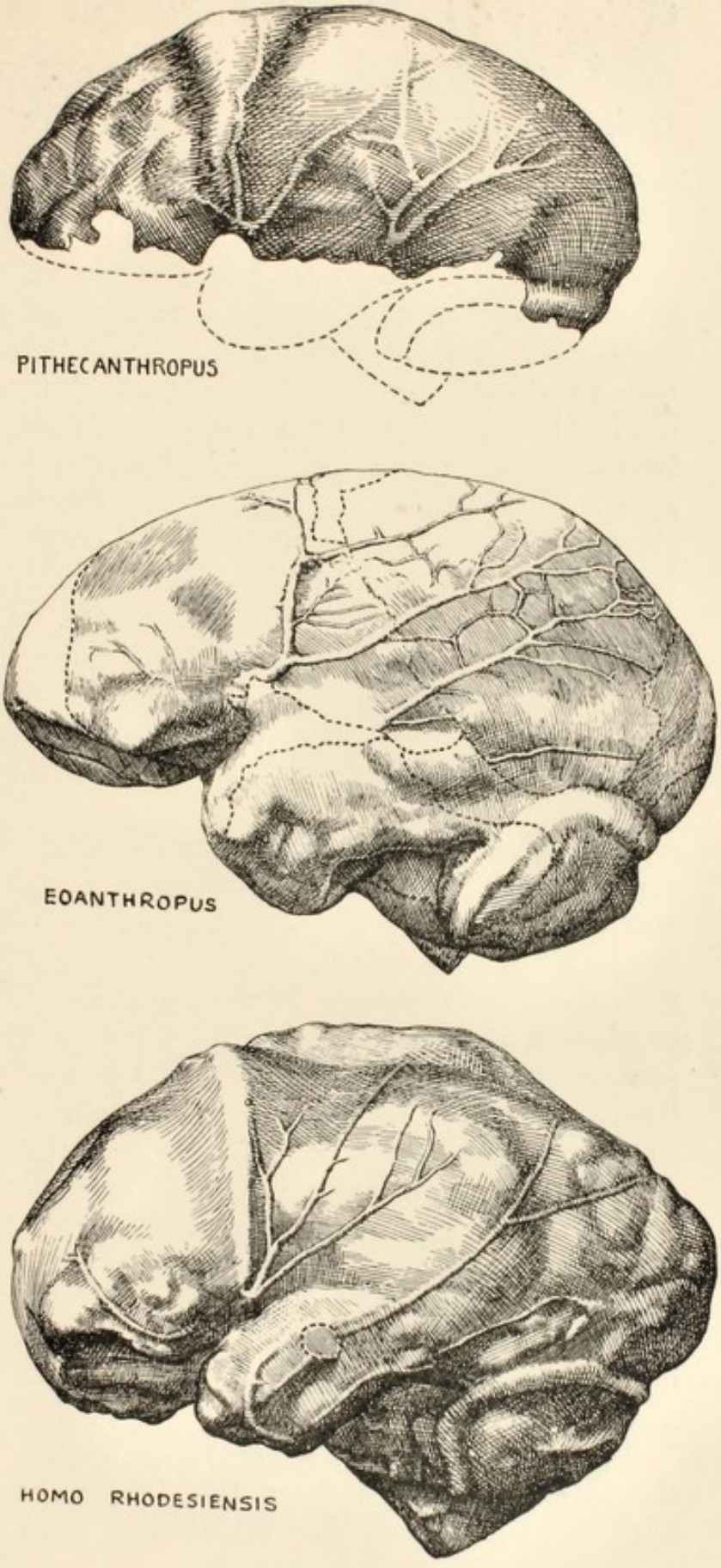

FIGURE 12. Endocranial casts of the three most primitive members of the Human Family, drawn by T. L. Poulton, to indicate that the newly expanded cortical areas are those which are most feebly developed in the primitive type of Man and undergo progressive expansion.

Javan Ape-Man possessed this hall-mark of human rank, and the right to be included in the Human Family.

The same distinctive features are recognizable also in the somewhat larger endocranial cast of the Dawn-Man of Piltdown. The peculiarities of the brain of Rhodesian Man can best be summarized by the statement that it is intermediate in type between those of the Piltdown and of the Neanderthal men. It is distinctly larger than the former, but smaller than the latter. The process of development revealed by comparing the endocranial cast of the Piltdown skull with that of *Pithecanthropus* is carried a stage farther in the Rhodesian brain. The expansion has involved other areas; but there are still territories in the upper parietal, prefrontal, and inferior temporal regions of the Rhodesian brain which are singularly ill-developed as compared with the corresponding parts of the brains of either the Neanderthal or the modern species of Man.

It is of special interest to note that the defective areas of the brain are those parts which attain their maturity latest in the developmental history of the modern human infant, and are especially associated with the discrimination of the form, weight, and texture of objects as they appeal to the sense of touch, with the power of learning highly skilled movements with the hands, and, in a general sense, with the higher intellectual functions. The part of the brain which has been found to be highly developed in several modern men distinguished for musical genius is remarkably small, and simply folded, in the Rhodesian brain. This brain, in fact, was deficient in those parts by which the degree of foresight, discrimination, and refinement of modern men is determined and made possible.

The evidence afforded by the brain thus corroborates the inference drawn from the peculiarities of the face and the skull, that the Rhodesian Man conforms to

a type definitely more primitive than that of the Neanderthal species.

But there is one feature of the remains found at Broken Hill that has raised some doubt as to the correctness of this inference. The leg bones found with the skull are longer and straighter than the corresponding bones of members of the Neanderthal species. The short, thick, and curved leg bones of Neanderthal Man, which indicate this ungainly type of mankind with a shuffling gait and bent knees, are often regarded as survivals of Man's more simian ancestors. The condition of the neck vertebrae and the skull of Neanderthal Man corroborates the conclusions drawn from the leg bones; for they complete the picture of the slouching bodies by showing that the head was thrown forward on the thick massive neck. Instead of being truly erect, the body was carried in a stooping attitude, the line of the back passing, by a gradual curve, along that of the neck to the brutal flattened head.

The length and straightness of the Rhodesian leg bones and the features of the base of the skull have been claimed as evidence that the Man of Broken Hill walked upright, and had therefore lost the mark of the Ape which survived in Neanderthal Man's posture. If the Rhodesian Man has really lost this simian trait, which Neanderthal Man has retained, how, it may be asked, can the former be regarded as a more primitive type than the latter? Is Dr. Smith Woodward right in claiming that the Rhodesian Man walked erect, and represents a phase of evolution later than the Neanderthal type? These are the problems that have to be threshed out during the coming months. All that I need say on the matter now is, first, that the base of the skull (and especially the position of the *foramen magnum*) is not in such close agreement with that of modern Man as has been supposed; and, secondly, that the leg bones present peculiar features which differentiate them from those both of modern Man and Neanderthal Man.

In the discussion of this extremely difficult and highly

technical problem, the question of the significance of the thigh bone found along with the skull-cap of *Pithecanthropus* will have to be threshed out once more. If the leg bone found in the same formation as the skull at Trinil really belonged to *Pithecanthropus*, and the specific name *erectus* given to the Javan Ape-Man by Professor Dubois is a correct description of its posture, the recognition of this fact will have a very direct bearing on the estimation of the significance of the Rhodesian Man's posture. For, if the most ancient and primitive member of the Human Family walked erect, the (assumed) erectness of Rhodesian Man cannot be fatal to the claim to regard him as primitive. In the meantime, the evidence provided by his face, brain-case, and endocranial cast, seems to me to point conclusively to the fact that, in the bones found in the Broken Hill mine, we have the remains of a type of mankind definitely more primitive than all the known members of the Human Family, with the exception only of *Pithecanthropus* and *Eoanthropus*, from Java and Piltdown respectively.

The Rhodesian remains have now found a resting-place, beside those from Piltdown, in the Natural History Department of the British Museum at South Kensington; and under the competent direction of Dr. Smith Woodward the difficult problems which will arise in the investigation of their anatomical features, and the interpretation of their significance, will be accomplished with care and sobriety of judgement.

Although the actual bony remains of the Neanderthal species of Man were unknown before 1848, their handiwork—the rough implements of stone made by these men and their predecessors—had been the subject of much discussion before then. As long ago as the year 1690 a flint implement was found along with a Mammoth's tooth in the course of excavations in Gray's Inn Lane in London. Many other implements associated with the bones of extinct Mammals

and Men were found between then and 1847, when M. Boucher de Perthes published an account of the rude flint implements found by him in the ancient river gravels of the Somme, which claimed that these weapons had been fashioned by men who were contemporaries of the Mammoth in France and Britain.

But it was only after ten years of vigorous controversy, and in the face of the most strenuous opposition, that M. Boucher de Perthes gained recognition for the claim for which earlier pioneers, from the closing years of the eighteenth century onwards, had been unable to gain acceptance. In course of time the flint implements were classified: and in 1869 they were arranged by Gabriel de Mortillet into a chronological sequence, the different groups of which were named from the places where the representatives of each were first found and defined—from Chelles, near Paris, Saint-Acheul, at Amiens, and Le Moustier, near the Vézère, just as those of the Upper Palaeolithic, as has already been pointed out, received their distinctive titles from the grotto of Aurignac, from Solutré, the rock-shelter of La Madeleine, and finally the cavern of Mas-d'Azil in Ariège. However, the so-called Azilian Period, named after the latter place, is, I think, merely the first stage of the Neolithic Culture-epoch.

After Édouard Lartet had laid the foundations of the classification of the stone implements of the Quaternary Period, Sir John Lubbock (afterward Lord Avebury) in 1865[1] suggested the use of the term 'Palaeolithic Age' to distinguish the period when rough stone implements (*de la pierre taillée* of French writers) were made in Western Europe, and the term 'Neolithic Age' for the period when polished implements (*de la pierre polie*) were fashioned.

These terms were suggested at a time when little was known of the early history of Man except such evidence as his stone implements provided, and for

[1] *Prehistoric Times*, p. 60.

half a century they have been of considerable service. Since then a great deal of information has been acquired of the remains of the actual makers of such implements and of their achievements other than mere flint-knapping. As the result of this fuller knowledge it is coming to be recognized that the use of the terms 'Palaeolithic Age' and 'Neolithic Age' is fruitful of misunderstanding. If these expressions were used merely with reference to the stone implements themselves and to the area of Western Europe they would still be misleading, though perhaps not so seriously as they are now. But even if the confusing chronological implication and the obvious disadvantage of defining stages of culture by one class of local evidence alone be put upon one side, there is the still more fundamental objection that the great cultural break in Western Europe itself (and even in its flint work) did not fall between the so-called Palaeolithic and Neolithic Ages, but between the Lower and the Upper Palaeolithic Periods.

There is a much closer kinship between the flint-work of the so-called Upper Palaeolithic and the Neolithic Ages than there is between the former and that of the Lower Palaeolithic Period.

Not only so, but a whole series of other industries of the Upper Palaeolithic Period, new methods of stone work, modelling, painting, and other kinds of artistic work, reveal the modern spirit of Man in a manner which is unknown in the Lower Palaeolithic. But what is more important still, men of the modern type, undoubted members of our own species, *Homo sapiens*, came upon the scene in the Aurignacian Period (the commencement of the Upper Palaeolithic), and replaced *Homo neanderthalensis* of the Mousterian Period.

Thus the new spirit of Man and modern Man himself are revealed in the Upper Palaeolithic Period. This *Neoanthropic phase*, as I have called it,[1] begins

[1] 'Men of the Old Stone Age', *American Museum Journal*, vol. xvi, May 1916, p. 325.

in the Aurignacian Period and includes all the subsequent epochs of Man's history.

The term 'Palaeolithic' has become so ambiguous and misleading that it would make for clearness and accuracy if it were wholly discarded. The various subdivisions of mankind who lived in the so-called 'Lower Palaeolithic Age' have their own distinctive names, *Eoanthropus*, *Homo heidelbergensis*, and *Homo neanderthalensis*, as also have the different categories of implements, Chellean, Acheulean, and Mousterian.[1] The latter might be referred to collectively by the term 'Protolithic', suggested by Mr. A. G. Thatcher,[2] or the whole group of men and their phase of culture as 'Palaeanthropic'.

Much of the ambiguity that results from the application of the term 'Palaeolithic' to the Aurignacian, Solutrean, and Magdalenian phases of culture is avoided by French writers, who often speak of these three periods in French history as the *Age* or *Époque du Renne*. The confusion that is introduced into the consideration of these problems, especially by English writers, is nowhere revealed so emphatically as in the discussion of the question whether or not 'Palaeolithic Man' is still in existence. Such references are intended, as a rule, to mean only men of the Reindeer Epoch, but many people, not excluding even scientific writers, often become confused and interpret the term 'Palaeolithic' as a reference to Neanderthal Man, whose extinction is not in question.

There are many indications that the phases of culture of the Reindeer Period in Europe which are distinguished respectively by the terms Aurignacian, Solutrean, and Magdalenian, cannot be regarded,

[1] It must not be supposed, however, that, except in the case of Neanderthal Man, who made Mousterian implements, there is any close relationship between the other two human varieties and the two industries.

[2] *Science Progress*, January 1917, p. 477.

although so many writers tacitly and I think erroneously make the assumption, as epochs in the history of mankind as a whole. Even in Europe itself the limitations to the application of these terms are clearly shown. Into Italy, Southern Spain, and the greater part of the Mediterranean area it is now generally admitted that the Solutrean and Magdalenian industries did not make their way. Hence these regions remained in the Aurignacian phase, while Western and Central Europe were passing successively through the Solutrean and Magdalenian stages of culture. Thus the Mediterranean lands as a whole passed directly from the Aurignacian stage to the Neolithic, or to its inaugural phase, which is now known as Azilian.

These facts serve to emphasize how confusing is this use of the word 'Age'. They also reveal how devoid of foundation is the mis-named 'evolutionary' theory that claims all these phases of culture as so many natural stages through which every people has passed in virtue of the operation of the blind forces of an arbitrary and inevitable process of evolution. The fact that the greater part of the Mediterranean area seems to have escaped typical Solutrean and Magdalenian stages becomes all the more significant when it is recalled that the industries which attained such a remarkable pitch of excellence in Predynastic Egypt were essentially Solutrean [1] in character.

The Solutrean industry is generally believed to have made its way into Europe from the neighbourhood of the Black Sea. After a short time, it was driven out of Europe again by the Magdalenian culture, which shows no affinity to the Solutrean, but is apparently related to the Aurignacian culture. We know nothing of the physical characteristics of the people who introduced the Solutrean industry into Europe. But although their methods of stonework endured only for

[1] See L. Capitan, 'Origine et mode de fabrication des principaux types d'armes et outils en pierre', *Revue Anthropologique*, January 1917; also Sollas, *op. cit.*, and Déchelette, *op. cit.*

a very brief time in the west, they spread in other directions to the uttermost parts of the earth, to South Africa, Australia, and America (Capitan, *op. cit.*, Sollas, p. 437), where they have persisted with remarkable constancy and attained to a pitch of excellence which is exceeded only by that of Predynastic Egypt.

Wherever the home of this industry may have been, it is quite clear that it must have been the source of the inspiration of Egypt's early industry.

Remembering the fact that the climate of Europe, which in the 'Reindeer Age' had been very cold, became more genial toward the end of the Magdalenian, and in fact settled down to the sort of conditions that have prevailed ever since, it is important to bear in mind that there was also a great change of climate in Egypt[1] not long before the settlement of the Predynastic people in the valley of the Nile. No doubt the people who dwelt in the forests which then existed east of the Nile were making implements of Solutrean type. Egypt and East and South Africa must have acquired this industry from the same source. It is equally certain that in the Neolithic implements of Europe is revealed still further evidence of the influence exerted by the Solutrean industry, not locally in Europe, but in some other region where the new development was in more or less intimate relationship with the phase represented in Predynastic Egypt.

The terms 'Neolithic Age' and 'Neolithic phase of culture' cannot be used without ambiguity except with reference to Western Europe. But if the adjective Neolithic be interpreted as defining a particular method of chipping and polishing stone, it can legitimately be used in the wider sense in which so many writers erroneously employ the phrases to which I have just objected.

It must be remembered that the term 'Neolithic Age' is usually interpreted as meaning a definite

[1] This information was given me some years ago by Dr. Hume, Director of the Egyptian Geological Survey.

period in history when men first began (*a*) to shape their stone weapons by polishing them, without however giving up the practice of chipping; (*b*) to domesticate animals; (*c*) to cultivate cereals and fruit trees; (*d*) to erect megalithic monuments; (*e*) to make pottery; (*f*) to weave linen; and (*g*) to give definite evidence of religious beliefs and a funerary cult.[1]

Many writers divide the so-called 'Neolithic Age' into a series of stages of which the 'Megalithic' is the last, and the earliest that of the 'Kitchen-middens', when most, if not all, of the distinctively Neolithic features were absent. Now it is generally recognized that, except in Western and Northern Europe, megalithic monuments are found in association with the 'Ages of Metal', Copper, Bronze, or Iron, in different areas. Hence their inclusion within the Neolithic culture-complex is not only confined to Western Europe, but also implies that the latter part of the so-called Neolithic 'Age' there is at least as late as the Bronze Age in the East. Nor is the domestication of animals and the practice of agriculture necessarily connected with the manufacture of flint implements of Neolithic type. In fact, polished flints are found in use among many peoples who have no domesticated animals, except the dog, and do not cultivate cereals. In other words, the Neolithic culture in Europe is compounded of a number of implements which are found in other parts of the world dissociated the one from the other, and each of them linked on to other culture-complexes which belong to totally different 'Ages' in Europe.

During the last half-century there has been a vast amount of discussion as to whether or not there was a hiatus between the so-called 'Palaeolithic' and 'Neolithic' Ages. But if the whole of the evidence that is now available is viewed in proper perspective it is clear that this question has loomed so large

[1] Déchelette, *Archéologie préhistorique*, p. 311.

mainly because Lubbock's terminology was responsible for magnifying into a vast revolution what is really a relatively insignificant incident in the history of Man in comparison with the real revolution in Europe when the more nimble-witted *Homo sapiens* replaced the inferior type of *Homo neanderthalensis*, whose mere brute-strength was not sufficient to protect him from extinction. In the later stages of the so-called 'Palaeolithic Age' there were many movements of varied peoples in Europe presenting in greater or less degree affinities to the populations of the so called 'Neolithic Age', both in physical structure and in their industries. Whereas they were succeeded by another series of peoples, some or all of which are included by various authorities in the 'Neolithic Age', although they had not yet acquired many, or indeed most, of the arts that are regarded as distinctive of Neolithic culture. Thus the much-discussed 'hiatus' disappears. If the Neolithic and later phases of the whole of the so-called 'Upper Palaeolithic Epoch' are linked together so as to include the whole of the history of *Homo sapiens* in a Neoanthropic Age, it will then be possible to examine the great events of the history of our own type of mankind without prejudice and bias.

From the time of the advent in Europe of men of the Crô-Magnon type, bringing with them (probably via the North African littora from the East) the germs of the culture now called Aurignacian, there has been a series of waves of immigrants reaching Western Europe by the most varied routes, and introducing from time to time new elements of culture. The study of the history of this early civilization of Europe reveals incidents which, though the merest commonplaces of more recent history, have been a never-ending source of difficulty to many who have discussed the Reindeer Age in Europe. I refer to the decadence and replacement of arts and industries. It has been clearly demonstrated in the case of ancient Egypt that, with the development of the art of making

stone vases, there was a pronounced falling-off in the potter's skill, and with the introduction of the use of metals an equally marked decadence in the working of flint. No doubt this was due partly to the fact that the most skilled artists and artisans devoted themselves to the new crafts and that their patrons wanted the more fashionable and the more durable objects. But the same principle is witnessed at every stage in the early history of Europe. In the Magdalenian phase, during which a multitude of new arts came into being, and the skill of the fresco-painter and modeller attained to a pitch of excellence far surpassing that of his predecessors, there was a most pronounced decadence in the workmanship of the flint-knapper, who in the Solutrean phase had become so deft an artist. So again in the Neolithic phase, when the crafts of the potter, the agriculturist, the weaver, and the cattle-breeder were first introduced, there seemed no longer to be any demand for high art, nor indeed any evidence that there was any of the feeling that prompted the masterpieces of the Magdalenian painters. But these fluctuations of skill and interest must not be attributed wholly to the reasons suggested by the Egyptian analogies. In Western Europe, not only did the centre of interest change from time to time, but also the people themselves. In Magdalenian times new immigrants came in with their own interests to cultivate. They had no reasons for acquiring those arts in which their Solutrean predecessors were pre-eminent. So again in the Neolithic Age a succession of new waves of population intruded from time to time, each bringing some new contribution to the growing civilization, some newest fashion upon which the attention of the community would for a season be concentrated. Thus the early history of Europe becomes intelligible if we bear in mind what is happening to-day.

This is one more illustration of the fact that the spirit of Man is the same in every age, and that much of the difficulty in interpreting the 'Stone Age' dis-

appears if it be remembered that changes were brought about then in much the same way as is happening now.

So far as I am aware, no one entertains the view that Man was evolved in Europe. Moreover, in the opinion of most serious investigators, the evidence in support of the theory that all the known early races of Men, those of Piltdown, Heidelberg, Neanderthal, and Crô-Magnon, and the various peoples who intruded into Europe until the Neolithic phase of industry came into existence, were each of them immigrants who had acquired their distinctive features and the germs of their culture elsewhere. In other words, there is nothing to suggest that the evolution of one type from another occurred in Europe.[1] But although most scholars do not hesitate to accept this conclusion when the question is put to them categorically, nevertheless few writers wholly rid themselves of the bias or the tacit assumption that the successive series of races and industries revealed in Europe represent an orderly procession of evolutionary changes. It is of the utmost importance deliberately to set aside this assumption, which in the past has been so fruitful of ambiguity and confusion.

The profound contrast between the physical characters and technical achievements of the Neanderthal and Crô-Magnon peoples, and the sudden appearance of the latter in Europe, justify the conclusion that the newcomers were not evolved there from their predecessors. The two species represent divergent offshoots from the common stock of the genus *Homo*, which acquired their distinctive features and their initial cultural equipment somewhere beyond the limits of Europe.

It must not be supposed that, when the Crô-Magnon race came into existence and wandered west into Europe,

[1] M. Déchelette is one of the few serious upholders of the local evolution theory; or, perhaps it would be more correct to say, of the refusal to admit a series of waves of immigrants. *Archéologie préhistorique*, p. 312.

it was the only representative of the species *sapiens* then alive. It is not only probable, but quite certain, that before then many other varieties must also have been budded off the common stem of this species and scattered in other directions. For there is a large series of other types, some of them definitely more primitive than the men of Crô-Magnon, which never came into Europe. Others again did not reach Europe until the commencement of the Neolithic phase of culture had developed. The ancestors of the aboriginal Australians, while conforming in certain essential respects to the type of modern Man and being unquestionably members of the species *sapiens*, also present a number of primitive structural features that suggest affinities with the species *neanderthalensis*. I venture to suggest that these facts can be explained only by the assumption of the early origin of the Australian. At a time when the species *neanderthalensis* and *sapiens* had recently become specialized along their distinctive lines, no doubt both retained a good many features in common that were also shared by the parent stock from which both had sprung. In course of time many members of both phyla became profoundly modified. The great expansion and specialization of the brain of Neanderthal Man, and the far-reaching transformations in the structure of most members of the species *sapiens*, afford ample evidence of this. But the retention of so many primitive features in association with Neanderthal characters as the aboriginal Australian presents can only mean that in that race is revealed the persistence of the earliest features of the species *sapiens*, with certain relatively unimportant specializations which have since been acquired.

The hypothesis which is involved in the application of the unfortunate term 'Caucasian' to the Australians shows a lamentable lack of perspective on the part of those anthropologists who use this expression.

When the easterly migration of these most primitive

representatives of our own species began is quite unknown. The recent discovery at Talgai, in Queensland, of the fossilized remains of a human skull reveals the fact that the earliest known Australian, who probably reached the island continent when the great extinct Marsupials were still living, presents the distinctive traits of the modern Australian, in association with even more primitive features in the teeth and jaws than his modern successors. But the fact that he was probably accompanied by his Dogs suggests that his easterly migration set out from Asia approximately at the same time as the westerly movement of the much more favoured branch of the species *sapiens* which introduced the Neolithic culture into Europe. Of course the movement may have begun long before this and for some reason the arrival of the domesticated Dog in Europe may have been delayed. If the practice of mutilating the hands and recording impressions of them upon rocks was introduced into Australia by the earliest immigrants—which of course there is no warrant for assuming—it is important to remember that this curious procedure was brought to Europe by its earliest colonists of the species *sapiens*, the men of the Aurignacian phase of culture.

The fossil skull recently discovered at Boskop in the Transvaal is an example of another diversely specialized, but probably much later, branch of the species *sapiens*, which wandered as far as South Africa. It is much more nearly akin to the Crô-Magnon group than the Australians are, but it also presents certain features (not those, however, to which I have referred in the case of the Australians) that are distantly reminiscent of the Neanderthal Race.

When and how the diversely specialized Negro and Mongolian races came into existence is quite unknown.

Two of the races of which the modern population of Europe is compounded—the Brown Race of the Mediterranean Area and the western Littoral, and the Blond Race of the Baltic—reveal evidence of

affinities with the earlier Crô-Magnon series of waves of immigrants, more especially those of the Magdalenian phase, although there are no grounds for assuming that they were derived from the latter. They probably originated further east and began to filter into Europe at the time when the Magdalenian art was at its height.

But the third of the principal components of Europe's population—the broad-headed race commonly called Alpine—certainly arrived later, and came from a more distant area of characterization, the centre of which was probably somewhere in the area between the Caspian Sea and the Altai. This race is much less closely akin to the Crô-Magnon people than the Brown and the Blond races are. In some respects, such for example as the form of the skull, it is highly specialized. In other respects, such as the robustness of build, the prominence of the eyebrow-ridges, and the abundant development of hair, it is more primitive. It certainly acquired its distinctive characters in some domain which for a long period was shut off from contact with the territories of the other white-skinned races (in Western Asia, Europe, and North Africa), to which no doubt it is distantly akin, and those of the yellow race further east, from which it is more widely differentiated. The unlocking of these areas of characterization by the great thaw during the Magdalenian Age in Europe probably opened the way for the great movements of the Human Family which closely followed this momentous event.

Little is known of the early history of Man in America. Fossilized human remains[1] have been found, but as they were associated with pottery, which even in Europe is unknown before the Neolithic phase of culture, no great age can be assigned to them. So far as his physical structure is concerned the American

[1] See, for example, the series of articles in the *Journal of Geology*, vol. xxv, January–February, 1917, under the heading 'Symposium on the Age and Relations of the Fossil Human Remains found at Vero, Florida'.

Indian reveals evidence of distant kinship with the Mongolian race. But there are many points of difference. In both respects there is a remarkable similarity to, and probably a racial identity with, certain races which still survive near the head waters of the Yenesei and elsewhere in North-eastern Asia.[1] Presumably these represent outlying and less highly specialized members of the Mongolian family, who have survived as persistent witnesses of the source of the main element in the composite stock of the original American population.

Beyond the limits of Europe practically nothing is known of the early history of the Human Family, except a few hints as to its ancestry, and such information as the finding of flint implements provides. But the lack of direct evidence ought not tacitly to be assumed to mean that the great events which must have been happening in Asia, Africa, and, later, in America, can be left wholly out of account. The mere fact that such diversely specialized races exist and have each of them wandered in certain definite directions must be given due weight in discussing primitive human history. That all of these races belong to the species *sapiens* is presumptive evidence that the dispersal of the members of this species, which, as has been seen, was unknown in Europe before the Aurignacian phase of culture, was relatively recent in the geological sense. The validity of such chronological inferences is strengthened when it is realized that the methods of flint-working of practically every race conform essentially to the same types as those which are revealed in Europe. And such arguments acquire still further cogency when it is realized that in South Africa, Australia, and America, methods of flint-working which appeared in Europe in succession, and with very long intervals of time between

[1] A. Hrdlička, *Annual Report of the Smithsonian Institution* for 1913.

the different phases, may be found in association the one with the other. In other words, some movement of population must have begun after the introduction of the most recent of the series of industries thus represented, and as it advanced other more ancient methods that had lagged behind in more backward areas were added to the equipment of the wanderers, so that a collection of methods distinctive of widely different periods in the respective homes of their invention may simultaneously be introduced into some new region.

It must not be assumed that the Aurignacian culture was necessarily invented by the same people who introduced it into Europe and whose remains are associated with it there; nor, if on the other hand proof should some day be forthcoming that people of the Crô-Magnon race were responsible for this great progress in civilization, should we expect to find this physical type invariably associated with it elsewhere. For any culture can be transmitted to an alien people, even when it has not been adopted by many branches of the race which was responsible for its invention, just as gas-illumination, oil lamps, and even candles are still in current use by the people who invented the electric light, which has been widely adopted by many foreign peoples. This elementary consideration is so often ignored that it is necessary thus to emphasize it, because it is essential for any proper understanding of the history of civilization.

If, for the moment, we assume that the distinctive elements of the Aurignacian industry were invented by people of the Crô-Magnon type—who of course are the only people known to be exclusively associated with that particular phase of culture—such an assumption implies that the Crô-Magnon people originally—i. e. before their most significant inventions were made—were using implements of another type, not necessarily Mousterian, though possibly akin to it. When the new inventions were made no doubt the history of their

adoption was essentially identical with that of every similar occurrence since the world began.

In the early history of the gropings after new knowledge and skill in arts and crafts human nature was probably not very different from what it is to-day. When, after countless thousands of years' experience of the use of stones as implements, some man of clearer insight learned to appreciate the fact that an edge could be given to the stone by deliberately chipping it in a particular way, no doubt he was regarded as a foolish visionary, whose pretensions were resented by his staider and duller companions. Perhaps he was even reproved with the palaeolithic argument that his predecessors found unchipped stones good enough for them, and it was therefore supremely foolish to attempt to supersede methods which experience had shown to be so thoroughly efficient. However, in course of time, the momentous invention was adopted: but although there are scores of ways of chipping a stone implement,[1] the one original method was meticulously followed for many centuries to the exclusion of all others. Not only so, but it became stereotyped and adopted far and wide as one people after another learned the technique of this particular method. After this process had been going on for many centuries some new genius arose, and although no Samuel Smiles has put on record the history of the difficulties he had to overcome before he could persuade his generation to adopt a slightly different method of chipping flint, there can be no reasonable doubt that his experience was similar to Galileo's, Watt's, and Lister's. He had

[1] It has been claimed that the different methods of chipping flint implements form a natural series, passing from the crude to the more highly finished technique, representing the stages through which the process of evolution would have passed independently among any people. But consideration of the actual facts lends no support to this view. Moreover, it is at least as simple, if not definitely easier, to shape an implement by rubbing and polishing. Yet this was not attempted until many thousands of years after flint-knapping had been practised.

to fight against the forces of cultivated prejudice and inherent stupidity. In time, however, the new technique became the fashion; and in the course of centuries it slowly percolated to the ends of the earth. So, age after age, new methods of flint-working were successively devised, and, persisting among living men in various localities, or buried in the soil in many parts of the world, they have left indelible records of these earliest migrations of culture.

The influence of the fashionable doctrines of ethnology has made itself felt among archaeologists, certain of whom refuse to accept the clear significance of the evidence provided by flint implements.

It is admitted that flint implements made in accordance with a distinctive method, say Chellean, may be found in places as far apart as France, South Africa, India, and America. The details of the arbitrary technique may be so closely identical that all of these implements, collected from the ends of the earth, might have been made by the same workman. Yet many writers are still willing to believe that this result has been achieved by the blind operation of some process of evolution; and that these identities of technique afford evidence, not of the diffusion abroad of an arbitrary procedure from the centre of its invention, but of the perfection and precision of the mysterious 'psychic unity' that leads men independently the one of the other to arrive at the same destination.

In the report of a course of lectures entitled 'Origine et mode de fabrication des principaux types d'armes et outils en pierre',[1] Professor L. Capitan discusses these problems with all the authority of his wide knowledge and experience. It is a remarkable circumstance, he says, that in whatever part of the world Chellean and Acheulean implements are found, they invariably present the same form, whether they came from the banks of the Thames or from the Cape of Good Hope, or

[1] *Revue Anthropologique*, January, 1917.

such intervening regions as Tunis or Egypt, Timbuctoo or Somaliland, or from the banks of the Delaware or from India. Their general shape is so definite and presents such an individuality that one is tempted to regard them, not as sporadic creations of the human intellect working simultaneously and independently in different parts of the world, but rather as a tradition handed on from one place to another.

But what other interpretation of the facts is credible? The implements in question were in Europe the handiwork of the predecessors of *Homo sapiens*. America, India, and South Africa are populated with varieties of *Homo sapiens*. They must, therefore, have left the original home of the species when such implements were in use, or at some subsequent period. Is it credible that, after carrying with them in their migrations weapons of these or later types, they should, on arriving at their destination, have thrown them away, and then immediately have set to work again and invented the same arbitrary forms as they had just discarded and devised an identical technique? Surely no serious inquirer can deny the reality of the ancient migrations of culture of which these implements provide such clear and unimpeachable evidence!

Yet Dr. Capitan does show signs of weakening. For, after referring to the extension of the use of such implements in time (from the beginning of the Chellean to the middle Aurignacian) as well as in geographical range, he expresses the opinion that 'it is very probable that this evolution, which is apparent in Europe, and especially in France, must have followed a similar course throughout the world'. But if each type of implement was spread abroad from the centre where it was invented, can one speak of the occurrence of a series of these types in some outlying area as evidence of local evolution? In many places several forms of implements which made their appearance in Europe successively at long intervals seem to have been introduced elsewhere simultaneously and many

centuries after their use in Europe had been completely abandoned.

Leaving the Palaeanthropic peoples and passing to the Neoanthropic group, Capitan says that in the technology of the implements, the transformations introduced by the Aurignacian people were radical.

There was in fact the great break between the men and the industries of the now extinct species and the advent of our own species and its distinctive innovations. The latter are displayed especially in two features, first, the invention of the technique that made it possible to obtain long, narrow, and fine blades; and secondly, the utilization of bone, horn, and ivory, which had been almost completely ignored by the Mousterian people and wholly[1] by their predecessors. 'A côté des lames-couteaux des Aurignaciens, on trouve dans leurs foyers une série d'outils nouveaux, les grattoirs, perçoirs, burins, totalement ignorés des Moustériens.'

In his memoir Dr. Capitan tells us further that, just as the Acheulean technique was spread abroad throughout the world, so also was that of the Solutrean period, which is all the more remarkable in that this phase of culture lasted only a very brief time in Europe. Yet elsewhere in outlying places in the world it not only was adopted, but in some cases has persisted even to the present time, as, for example, the aboriginal people of Central Australia, who still make exquisite implements of Solutrean type from broken soda-water bottles and telegraph insulators.

> 'The sacrificial knife with which the Aztecs used to cut into the bodies of their human victims for the purpose of tearing out the heart was a Solutrean blade.'
>
> 'In the middle of the fourth [Capitan erroneously says the fifth or sixth] millennium B.C. the Egyptians manufactured admirable implements of this kind (the

[1] Capitan's statement is not literally correct, because Dr. Smith Woodward and the late Mr. Charles Dawson have described an implement made of an elephant's femur by a Piltdown man.

most beautiful on record), and so also in Japan, the United States, Australia and Africa, this industrial type was extremely widespread and is still used for ritual purposes.'

The problems arising out of these discussions have been further confused by the assumptions made by some writers that the finding of implements of some definitive Palaeolithic type implies the existence of a Palaeolithic 'Age' throughout the world. The fact that such implements are still being made to-day in certain localities ought to be sufficient to put this matter in its right perspective. But there is the further fact that in some places implements representing a series of cultural phases in Europe, which were separated the one from the other by vast intervals of time, may be found under circumstances which suggest that they were all manufactured at the same time. Illustrations of this are provided in South Africa,[1] Australia, and America.

No fact is more notorious than the reluctance on the part of any people to give up methods or ideas to which long usage had familiarized them. I have already suggested that there cannot be any doubt that the Chellean inventor was probably regarded by his fellow men as a crazy visionary and that he had to struggle against their ridicule and practical opposition before he was able to convince them that his method of chipping flint was a real advance upon their Eolithic crudities. And even when it was adopted it is highly probable, to judge from the history of other inventions which is known to us, that it spread abroad only with extreme slowness. In fact, although it was many centuries before some conspicuous genius discovered that there were other ways of chipping flint and invented the technique which we call Acheulean, it is not unlikely that the Chellean method has not yet reached the outlying parts of the world, when

[1] See, for example, L. Péringuey, 'The Stone Ages of South Africa, &c.', *Annals of the South African Museum*, vol. viii, 1911.

perhaps the Acheulean or even the Mousterian or Aurignacian methods had been adopted in turn near the progressive centre of invention. Thus, if some great movement took place, such as that which led to the first peopling of South Africa or America, it is quite possible that wanderers from the centre, say at the time of the Neolithic phase, in passing outwards to the periphery, may have passed through a series of zones in which successively they might have found the Magdalenian, Solutrean, Aurignacian, Mousterian, Acheulean, and Chellean methods as severally the latest fashions in stone-working; and, though themselves the pioneers of the Neolithic phase, they may have attracted to their wandering band representatives of these other zones who were accustomed to make use of more ancient procedures. Thus it was possible for people contemporaneous with the Neolithic phase in Europe to have introduced, say into America, an alien culture which was a jumble of a variety of phases definitely associated with different times and places in the Old World.

Within the limits of an address upon so vast a subject as the history of Primitive Man it has been possible merely to glance at certain facets of the mass of problems presented for discussion. Fortunately many books [1] are now available to give full information to the reader who is not familiar with the rich harvest of knowledge that has been garnered in this field of investigation during the last decade. But the aspect of the problems to which I have devoted chief attention has been almost entirely neglected by most writers. In fact, Professor Sollas is the only one, so far as I am aware, who has attempted to discuss the wider question of the relationship of the information derived from

[1] Such, for example, as J. Déchelette's *Manuel d'Archéologie préhistorique celtique et gallo-romaine*, tome 1, *Archéologie préhistorique*, Paris, 1908; and Henry Fairfield Osborn's *Men of the Old Stone Age*, among many others.

the early remains of Man in Europe to the world-wide history of the human race. His book *Ancient Hunters* gives an excellent survey of the results of recent investigations, and it will be convenient to refer the reader to it for fuller information on most of the topics raised for discussion in this lecture.

Unlike most writers Professor Sollas has not been content merely to study the succession of races and industries that made their appearance in Europe, but he has endeavoured to discover whence they came and whither they went. In the course of such inquiries he has made use of the evidence afforded by peculiar and distinctive elements of culture in substantiation of the reality of these early movements of peoples and the diffusion of customs and beliefs.

The peculiar custom of mutilating the fingers and silhouetting upon the walls of caves the evidence of the damage so inflicted has preserved the record of one of the earliest examples of such a blazing of the pathways of diffusion of early culture. Concerning this custom Professor Sollas says:

> 'We have another instance of a singular practice which is common to a great number of peoples who are isolated, and have long been isolated, from one another by great distances and other geographical conditions.
>
> 'There is room, no doubt, for more than one explanation, but the simplest and most satisfactory would seem to be that which is based on the great antiquity of the custom, for . . . it was already in existence when the forefathers of these now widely separated races were probably in direct or indirect communication with one another. If, as may well be the case, they once occupied the old world, that cradle of human race, and have since been dispersed to their existing homes, carrying their ancient customs with them, our problem would be solved.'[1]

In considering the fact that peoples so remote in

[1] *Op. cit.*, pp. 351, 352.

space as the North-American Indians, the Bushmen of South Africa, and the Aboriginal Australians

> 'all possess the same curious custom of mutilating the fingers, it is scarcely likely that so strange a proceeding was evolved in response to the environment. The motives alleged are various, but probably the idea of sacrifice is the most fundamental. It would be not a little remarkable, however, if this idea found independent expression in the same extraordinary fashion in three several instances. I cannot help thinking that it is far more likely we have here a case of borrowing from a common source' (p. 487).[1]

In view of the fact that this particular custom was already being practised in Europe at the time when men of the modern type first became known, there is a strong element of probability in Professor Sollas's view that when the different varieties of *Homo sapiens* radiated out from the common home they may have carried this primitive custom with them. But I must enter the most emphatic protest against one link in his chain of argument, the weakness of which is more fully revealed when Professor Sollas applies it to cases in which it cannot support the strain put upon it. For example, in his discussion of the practice of totemism, he says: 'When a custom is thus widely, but discontinuously, distributed we may conclude that it must be very ancient' (p. 233).

But the customs of using steam engines and wax matches, and in fact practically all the elements of modern civilization, are 'widely, but discontinuously, distributed', yet many of them are modern. Nor is it improbable that totemism is a relatively modern invention, which was spread abroad many centuries after the primary dispersal of *Homo sapiens*.

[1] For an exposition of the other point of view see Déchelette, *op. cit. supra*, pp. 263 *et seq.* and especially p. 313:—'Quel préhistorien serait assez hardi pour expliquer par une théorie monogéniste les mains rouges des cavernes australiennes et les mains rouges des grottes pyrénéennes?'

Professor Sollas ignores the means by which rapid diffusion of practices has been taking place throughout the history of mankind. Hence he is not justified in assuming that 'If it [totemism] originated once for all at a single centre . . . it must on any hypothesis have taken a long time to reach places so remote from one another as North America, Africa and Australia' (p. 233). On the contrary, I think it will soon become possible to establish the proof of the fact that totemism was practised in the neighbourhood of North-eastern Africa for many centuries before it spread far afield, and then suddenly it was diffused along definite routes to the ends of the earth.

But I am in complete agreement with Professor Sollas in his exposure of the fallacy underlying the modern ethnological dogma of the independent evolution of such arbitrary customs.

> 'If it is difficult to conceive how such ideas as are involved in totemism originated at all, it is still more difficult to understand how they should have arisen repeatedly and have developed in much the same way among races evolving independently in different environments. It is at least simpler to suppose that all totemic beliefs have a common source . . . and may have since been carried by migrating races' (it would have been more exact if Professor Sollas had said by small groups of wanderers by land and sea) 'to remote parts of the world' (pp. 234 and 235).

The issue raised in these quotations has of late years intruded itself into almost every branch of humanistic study, ethnology and archaeology, sociology and politics, psychology and educational theory. The divergence of opinion between the so-called 'historical' and the misnamed 'evolutionary' school is fundamental. It extends as a deep chasm between the two possibilities in interpretation. The 'historical' attitude is based upon the solid foundation of the known facts of history and human behaviour. When identities are found

between complex and arbitrary customs and beliefs in different parts of the world, these are explained in accordance with the analogy of similar incidents of which the history is known. The American Indian's belief that a Dragon equipped with wings and Deer's antlers is a power controlling water is assumed to have been derived from Asia, where the same complexly-eccentric belief is entertained. Even though no official records have been preserved of the flight of this Asiatic wonder-beast across the Pacific Ocean, the 'historical' school of ethnologists is convinced that it got to America in very much the same way as the Spaniards' guns or the Englishmen's steam engines. In other words, the arbitrary nature of such beliefs or contrivances affords the most definite and conclusive evidence of contact and diffusion of culture in the past.

The other school, which has appropriated[1] to itself the wholly misleading legend 'evolutionary', starts out with the large demand that Man is endowed with extensive powers of originality, which, however, are held in check and guided into certain definite channels by some mysterious force, quite unknown to psychologists, which the ethnologists, following the lead of Bastian and Tylor, call 'psychic unity'. It is not the psychic unity which I am insisting upon in this lecture, but some blind force, a sort of mechanically working destiny, which drives men to restrain their inventive genius in all directions but those which fall into the scheme of these idle speculations. But in these it leads mankind with the precision and definiteness of aim with which instinct guides the bee to build its honeycomb and to fill it with honey. These 'evolutionary' ethnologists indignantly protest[2] if a critic insists that the working of their brand of 'psychic unity' is indistinguishable from what the psychologist calls instinct. But if people upon the two sides of the Pacific independently the one

[1] Under the misapprehension that it is applying to ethnology and sociology the principles of biological evolution.

[2] See *Science*, October 13, 1916, Dr. Goldenweiser's letter.

of the other invent a winged Dragon with Deer's horns to look after the weather, and provide this wonder-beast with an extensive repertory of identical fantastic tricks, how can this be explained except by postulating a highly specialized human instinct to dream Dragons. The only other possible escape is to drop all this puerile speculation and admit the patent fact that the American Dragon came from Asia. There is hardly any element in the Pre-Columbian civilizations of America the source of the inspiration of which cannot be identified and referred to its proper epoch and place in the history of the Old World.

Such idle speculations as I have just been discussing have sterilized a vast amount of laborious research during the last half-century, and prevented the reaping of the rich harvest of knowledge of ancient history awaiting those who refuse to be blinded by such sophistry.

Lest I be accused of exaggerating the far-reaching significance of these factors I shall again quote M. Joseph Déchelette. The fullness of his survey of the facts and the care and sobriety of the statement of his opinions serve to emphasize the profound influence of the so-called 'evolutionary' doctrines. While frankly admitting that Western Asia and Egypt exerted some indirect influence upon Neolithic Europe he says :

> 'Nous ne saurions souscrire aux doctrines intransigeantes des orientalistes et des archéologues de l'école de M. Sophus Müller, . . . , et expliquer toutes les ressemblances des formes industrielles, toutes les similitudes ethnographiques par des rapports de filiation. Comme on l'a fait observer avec justesse, on pourrait, en se servant de cette méthode, établir l'origine égyptienne des civilisations de l'Amérique précolombienne et de tous les pays du monde' (*op. cit.*, p. 313).

This argument was the sole one adduced against the recognition of the Egyptian origin of the conception of constructing megalithic monuments. The late

M. Déchelette does not seem to have realized that in referring to the American civilization he was using a boomerang which would hit and demolish the foundations of his case. He proceeds:

> 'Il suffit de parcourir les galeries d'un musée d'ethnographie comparée, pour constater que la période initiale de la civilisation chez tous les peuples du globe terrestre présente partout sinon un facies uniforme, du moins bien des traits fondamentaux identiques. Partout une même industrie correspond à une même phase de culture. Plus on avance dans la connaissance des civilisations primitives, plus on reconnaît les effets constants du déterminisme qui régit le développement de l'industrie humaine. Quel préhistorien serait assez hardi pour expliquer par une théorie monogéniste les mains rouges des cavernes australiennes et les mains rouges des grottes pyrénéennes, les momies du Pérou et les momies d'Égypte, les sépultures en jarres du Nouveau Monde et celles de la Péninsule ibérique, l'attitude repliée des squelettes dans les sépultures de l'Europe préhistorique et de l'Amérique, le culte superstitieux des pierres à cupule apparaissant tout à la fois au delà de l'Atlantique et dans tant de régions de l'Europe et de l'Asie? Et cependant la plupart de ces analogies sembleraient offrir un critérium plus net et plus caractéristique que le polissage des instruments de pierre ou la forme circulaire d'une hutte' (*op. cit.*, pp. 313, 314).

I have quoted this passage as evidence that the views I am attacking are widely maintained: for M. Déchelette in his memoir is scrupulously careful to present what he believes to be the opinions approved by the general body of archaeologists. The quotation is additionally interesting to me because the particular series of analogies selected by him for his argument by *reductio ad absurdum* is composed of precisely those items that I have used for the purpose of demonstrating the reality of the diffusion of culture, the mere possibility

of which M. Déchelette considered to be manifestly absurd.[1] I need not refer to this matter further here, except to make one comment. It is commonly assumed that the earliest population of America was derived from the Old World 'during the Neolithic Age'. Why then is it absurd to suggest that so distinctively Neolithic a practice as burial in the flexed position is due to the Old World influence? The alternative assumption is that the original immigrants into America, who in Asia were accustomed to bury their dead in the flexed position, abandoned this custom, with all their stone weapons, as soon as they arrived in America, and then immediately set to work to devise precisely the same burial customs and methods of making flint implements as those which, according to this hypothesis, they had just discarded. Surely such speculations as this are unworthy of serious consideration, revealing as they do a complete absence of any attempt really to picture what is involved in statements so lightly made and so flippantly used. I should not like it to be thought that in making these criticisms I am referring to M. Déchelette. I have chosen his statement out of a very large series, from any of which I might have quoted, simply because he has set forth with exceptional fullness, but with strict impartiality, what he regarded as the accepted doctrines of modern archaeology and ethnology. I have attempted to show that if one scratches the foundations of this elaborate edifice of speculation there will be found only shifting sand, wholly inadequate to support the weight of theory put upon it.

Modern sociological and ethnological speculations have been led into grave errors through undue neglect of the consideration that members of any civilized society acquire from it some share in its intellectual heritage and moral outlook. For most individuals practically the whole of their knowledge and beliefs

[1] *Migrations of Early Culture*, Manchester University Press, 1915.

have been obtained from this source; and not from the working of some innate and highly specialized instinct. By emphasizing, and rightly emphasizing, the far-reaching influence of heredity, the enthusiastic energy of Eugenic Societies has unintentionally had the effect of obscuring the factors of environment and education. No one who has studied the problems of genetics is likely to deny the vast potency of heredity in determining the structure of the body and in conferring upon the individual certain generalized aptitudes of mind and temperament. But the direction in which these aptitudes find specific expression is determined by the individual's personal experience and by his environment. And on the moral side any child's character can be debased and brutalized if subjected to sufficiently intense and prolonged evil influence. But this is not affected by the consideration that some individuals and some races are more apt than others to be affected by such influences. These statements are all of them obvious truisms. Yet at the present moment they are constantly being ignored or unduly minimized in the discussion of the problems of sociology, education, politics, and the wider sphere of ethnology. This neglect to appreciate the far-reaching influence of individual experience is distorting the vision of scholars in almost every domain of humanistic study, with the exception of philology.

So far as I am aware, no one has ever had the temerity to claim that the peoples of India, Greece, Spain, and Scandinavia had wholly independently the one of the other invented the Indo-European language that is common to all of them. Yet many, if not most, of the scholars who would regard the merest suggestion of such a view as utterly ridiculous and preposterous, do not hesitate to accept the opinion that the no less complex, arbitrary, and artificial structure of many of the identical myths and folk-tales of these same peoples, even when preserved in the language which is admitted to be common in origin to them all, have been invented

quite independently. This kind of inconsistency permeates the whole tissue of modern scholarship. The criteria upon which the archaeologist confidently relies as the basis of his identifications of cultural contact are precisely those which the ethnologist rejects as evidence of such influence, and interprets as proofs of the 'psychic unity' of mankind. By this is meant some mysterious force, quite unknown to psychologists, which has led men in separate localities and quite independently one of the other to do quite arbitrary, bizarre, and complicated things.[1] When challenged to cite any instance in history or principle in psychology in justification of such large demands upon one's credulity, the only relevant reply given is the absence of any written historical records in substantiation of the contact between the peoples who have these similar beliefs and customs. One of my aims in this chapter is to protest against the practice of ignoring the vast mass of unimpeachable evidence supplied by human structure and institutions in proof of the reality of the movements of people and the diffusions of culture in the unrecorded past simply because the 'bills of lading' of the ancient shippers who carried these cargoes have not been preserved.

There is a continuity in the stream of civilization :

[1] The discussion of these problems in modern ethnological works reveals two phenomena of intense interest to the real psychologist.

Many ethnologists, who hold with the utmost tenacity the strange doctrine that the similarity of the working of the human mind leads quite independently to similarly eccentric and arbitrary results in the customs and beliefs of distant peoples, protest indignantly in the course of argument when their opponents accept their statement that the results *are* similar. Moreover, they pretend that those who refuse to accept the term 'psychic unity' in the sense in which they employ the phrase are neglecting the psychological factor (see Malinowski, *Nature*, March 1, 1924, p. 301).

In the course of the diffusion of culture it is often the purely arbitrary and fantastic details that are adopted when more important and fundamental customs and beliefs are ignored. Like vestigial remains as evidence for biological evolution, such evidence is conclusive proof of the reality of diffusion.

but it is not by any such 'psychic unity' as the ethnologists have invented that men's efforts have been linked together in a common purpose. The intellectual progress of the world in general has been brought about by the handing on from one people to another of discoveries and inventions, as well as ideas and beliefs, each of which originated in one definite locality.

There is no innate tendency in Man to be progressive. To the untutored savage most of the elements of our civilization are uninteresting, unattractive, and irrelevant. Not only has he no impulse to devise such things, but he fails to take any interest in many of them even when they are presented to him ready made. And even when he is driven to adopt any of the elements of civilization, in most cases there is no progressive development of them. A gradual degeneration sets in until in course of time many of them are permitted to lapse completely. Why is it then that so many human societies are unprogressive and so few really progressive? The correct answer to this question, which has so often been discussed by historians, is of fundamental importance in this argument.

Primitive Man no doubt continued to spend his time much in the same way as his simian ancestors were wont to do, mainly in the search for food and the avoidance of danger: but he brought to these tasks greatly enhanced abilities and attained amazing skill in such observations and inferences as affected his vital welfare. The modern fallacy of supposing that he spent his time in contemplation of the world around him, speculating upon the nature of the stars above him, or devising theories of the soul, is probably as far from the truth as it would be to assume that the average modern Englishman is absorbed in the problems of zoology, astronomy, and metaphysics.

Such speculations fail to take into consideration the outstanding feature of human thought. Man does not concentrate his attention upon specific problems until

some definite and explicit circumstance compels him to do so. The sun and the moon were not regarded by Primitive Man as objects of scientific curiosity until a very special train of reasoning, excited probably by certain circumstances in the early practice of agriculture, compelled him to give some thought to matters which seemed to affect his means of livelihood. He did not instinctively bow down and worship the sun and adore it as the source of all heat and fertility. These are merely the anachronisms of the ethnologist clutching for evidence of 'psychic unity'. Primitive Man looked upon the sun in much the same way as the average modern Englishman does, when he has forgotten the scraps of astronomical knowledge he may have learnt at school.

What the ethnologist usually fails to recognize is that among primitive men, as amongst modern scholars, before attempting to solve a problem it is essential to recognize that there is a problem to solve. The sun to the Primitive Man was as much a matter of course as the air is to many of us. Unless definite instruction in physics and chemistry were provided, how many people would realize that there was anything to discover about the air? In the early days of Man's existence, when his whole attention was concentrated in the satisfying of his immediate appetites, he became the most expert tracker and the most acute observer of certain aspects of natural phenomena around him. In other words, he was possessed of the powers of pursuit and cunning with which all the higher Mammals are endowed, but in an immeasurably keener and subtler degree. In the pursuit of his quarry and in the avoidance of danger the hunter was forced to be an observer of certain particular things, and was quite oblivious of others which did not affect, or did not seem to him to affect, his occupation.

Illustrations of this without number might be quoted from Africa and Asia, and especially from America and Australia. Where a European can discover no indica-

tion whatever, primitive natives will point out the footsteps of any number of people, enumerating men, women, and children, and even their racial peculiarities and personal idiosyncrasies, and will state the day or even the hour at which they passed. To the European who can detect nothing at all, or, at most, faint and confused marks, such powers seem to be almost magical. But it must ever be remembered that the acquisition of precisely these powers of observation and inference occupy the whole time and attention of Primitive Man. As Palgrave says, even of a branch of mankind so far removed from the primitive stage as the Arab: 'he judges of things as he sees them present before him, not in their causes or consequences'. While the children of civilized Man are engaged in absorbing the fruits of their people's conventions and traditions, those of the untutored savage are acquiring the more vital knowledge of the untamed world of Nature. Each of them, and especially the latter, gives little or no thought to the contemplation of the real significance of natural phenomena. Only a very rare genius amongst either group appreciates the fact that there may be something behind the obvious veil which the majority of his fellows is accustomed to regard as the real world.

The marvellous skill as a tracker which is displayed by all men in uncivilized communities is a really primitive human trait. But it was acquired by every individual under the pressure of the conditions of life that necessarily obtained before other means of securing a livelihood and protection were devised by Man. It illustrates the biological usefulness of Man's large brain and the advantage conferred by it upon the earliest human beings. For it made possible those powers of observation and skilful interpretation of events which enabled Man successfully to compete with and overcome the mere brute-strength of the creatures with whom he had to deal during the infancy of the human family.

The germs of civilization were planted when Man's

attention first became fixed upon specific problems, which he was able to deal with in an experimental manner and, in co-operation with other men, to solve in a way more or less satisfying to him and his contemporaries, and to hand on his solutions of them to those who came after them.

Once this process began, a new era in the manifestation of the human spirit was inaugurated. Every serious research, in whatever department of inquiry, leads to unforeseen results : it opens up new lines of investigation and suggests new trains of thought. So that once this method of groping into the unknown secrets of Nature was inaugurated, the human mind entered a new and ever expanding world of ideas ; and with many vicissitudes and fluctuations of zeal and insight, it has pursued this new direction, and has ever striven to attain the goal of new desires.

The point that I specially want to emphasize is that Man's mental equipment was in the past, as it is at present, derived almost entirely from the members of the community amongst which he grew up, and such insignificant crumbs of knowledge as he was able to pick up from his own experience of a life at first not essentially different from that of an Anthropoid Ape.

The jumble of new arts and practices which afterwards came to occupy more and more of his attention, and gradually relegated into the background those occupations of the tracker in which he had until then been so pre-eminently skilful, gave him a new aim in life—the pursuit of the elusive attractions of civilization.[1] It is not my purpose here to discuss the origin of the constituent elements of civilization. But it is essential that I should impress upon you its artificial

[1] Many writers assume that uncivilized man's abilities as a tracker are due to his keener sense-perception. But this view completely overlooks the fact that his skill is the result of an exclusive devotion to and training in the art of tracking from his earliest youth. Any human being could acquire a similar efficiency, if his attention were not concentrated on the attainment of other kinds of knowledge.

character, and the arbitrary nature of its composition. It bears the impress of its wholly accidental origin: it is equally alien to the instinctive tendencies of human beings. Such being the case, and recognizing that this complex confection was built up laboriously and exceedingly slowly, the acquisition of such arbitrary practices must be assigned to the category of knowledge that is adopted from the community in which one is born or by intimate contact with some other community which is addicted to such procedures. There is no natural impulse in Man to invent such customs or ability to do so independently in one generation. In other words, the possession of the arts of civilization by any population is positive evidence of the most definite kind of contact, directly or indirectly, with the people who actually invented their particular arts.

The records left behind by the earlier races of the Neoanthropic Age throw some light upon the development of beliefs which ever since have exerted a profound, if not a dominating, influence upon the working of the human mind. The representation [1] upon the walls of the Magdalenian Salon noir de Niaux of a Bison with four arrows stuck in its flank, pointing towards the heart, proves that the early hunters recognized that the flank was a peculiarly vital spot in the Bison's anatomy. But it was not merely the flank as a whole, but the heart in particular, that was regarded as the centre of vitality. This is shown by the still earlier (Aurignacian) picture [2] of an Elephant from the cave of Pindal in Asturias.

The survival of this remarkable manner of depicting the vital node of wild animals among the Ojibwa Indians of North America [3] and the aboriginal Australians [4] still further emphasizes its significance.

[1] Sollas, *op. cit.*, fig. 163, p. 326, after Cartailhac and Breuil.
[2] *Op. cit.*, fig. 171, p. 333, after Breuil.
[3] *Op. cit.*, p. 361, after Hoffman.
[4] Baldwin Spencer, *Native Tribes of the Northern Territory of Australia*, 1914, fig. 86.

The heart thus came to be regarded as a centre of life, feeling, volition, and knowledge. There are also indications that the contents of the heart were regarded as sharing these attributes. The custom of mutilating the fingers, to which I have already referred, was probably the outcome of this belief, as also were the later practices of circumcision, of perforating the ears and lips, and of scarring the body. These are amongst the most ancient ceremonial practices invented by Man, and, so far as one can judge from the scraps of evidence that have survived, the underlying idea was the transmission of knowledge and feeling from one individual to another and the union of the members of a group of people one with the other in this common understanding. At a much later time, when Man devised deities, who at first were wholly dependent upon him for their sustenance, the offering of blood was the means adopted to restore consciousness to the deity so that he (at first it was usually 'she') could hear the supplicant's appeals.

The widespread association of all these practices with the rites of initiation into manhood or womanhood, with death ceremonies, and at a much later time with acts of worship of deities,[1] find a natural explanation if we regard these beliefs as Man's earliest attempt to solve the great physiological and psychological problems of the nature of life, of the will and knowledge.

At this stage of his history Man was still a hunter and had not learned to domesticate any animal, so far as the evidence goes, not even the Dog. The earliest indication of the domestication of the Dog in Europe is supplied by the Danish kitchen-middens, which are referred to the commencement of the Neolithic phase of culture in Europe. M. Salomon Reinach[2] has hastily jumped to the conclusion that these early

[1] Zelia Nuttall, 'A Penitential Rite of the Ancient Mexicans', *Archaeological and Ethnological Papers of the Peabody Museum*, Harvard University, vol. i, No. 7, 1904.

[2] *Cults, Myths, and Religions*, London, 1912, p. 90.

inhabitants of Denmark were the tamers of the Wolf. 'Common sense inclines one to suppose that the Dog is a descendant, domesticated by totemism, of some species of Wolf which inhabited the dense forest of Europe.' But 'common sense' once taught men that the earth was flat and that the sun went round the earth, and I think that it has led M. Reinach equally astray in his view on Dogs and totemism. For the earliest known inhabitants of Australia, whose fossilized remains have been found[1] in association with extinct Marsupials, were accompanied by their Dogs when they first made their way into the great Southern continent. I do not think they obtained their Dogs from the coasts of Denmark, nor do I attach any importance to the other claim made so light-heartedly by M. Reinach, that 'the gradual evolution of certain Wolves and Jackals into domestic Dogs might have taken place in several parts of the world at the same or different times'.

The evidence all points to the conclusion that the Dog was domesticated somewhere in Asia; and that, if the Dogs of the Danish kitchen-middens and of the Australian cave breccias were not derived from the same stock, the idea of taming wild animals, whether Wolves or Jackals, must have come from the place where the first Dogs were domesticated. When this was accomplished is not known, nor how long it took for the custom to spread either to the west of Europe or to Australia. But until further evidence is forthcoming it supplies a hint vaguely suggesting that the fossil Man whose remains were found at Talgai in Queensland may possibly have migrated to Australia approximately in the same age when the kitchen-middens of Denmark were made.

The theory of the domestication of animals expounded

[1] Richard Etheridge, junior, 'Teeth of the Dingo from the Breccia of the Wellington Caves' (British Association Meeting, 1914): published in *Memoirs of the Australian Museum*, 1916.

by M. Reinach was, he says, 'first broached by Mr. (now Sir James) Frazer; later it was taken up by Galton, and finally developed by Mr. Jevons'.[1] But I think it likely that, instead of the phenomena of totemism being at the root of the domestication of animals, future research will prove that totemism was really an outcome of Man's intimate association with animals which was incidental to the pastoral life.

In seeking for the explanation of the relatively simple matter of the domestication of animals, it is surely topsy-turvy to assume the previous development of the complex business of totemism, of the composition of which the close association with tame animals is an integral part.

Long after the Dog was domesticated, one by one a series of other animals, the Ox, the Sheep, the Goat, the Pig, and (probably much later) the Horse, were tamed. It was not until the Neolithic culture was well established in Europe that this new stage of civilization made its appearance there: but in Asia and possibly also in East Africa it probably began at some earlier time. One result of this innovation was in some measure to restrain the roving of men, because their movements would now be hampered by the tending of their flocks and the selection of grazing-places for them.

It is important to remember that there are not a few populations still living who, apart from the Dog, have no domesticated animals, and possibly never had any. In other words, the date of their migration from the original home of the custom of taming animals may have been before the Ox was domesticated. In support of this suggestion there is the fact that one of the great physiological discoveries which could not fail to have been made by the early breeders of cattle is still unknown to some of these peoples. I refer to the knowledge that sexual intercourse is essential for propagation. Many primitive people are still unacquainted

[1] *Op. cit.*, p. 91.

with this biological fact,[1] and probably a vast number of other peoples have only learned it within relatively recent times. Before some pre-eminent physiologist among the early pastoralists made this great discovery all ideas of relationship were based upon the fact of motherhood. But when the new theory was established, that the male was the fertilizing agent and that relationship was not by 'blood' but by 'seed', as Hebrew writers many centuries afterwards came to express it, opinion veered too far in the other direction. The female became the mere 'matrix' in which the seed germinated and the male came to be regarded as the real parent. One of the most curious products of this revulsion of opinion was the custom which developed—and persists among many simple people in outlying corners of the world even until the present time—of subjecting the father, on the occasion of the birth of a child, to the discipline which before then necessity had imposed upon the mother during the puerperium. This fantastic practice, now known as *couvade*, can be regarded as the stereotyping of the ideas which not unnaturally arose when the significance of the meaning of the physical process of fertilization first dawned upon men's minds.

But the event which wrought the greatest and most far-reaching influence in the development of civilization was the invention of the art of agriculture. This probably occurred just before the earliest domestication of animals, at a time soon after the settlement of the Predynastic Egyptians in the Nile Valley. The first attempts to cultivate cereals were probably made in Egypt, as Professor Cherry has suggested.[2] The late Mr. Grant Allen put forward the hypothesis that the germination of offerings of wild fruits and seeds placed

[1] Bronislaw Malinowski, 'Baloma: the Spirits of the Dead in the Trobriand Islands', *Journal of the Royal Anthropological Institute*, vol. xlvi, 1916, p. 415. 'The Psychology of Sex in Primitive Societies', *Psyche*, vol. iv, 1923, p. 98.

[2] G. Elliot Smith, *The Ancient Egyptians*, 2nd edition, 1923.

upon the upturned soil of newly-made graves supplied the idea. Another novelist, Mr. H. G. Wells, suggests that when Man first acquired sufficient forethought to store up food for the cold season during which his favourite wild cereals would otherwise be unobtainable, the germination of the supply if it became damp would have forced him to learn the lesson.

Many writers have claimed that the earliest cultivation of cereals was attempted in Mesopotamia. The evidence in support of this, according to de Candolle, is quite inconclusive. Others have claimed Syria or Asia Minor as the original home of agriculture.

But wherever the arts of agriculture were first invented, it is certain that not long afterwards they were put into practice on the banks of the Nile, the Tigris, and Euphrates. Among the immediate effects of the adoption of an agricultural mode of life were the adoption of a really fixed mode of existence, and the possibility of a large population subsisting in settled communities upon the produce of a very much more restricted area of land than had been necessary hitherto when men were hunters. This alone transformed Man's methods of existence and laid the foundation upon which the fabric of his material prosperity was built up. But it was even more fruitful in the realm of ideas.

Cultivation of the soil first led men to appreciate the significance of water, which was interpreted as the great fertilizing and vitalizing element. The train of thoughts thus started developed into a luxuriant crop of philosophical beliefs which dominated men's minds for many centuries afterwards. By a not unnatural syncretism these ideas of the fertilizing power of water became merged with the physiological theory of animal fertilization, which, as I have already hinted, probably came into existence when men became cattle-breeders. At this stage in Man's history there arose the germs of the biological ideas which subsequently became personified in the stories of Osiris, of Tammuz, and of Ea, and their legions of offspring. These stories were no doubt

originally founded upon the historical incidents of kings who introduced into their respective dominions a knowledge of agriculture and the value of irrigation. But as they grew and became embellished, these myths, and the dragon-beliefs that developed out of them, came to include within their scope all the innermost beliefs of mankind at the time when the foundations of the thoughts and hopes of civilized man for all time were being established.[1]

But the introduction of agriculture had other far-reaching effects. It made it incumbent on Man to watch the seasons and to determine the appropriate times for planting. This directed Man's attention to the moon as the measurer of time, and as the power controlling water and, as they imagined, the periodicity of womankind. And the inferences which had already been made about the life-giving property of water and the processes of human reproduction served not only to reinforce these ideas of the moon's powers, but also incidentally to bind together into a consistent and rationalized body of scientific doctrines all the ideas as to the nature of life and matter that had already grown up.

Thus the foundations of human knowledge came to be established; and it is important to remember that in these first attempts to interpret the phenomena in himself and the world around him, Man was not merely formulating explanations of the facts of physics, biology, astronomy, and mathematics that his own needs and the force of circumstances compelled him to try to understand, but also that he was framing the whole of his beliefs. Many of the problems of physiology to which he addressed himself were matters which in these days would be regarded rather as theological questions. But at this stage of Man's history, when the attempt was being made frankly to interpret natural phenomena and to construct a rational scientific explanation of the events taking place around him, it would be misleading

[1] G. Elliot Smith, *The Evolution of the Dragon*, 1919.

to brand any of these working hypotheses as religious or magical. They were all frankly rationalistic, and none of them more emphatically so than those which ultimately became the basis of religious beliefs.

Such was the mental ferment that was beginning to act when the great civilization of Egypt and Western Asia germinated. I use the singular and not the plural because I think it certain that the earliest cultures of Egypt and Sumer, and of Crete and of other centres in Western Asia and North-eastern Africa, were merely so many local manifestations of the influence of the same leaven that was at work throughout this area.

But these vague gropings after explanations of natural phenomena assumed a more definite form when the Predynastic Egyptians' thoughts were directed in a more specific manner toward the contemplation of the problems of life and death by the discovery that the bodies of their dead did not always suffer corruption in the grave, but were often preserved as the result of desiccation by natural forces. In attempting to solve the new problems thus set them and to determine what was lacking in the dead body, and the life-like portrait statues which they were prompted to make of it, they were guided by the system of philosophy to which I have already referred. The body lacked the breath of life, the vitalizing fluids, and the sweat and odour of the living. In response to this conviction there developed the ritual for restoring to the mummy or its portrait-statue these vitalizing properties by the ceremonies of 'opening the mouth', of offering libations and burning incense. As the new conceptions were added to the body of scientific theory they became intimately rationalized in a very complex system. The breath of life came to be the vital 'soul' of the body: the functions of the blood and the heart were then restricted to being the vehicles of feeling, knowledge, and volition. The conception of the possibility of the body continuing its existence if it was provided with the vital elements which it lacked grew more and more

definite and insistent: but it was recognized that such a continuation of existence was entirely at the mercy of the survivors, without whose help in supplying food and drink and the other needs of the dead such existence was impossible. Even when the dead were deified, they they were still wholly dependent upon living mortals for their means of sustenance.

The influence of these early conceptions of Man's first system of biology has continued to mould human thought ever since, not merely in the valley of the Nile and in Mesopotamia, but wherever civilization has manifested itself in any part of the world. Its effects are seen not only in the ritual practices of every religion, but also in the direction of the innermost thoughts of all peoples and their expression in every language.

It is important to remember that the whole of this system of philosophy came into being long before the construction of megalithic monuments or in fact any use of stone for building had yet been attempted.

In setting forth this crude and tentative sketch of the mode of origin and development of ideas that lie at the very root of all human beliefs, I have been attempting to combat the pseudo-psychological dogmas that are still being put forward as substitutes for serious argument. I refer to the claim that the human mind has been undergoing some process of mechanical and automatic evolution, in virtue of which it has passed through a series of 'culture epochs', not as the result of the accumulation of knowledge and experience, but as the outcome of some blind and intangible change in the structure of the mind. It is difficult to regard seriously a claim that even on the most cursory examination seems to be so utterly devoid of foundation. Yet many of the foremost scholars of recent years have accepted it as an explanation of the data of their investigations; and certain branches of inquiry have been permeated by the effects of this false doctrine. Though ethnology

has been most seriously affected by it, hardly any field of investigation has wholly escaped.

As I have already mentioned, it is claimed that to meet similar needs men in a similar stage of culture will invent identical appliances and devise similar explanations of their experience. But since this claim has been made in these general terms it never seems to occur to those who argue in this way to inquire whether, in the cases where such cultural identities are found, the circumstances, the needs, or the stages of culture were really similar, for such inquiries would at once prick this bubble of speculation. Nor does such theorizing offer any suggestion in explanation of the fact that of kindred peoples living under precisely similar circumstances and in close proximity the one to the other, for instance in Indonesia and Melanesia, one may have been in possession of the complex culture that is associated with the practices of sun-worship and megalith-building, whereas the other may not have a single item of the scores of peculiar customs and beliefs of which this civilization is compounded.

The careful analysis of all the available evidence seems to point clearly to the conclusion that until the invention of the methods of agriculture and irrigation on the large scale practised in Egypt and Babylonia the world really enjoyed some such Golden Age of peace as Hesiod has described.[1] Man was not driven into warfare by his instinct of pugnacity, but by the greed for wealth and power which the development of civilization itself was responsible for creating. Upon the banks of the Nile and the Euphrates extensive irrigation works had to be undertaken. This taught Man to organize labour and prompted the idea of exploiting his fellow men in vast works of personal aggrandizement such as the pyramids. The trouble began when one community tried to enslave its neighbours, not only for these great

[1] W. J. Perry, *The Growth of Civilization*, London, 1924.

industrial works and boastful monuments, but for sacrificial purposes also, when the idea developed that a Man's standing in the world of the dead depended upon the number of his retinue of attendants. The earliest warfare consisted in slave-raiding and head-hunting; and the motive that prompted it was the common human desire to secure ease and luxury, both in this world and the next, at the expense of one's fellow men. The exploits of this military aristocracy, the 'children of the sun', during the last forty centuries make up the greater part of what usually passes for 'history'. They have been so widespread as to have misled most sociologists into the belief that warfare was a manifestation of the primitive instinct of pugnacity, instead of merely a by-product of civilization itself. The whole question is now being illuminated by the researches of my friend Mr. W. J. Perry, so that I need not follow it farther, except to note one point. The coincidence in the geographical distribution of habits of warfare and certain elements of culture has been erroneously interpreted by many writers as evidence that certain peoples were more highly endowed with the instinct of pugnacity, in virtue of which they were able to overcome their more peaceful neighbours and attain a higher stage of civilization by surmounting difficulties. But the large assumptions involved in such speculations can be proved to be wholly unwarranted. Such theories of 'survival of the fittest' are as inappropriate as Bernhardi's misuse of this biological phase. The association of customs cannot be explained in this way, nor can the possession of the higher culture be attributed to any exceptional development of the instinct of pugnacity. For Perry has shown how both the culture and the habits and methods of warfare were introduced by the same people into most of the places where they are found. Both alike were the outcome of the development of civilization: and so far from the culture being a manifestation of survival of a race

superior in fighting qualities, it would be nearer the truth to say that the aims and methods of warfare were the results of the cultural developments, and not the cause.

In this chapter I have roamed over a very wide field of research; and perhaps the reader may think that I have devoted an undue amount of attention to the business of emphasizing perfectly obvious and commonplace facts. But those who are familiar with the recent literature of anthropology will realize that these matters are precisely those which hitherto have been overlooked in the discussion of Man's early history. The attention of most anthropologists has been so concentrated upon technical matters of controversy that the wider bearings of the knowledge gained have not received the consideration they deserve.

But the point that I want especially to emphasize is the conclusion which emerges from the investigation of every one of the many aspects of Man's achievements. The explanation of the intellectual and moral outlook of every individual and community is to be sought mainly in his or its history, and not in some blind mechanically working force of evolution. Throughout the course of human history Man's attitude has been determined, not by the alteration of the structure of the mind, but by the intellectual and moral influences which have been impressed upon each individual's mind by the community in which he lived. Whatever the inborn mental and moral aptitudes of any individual, whatever his race and antecedents, it is safe to say that if he were born and brought up in a vicious society he would have learned, not merely to converse in the language distinctive to that particular group of people, but in all probability to practise vicious habits. The fact that his skull was long or broad, or his hair blond or dark, or the matter of his ancestry, whether he

belonged to the Alpine, the Nordic, or the Mediterranean races, would count for little in this process in comparison with the potent moulding force of the atmosphere of the family and the society in which he grew up during the years of his mental plasticity.

The great factor in all human history has been determined by the consideration that each individual has not really had to work out his own salvation. There has gradually been accumulating throughout the ages a body of arts and crafts, and customs and beliefs, from which each group of human beings has adopted its social equipment. For every human being there has been provided a ready-made supply of opinions and ways of thinking and acting; and in the vast majority of cases these have been accepted without question as proper and natural to accept at their face value. There has been no general or even widespread tendency on the part of human societies to strive after what by Europeans is regarded as intellectual or material progress. Progressive societies are rare because it requires a very complex series of factors to compel men to embark upon the hazardous process of striving after such artificial advancement.

The history of Man will be truly interpreted, not by means of hazardous and mistaken analogies with biological evolution, but by the application of the true historical method. The causes of the modern actions of mankind are deeply rooted in the past. But the spirit of Man has ever been the same: and the course of ancient history can only be properly appreciated when it is realized that the same human motives whose nature can be studied in our fellow men to-day actuated the men of old also.

CHAPTER III

THE HUMAN BRAIN[1]

THE human brain is the instrument of the high powers of intelligence that distinguish Man from all other living creatures. The secret of Man's most distinctive attribute is hidden in the texture of his brain, and perhaps will never be fully revealed. Yet from time to time, with the growth of knowledge and the discovery of new methods of approach, we can profitably return to this greatest of all biological problems and get new glimpses of the factors that have made Man what he is. Two considerations make the present time appropriate for taking stock of the state of our knowledge of these matters. The emergence of a clearer understanding of the sequence of structural changes in the brain and body of Man's ancestors enables us to interpret the physiological factors involved in the widening and deepening of the intellectual powers and to appreciate the conditions essential for the attainment of such mental growth. In the second place, the new points of view regarding the functions of the cerebral cortex that have emerged from Dr. Henry Head's suggestive clinical investigations prompt one to examine the brain anew and endeavour to integrate the results of his brilliant analysis with those revealed in the study of the evolution of the brain. Whether or not it is yet possible fully to correlate the facts and conclusions of these two disciplines into one

[1] Discourse delivered at the Royal Institution on Friday, February 22. Reprinted from *Nature*, March 15, 1924.

coherent body of doctrine, it is well worth while to make the attempt to do so, if for no other reason than to direct attention to new problems that call for solution.

In the history of organisms endowed with the power of voluntary movement, which necessarily involves the ability to choose between conflicting impulses, the fundamental condition of progress is the attainment of quickness of appropriate response. The evolution of the nervous system is the means employed to enable increasingly complex and more completely adapted muscular actions to be performed with promptitude and precision. The brain in Mammals differs from that of all other living creatures, not excluding even birds, in having acquired a true neopallium, which is an instrument of almost unlimited potentialities for the cultivation of skilled movements of increasing degrees of complexity and adaptation to diverse circumstances. And in Man these potentialities achieve their highest expression. The human cerebral cortex provides the vital mechanism that can be fashioned by education to initiate and control an almost endless variety and complexity of muscular actions. It is able to perform these functions in virtue of the fullness of the information it obtains from a variety of sense-organs and the efficiency of the amazing machinery in the central nervous system for integrating the effects of these afferent currents and for controlling increasingly complex combinations of groups of muscles. But even more important still is the ability of the neopallium, by some means which is quite unknown, to record the results of past experience and to put the influence of such knowledge at the service of the muscular system. This provides the means whereby behaviour can be modified in the light of knowledge, but also enables a high degree of automatism to be acquired by training, which is perhaps the most essential factor in the attainment of high degrees of skill.

The acquisition of these extensive powers plays a fundamental part in the development of the physio-

logical dispositions which are expressed in intellectual operations. In fact, in a somewhat different sense from what Professor Pear had in mind when he coined the phrase, one can support the claim for 'the intellectual respectability of muscular skill'. In the evolution of Man the attainment of increasingly skilled movement involved the growth of mind.

Before proceeding to interpret and give precision to these phrases, it will be profitable to glance for a moment at certain incidents in the past history of controversies regarding the human brain. When one considers how fundamental is the interpretation of the human brain for the understanding of the distinctive attributes of mankind, it is remarkable how little has been done to solve its important problems. By this I do not mean to suggest that the volume of the writings concerning them is small. What, however, is impressive is the fact that the vast stream of books and memoirs has brought us so few indications of any serious attempt to probe into the really vital issues regarding the way in which the brain has acquired its highest powers. It is barely a century since the knowledge of the structure and function of the brain had reached the stage that permitted really profitable discussion of its distinctive attributes in the human being. The great revolution in attitude was effected by Gall, whose services in the advancement of science are now almost completely disguised by the notoriety associated with his name as the inventor of what afterwards became known as phrenology. Yet it would not be wholly true to say of Gall what Shakespeare put into the mouth of Mark Antony when he said of Caesar :

> The evil that men do lives after them ;
> The good is oft interred with their bones.

The evil part of Gall's teaching has undoubtedly lived after him : but the good attained what Huxley long ago called 'the euthanasia of scientific work' : it has been accepted as part of our heritage of knowledge,

even though the credit due to Gall for a great reform has for most of his successors been 'interred with his bones'. It was he who destroyed the ancient speculations concerning vital spirits dwelling in the ventricles of the brain. He proved that the white substance was fibrous, and introduced the method of exposing fibre-tracts by dissection to demonstrate the connexions within the nervous system. He called attention to the real significance of the grey matter. He was the first to give the correct account of the connexions of the optic tracts. The discussions arising out of his claims for cerebral localization provided the stimulus which was responsible for a profound revolution in cerebral physiology, even in spite of the fact that he was so incensed by the attacks of the physiologists as to deny the value of experiment. In his own lifetime it was the anatomical facts so easily susceptible of confirmation that were most violently assailed by his critics: hence the speculative and untenable part of the doctrines usually associated with his name escaped criticism and 'lived after him'. But his really great discoveries became tacitly absorbed into the great body of knowledge at the time when in later decades men were hot in pursuit of the fallacies of 'phrenology'. Although it was not until more than thirty years after Gall's death that the localization of function in the cerebral cortex began to be seriously entertained, chiefly under the influence of Hughlings, Jackson and Broca, much valuable work was accomplished in the first half of the nineteenth century.

Even before 1828 (when Gall died) attempts had been made to discover wherein the brain of Man could be differentiated from that of other Mammals. Curiously enough, the remarkable claim (which Sir Richard Owen revived in 1857) was made that the human brain was distinguished by the presence of a hippocampus minor; but in 1827 Serres disposed of this assumption, as Huxley and Flower did in 1862, by showing that 'the hippocampus minor is not distinctive

of man, as hitherto has been supposed, for it is present in the apes and seals'.[1] It is an amazing episode in the history of this subject that Owen should have resuscitated a fallacy which had been so utterly demolished as this claim had been; but the incident was not without its uses, for it stimulated Huxley to revise the anatomy of the occipital end of the cerebral hemisphere and so prepared the way for the particular line of research with the latest results of which this address is in the main concerned. Incidentally, also, it inspired Charles Kingsley to write in *Water Babies* one of the most ironical parodies of a scientific discussion in the English language (see p. 22).

But if Serres demolished this claim for one distinctive peculiarity of Man's brain, he set up three others which have little, if any, better justification. For, he wrote, 'Man alone possesses a tonsillar lobule in his cerebellum, striae medullares in his fourth ventricle, and salient and distinct corpora mammillaria on the base of his brain.' The most arresting episodes in the history of the subject during the last hundred years has been the setting up of a series of similar false claims and their subsequent refutation. Nor, unfortunately, is this comedy of errors yet done; although the nature of the supposed distinctions is undergoing a change.

Of the large series of supposed distinctive features of the human brain that have been extensively cited during the last half-century I shall refer here only to one directly relevant to the serious argument, which I must now set forth, based upon the further investigation of the area surrounding the sulcus which Huxley labelled 'calcarine'.

Upon the lateral aspect of the cerebral hemisphere in most of the Apes there is a furrow which was supposed to be so peculiarly distinctive of these Primates that it was labelled the *Affenspalte* or ape-fissure.

[1] E. R. A. Serres, *Anatomie comparée du Cerveau*, Paris, 1827, t. ii, p. 583.

More than twenty years ago its presence was demonstrated in the human brain, and as its old name was clearly inappropriate the new designation, *sulcus lunatus* (Figure 17), in reference to the semilunar form it usually assumes, was given to it.[1]

The identification of this furrow was established by the study of the distinctive texture of the cortical area responsible for its presence, now called the *area striata*, in reference to its most obtrusive feature, the stria of Gennari. This led to the measurement of the extent of the area striata, in which the optic radiations end; and the discovery that the visual receptive territory is just as extensive in the brains of many Monkeys, even small macaques, as it is in those of men. In other words, in proportion to the size of the brain the area of cortex concerned with vision is relatively enormous in the lowlier Primates. This investigation led to the realization of the important part played by the early cultivation of vision as the dominant sense in Man's ancestors, and pointed to the necessity for a detailed study of how and why this particular trend in evolution should have led to results of such vast significance as the emergence of the human mind.

In Chapter I I have given a sketch of the conclusions reached in 1912 in the attempt to interpret the significance of this suggestion. Since then much has been done to probe more deeply into the nature of the processes that have been at work. These inquiries have

[1] G. Elliot Smith: 'The so-called Affenspalte in the Human (Egyptian) Brain', *Anatomischer Anzeiger*, 1903; 'The Morphology of the Retrocalcarine Region of the Cortex Cerebri', *Proceedings of the Royal Society*, January 1904; 'The Morphology of the Occipital Region of the Cerebral Hemisphere in Man and the Apes', *Anatomischer Anzeiger*, 1904; 'Studies in the Morphology of the Human Brain, with Special Reference to that of the Egyptians, No. 1, the Occipital Region', *Records of the Egyptian Government School of Medicine*, vol. ii, November, 1904, pp. 125–73, 47 text-figures, 2 plates. 'New Studies on the Folding of the Visual Cortex and the Significance of the Occipital Sulci in the Human Brain', *Journal of Anatomy and Physiology*, vol. xli, pp. 198–207, January, 1907.

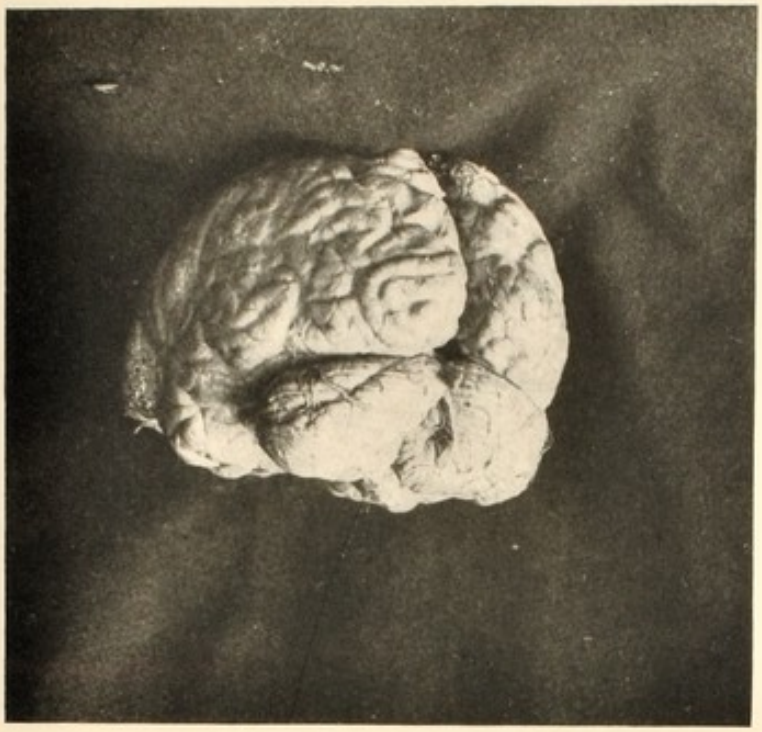

FIG. 13

Photograph of the back of an Egyptian brain seen obliquely from the left side, showing the *sulcus lunatus* on the left cerebral hemisphere.

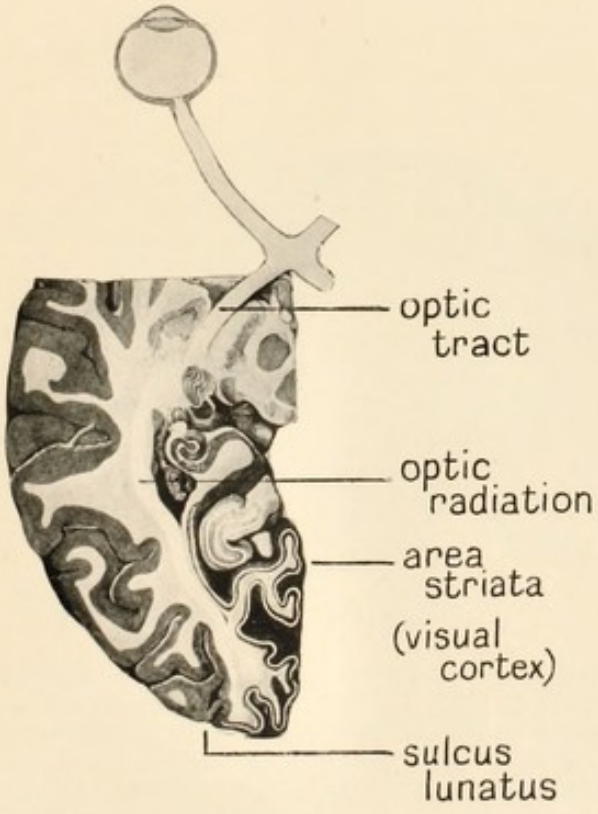

FIG. 14

Section of human brain to indicate the course of the pathway leading from the eyes through the optic tract and optic radiation to the area striata, marked by the white line of Gennari.

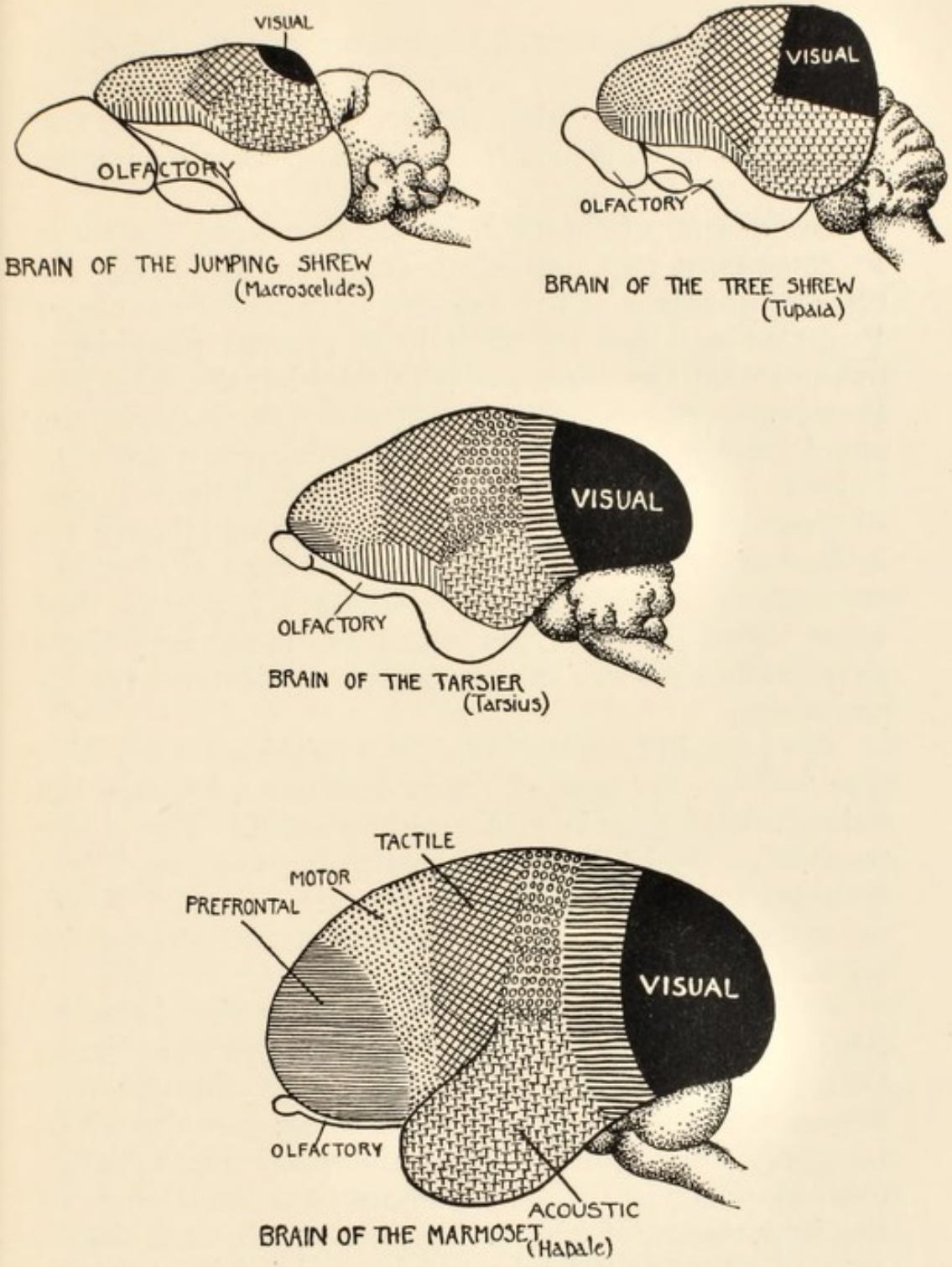

FIGURE 15. Diagrams representing the left side of the brains of the Menotyphlous Insectivores *Macroscelides* (the Jumping Shrew) and *Tupaia* (the Tree Shrew) (to illustrate the influence of change of habit in two members of the same Family), and of the Spectral Tarsier (*Tarsius*), the Prosimian, which had almost become a true Monkey, and of the Marmoset (*Hapale*), the most primitive surviving Monkey.

revealed the fundamental importance of the attainment of stereoscopic vision in preparing the way for the cultivation of those high powers of discrimination and understanding which are distinctive of the human family.

The diagram (Figure 2) in the Foreword was made to emphasize two important considerations: (*a*) the relative positions of the different branches of the Order Primates and (so far as it is at present possible to define them) the times at which they left the main progressive stream and became stereotyped in structure, and (*b*) the crucial phases in the evolutionary process.

Examining the condition of the brain at the first four of these significant phases, as represented (Figure 15) in four diagrams which I prepared in 1912 to illustrate the address reprinted here as Chapter I, a great deal more information can be extracted from the facts there graphically set forth than I was able to discover twelve years ago.

The Jumping Shrew has a very primitive brain with a relatively enormous olfactory apparatus, because the animal's behaviour is dominated by smell. The patchwork of cortical territories constituting the neopallium includes diminutive areas for the reception of visual, acoustic, gustatory, and tactile impressions and for the control of skilled movement.

The adoption of arboreal habits by the Jumping Shrew's cousin *Tupaia* effects a profound transformation in the cerebral representation of the different senses. The olfactory area is reduced; and the whole neopallium undergoes an even more pronounced change corresponding to a relatively enormous enhancement of the importance of vision, hearing, touch, and skilled movement for an animal living in the branches of trees.

A continuation of these changes, leading more especially to a further expansion of the visual territory, is responsible for the birth of the Primates (see Figure 2, *Prosimiae primitivae*). Also immediately one group (Tarsioidea) of the earliest Prosimiae carried this pro-

cess yet another stage corresponding to the condition revealed in the living *Tarsius* (Figure 15). The visual territory has become very extensive and the olfactory territory still further reduced in size ; and this corresponds in behaviour to the definite usurpation by vision of the dominant influence formerly (even in the Lemuroidea) exercised by smell.

The reduction of the snout in *Tarsius* (Figure 5) allows the eyes to come to the front of the face and to look forward. It also permits the visual fields of the two eyes to overlap, and so prepares the way for the acquisition of stereoscopic vision. But although *Tarsius* has binocular vision, it is not yet capable of appreciating stereoscopic effects. Probably it lacks the ability to appreciate the exact form and solidity of objects and to discriminate between substance and shadow. Nor is it yet able to appreciate the texture or the details of the things seen. For this purpose it is necessary to be able to move the two eyes in any direction in the closest co-ordination the one with the other; and *Tarsius* has not yet developed the complicated machinery necessary for effecting these nicely balanced adjustments. That it feels the need of these powers is evident. For *Tarsius* has acquired the power of moving its head upon the vertebral column throughout an extraordinarily wide range. In fact, with its body pressed against a tree-branch (Figure 16) it can turn its head almost to the extent of 180° and look backward. This means that *Tarsius* feels the need for moving its two eyes in co-operation the one with the other, but as it lacks the necessary range and precision of conjugate movements, it moves its head much as a cat does, and so roughly achieves its purpose of bringing the two eyes at the same distance from the object.

The enormous expansion of the cerebral cortex in the transition from the Tarsioid to the true Monkey is shown by contrasting the brains of *Tarsius* and *Hapale*. There is a sudden increase not only in the

visual territory but in almost every other neopallial area, tactile, motor, acoustic, and prefrontal. The latter is peculiarly significant. For experimental researches, especially those of Mott and Sharpey, Schafer, Risien Russell, and Sherrington and Leyton, have demonstrated that the prefrontal area (the cultivation of which is especially associated with the learning to perform skilled movements) is more especially associated with the acquisition of a wide range of conjugate movements of the eyes and of the power of exact convergence, which is necessary for the fixation of the eyes upon any object so that its image can be focused with precision upon associated spots in the two retinae. The ability to do this (in a mammal with conjugately linked eye-movements) is essential before a macula lutea or sensitive spot can develop, in virtue of which the appreciation of texture, detail, and colour becomes suddenly enhanced. But other profound structural changes are necessary before stereoscopic vision is acquired. Not only must the cortical instrument (prefrontal area) voluntarily perform the skilled movements that are necessary, and a specially sensitive spot (macula lutea) in the retina be evolved, but also the optic tracts must be rearranged so that the nerve-fibres from those parts of the retina that are brought into physiological correlation proceed to the same parts of the brain. Moreover, the oculomotor nucleus in the midbrain is remodelled so that it can effect automatically the conjugate movements of the eyes which the prefrontal cortex can consciously control. The ability to carry out these complex adjustments unconsciously enables the individual to concentrate his attention upon the thing seen rather than merely upon the muscular act necessary for seeing it.

The investigations of Brouwer, supplemented by Hunter's comparative examination of the oculomotor nuclei of *Tarsius* and the lemuroid *Nycticebus*, have elucidated these interesting facts, which provide so

FIG. 16

Tarsius (with her baby) showing the head looking directly backward, turned at almost 180 degrees with the axis of the body.

(From a photograph lent by Mr. W. E. Le Gros Clark, F.R.C.S.)

clear a corroboration of the inferences drawn from a study of the cerebral cortex.[1] One of the most significant of the changes that occur in the transition from the prosimian to the simian stage—in other words, that mark the acquisition of stereoscopic vision —is the splitting up of the nucleus for convergence so that each eye can be focused independently upon any object. The value and significance of this is that the two sharply defined and exactly focused images can be obtained even if the object is seen obliquely, and is therefore further away from one eye than the other. In other words, the animal is not compelled to move its head, as *Tarsius* does, so as to bring the two eyes into a position equidistant from the object. The eyes alone may be moved. It would be difficult to exaggerate the vast importance of this change in enabling the higher Primate to appreciate the form and size of objects by following their outline by means of delicate eye-movements.

Man has evolved as the result of the continuous exploitation throughout the Tertiary period of the vast possibilities which the reliance upon vision as the guiding sense created for a mammal that had not lost the plasticity of its hands by too early specialization. Under the guidance of vision the hands were able to acquire skill in action and incidentally to become the instruments of an increasingly sensitive tactile discrimination, which again reacted upon the motor mechanisms and made possible the attainment of yet higher degrees of muscular skill. But this in turn reacted upon the control of ocular movements and prepared the way for the acquisition of stereoscopic vision and a fuller understanding of the world and the nature of the things and activities in it. For the cultivation of manual dexterity was effected by means of the development of certain cortical mechanisms; and the facility in the performance of skilled

[1] John I. Hunter, 'The Oculomotor Nucleus in *Tarsius* and *Nycticebus*', *Brain*, 1923.

movements once acquired was not a monopoly of the hands but was at the service of all muscles. Skilful use of the hands was impossible without the appropriate posturing of the whole body. High co-ordination of hand movements and high co-ordination of movements localized elsewhere in the body must go together. The sudden extension of the range of conjugate movements of the eyes and the attainment of more precise and effective convergence were results that accrued from this fuller cultivation of muscular skill. They were brought about as the result of the expansion of the prefrontal cortex, which provided the controlling instrument, and also by the building up in the midbrain of the mechanism for automatically regulating the complex co-ordinations necessary to move the two eyes in association in any direction. The attainment of stereoscopic vision enormously enhanced the value of the information acquired by the eyes.

The development of maculae luteae made possible the fuller appreciation of the details, the texture and the colour, of objects seen, and in association with the increased precision of muscular control enabled the eyes to follow the outlines of objects and appreciate better their exact size, shape, and position in space. But this completer vision of objects in the outside world stimulated a curiosity to examine and handle them, and so led to a yet further cultivation of skill in movement and an enhancement of tactile discrimination. This higher skill was attainable because the powers of stereoscopic vision conferred more accurate control to the hands than was possible before it was at their service.

Thus the fuller cultivation of the results of the visual powers provides a new stimulus and new means for enhancing vision itself, and this cycle of developmental changes was repeated again and again in the history of the Primates, at each stage leading to a further enhancement of muscular skill and visual acuity.

It is of fundamental importance to remember that one result of this continued handling of objects is the attainment of a fuller understanding of the nature of the objects seen and of the forces that are operating. The closer correlation of the information gained by vision and touch played a leading part in the cultivation of an appreciation of form, which represents the germ of the aesthetic sense. There also emerged the aptitudes to estimate weight and to discriminate between textures.

When these had attained such a degree of exactitude that it became possible for the individual to distinguish sharply one object from another and to appreciate its manifold properties, the time had arrived when the process of naming it acquired a definite biological value. Man's ancestors were already provided with the muscular instruments for speech and the ability to use them for the emission of a variety of signals, mainly in the nature of cries to express emotional states. Hence, long before the need made itself felt for an instrument to express the names of objects, it was already in being, and all that required to be done was to devise the necessary vocal symbolism to express the visual experience—to give a name to an object seen. Moreover, long before the discovery of articulate speech, the ancestors of modern Man were conveying information of an intellectual kind one to another through the visual appreciation of the meaning of gestures and facial expressions. With the introduction of an auditory symbolism Man continued to do what he had done previously in a manner less precise and less capable of intellectual elaboration.

Thus the acquisition of speech was based primarily upon the fuller understanding of the world around the ancestors of men and the need for names as a sort of shorthand concisely to express the various attributes of a single object and other more complex states of consciousness; but it involved the seeing eye and the understanding ear and the highly skilled muscular act

involved in phonation and articulation. In other words, while the expansion of most cortical areas is essential for the interpretation of experience, the special development of territories in the neighbourhood of the areas concerned with the reception of acoustic and visual impulses and with the control of the musculature of the head and neck should be expected.

These localized hypertrophies of the cerebral cortex are, in fact, found in the primitive types of human brain such as are revealed in the endocranial casts of *Pithecanthropus*, *Eoanthropus*, and the extinct species of the genus *Homo*.

If the brain of Man's nearest relative, the Gorilla, be compared with the human brain (Figure 17) it will be found that the enormous increase in the cortical territories of the latter affects chiefly three areas, the parietal region (especially that part of it known as the supramarginal and angular convolutions), the prefrontal region, and the inferior part of the temporal area. These are the areas that reach their full development last in the human child. They were also the most defective parts of the brains whose forms and proportions can be inferred from the moulds of the brain-cases of *Pithecanthropus* and *Eoanthropus* (see Figure 12). They are also the parts of the brain injury to which has yielded the most instructive clinical results so far as mental effects are concerned.

Now that the tentative hypothesis to express the known biological facts has been formulated it is profitable to consider what light is thrown upon the issues by Dr. Head's clinical investigations, more especially by his two great memoirs 'Sensation and the Cerebral Cortex' (*Brain*, 1918) and 'Speech and the Cerebral Localization' (*Brain*, 1923).

In the former Dr. Head defines the functions of those parts of the cortex concerned with sensation. Injury to any part of the cortex disturbs attention. The cortex is the repository of past impressions and these sensory dispositions profoundly modify the effect

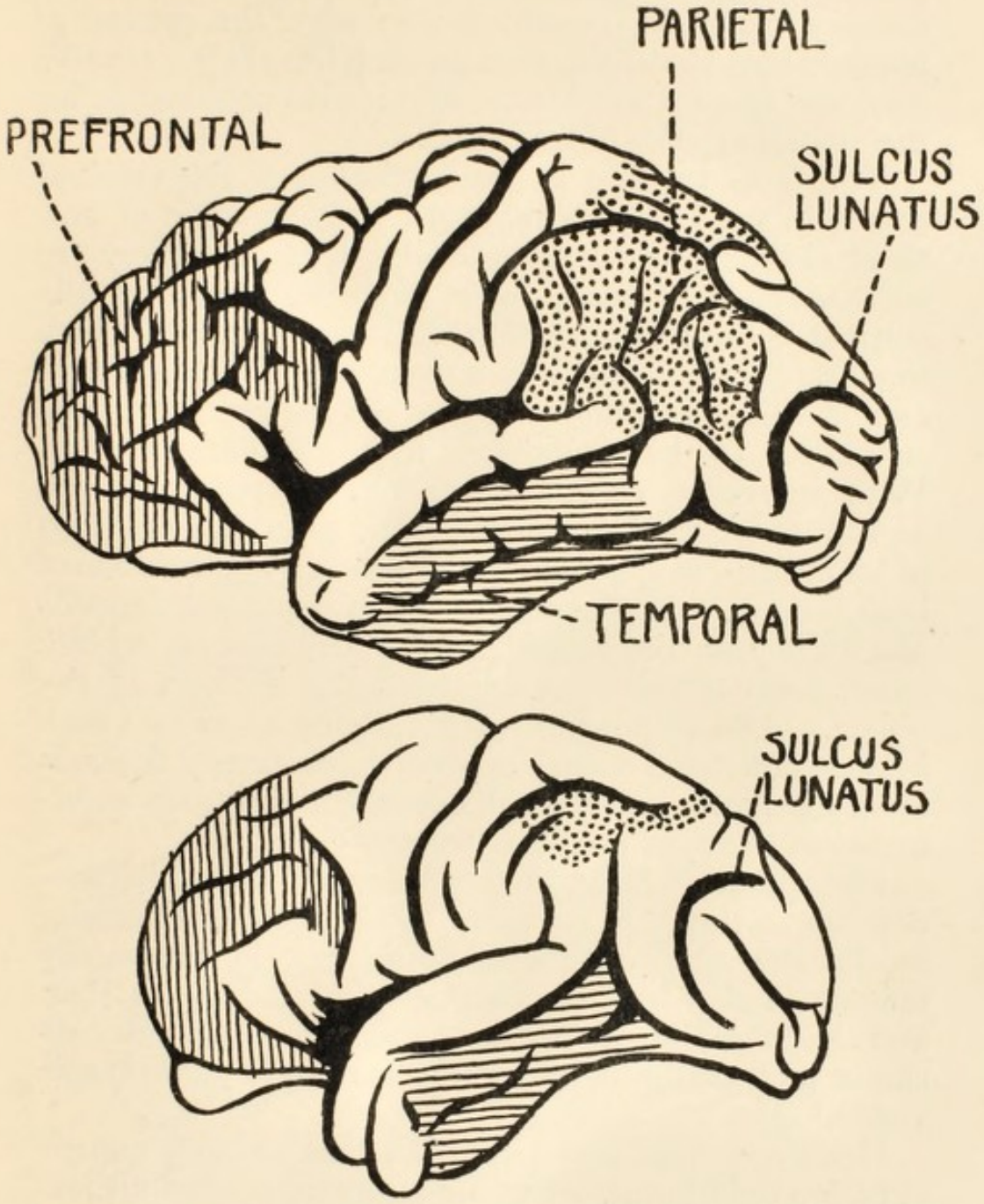

FIGURE 17. A comparison of the largest known Gorilla's brain (below) and the most ape-like human brain ever recorded to indicate the three areas (parietal, temporal, and prefrontal) which undergo the chief expansion in the evolution of Man.

produced by the arrival of fresh impulses. But the sensory cortex is concerned also with the power of appreciating the differences in weight, shape, relative size, and texture of objects, and is also responsible for the spatial aspects of sensation.

The facts relating to the evolution of the cerebral cortex in the Primates suggest the explanation of how these abilities, which in their fully developed form are so distinctive of man, have been acquired, by the cultivation and co-operation of vision and touch with the acquisition of skill in movement. The area concerned with sensation derives its power of spatial reference by its connexion with the visual cortex. With reference to the latter Dr. Rivers has given a clear account of the facts. The physiological basis of localization in space is the simultaneous stimulation of both retinae. The perception of form and size depends not merely on the retinal images but also on minute movements of the eyes following the outlines of the object. The acquisition of the ability to extract such information from visual experience obviously depends upon the power to effect the complex conjugate movements of the eyes with the necessary precision.

Perception of form in three dimensions—solidity—depends primarily on the physiological binocular mechanism for relative distance, but is profoundly influenced also by such psychological factors as light and shade and the ability to discriminate between substance and shadow—one of the results of stereoscopic vision.[1]

Head has emphasized the fact that sensory experience can only form part of a consecutive consciousness by virtue of the coherence which otherwise isolated incidents receive from the projected aspects of sensation. The activity of the cerebral cortex is essential for giving us our conceptions of coherence both in space and in time. Without the ability to refer the results of

[1] W. H. R. Rivers, Schäfer's *Text-book of Physiology*, vol. ii, p. 1132.

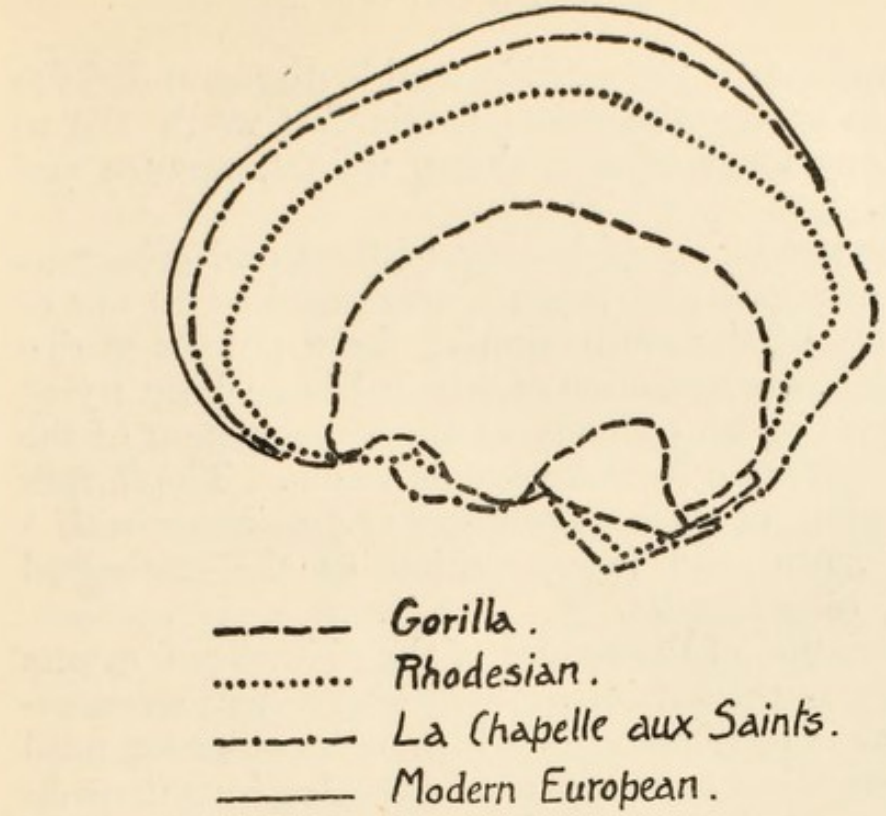

FIGURE 18. A series of profiles superimposed to indicate the relative proportions of the brain in the Gorilla, Rhodesian Man, Neanderthal Man, and Modern Man.

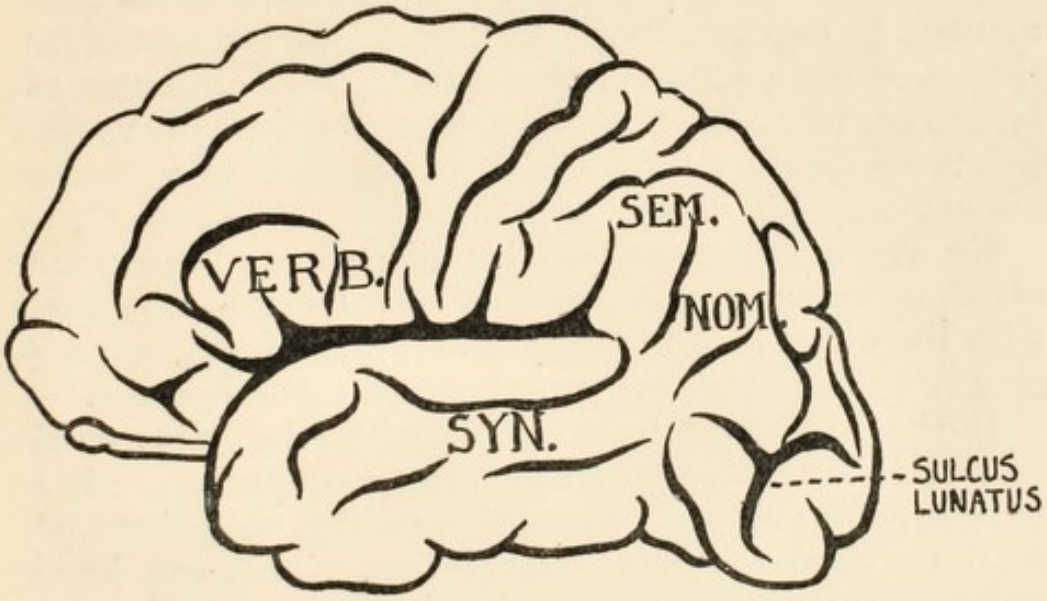

FIGURE 19. Diagram to illustrate the areas injury to which affects speech in different ways: nominally (NOM.), verbally (VERB.), syntactically (SYN.), and semantically (SEM.).

our sensations to the outside world—to some definite locality in space—the material stimulus would fail to convey any ideas of size, shape, weight, texture, and intensity.

The appreciation of beauty of form and colour, as well as of sound and rhythm, was acquired as one of the results of the cultivation of these powers of discrimination, the evolution of which I have been trying to interpret as an outcome of the development of the abilities conferred by stereoscopic vision. The further investigation of these evolutionary processes will, I believe, afford the interpretation of the biological meaning of aesthetics.

Appreciation of the nature of the objects and events happening in the outside world are dependent upon certain cortical developments which did not occur until Man's immediate ancestors were assuming human qualities. The attainment of the realization of space and time, and the faculty of recognizing objects by their shape, colour, size, and texture, marked the transformation of the Ape into a Man. For the ability to appreciate the manifold qualities and distinctive differences made it biologically useful for him to devise names for things, and so initiated the development and use of language with all that language implies in vastly increased capacity for thinking in symbols of value to himself and intelligible to others.

By the development of this line of argument, the origin of speech can be brought into logical connexion with the other factors that are expressed in the expansion of the parietal, prefrontal, and temporal cortex.

In the primitive human brain, such as the endocranial cast of *Pithecanthropus* enables us to picture, there is a very pronounced local expansion of the posterior part of the second temporal convolution. This can have only one meaning—the fact that in the earliest known member of the Human Family there was a sudden expansion of the acoustic territory for the appreciation of some sort of speech.

Primitive speech, apart from mere emotional cries such as all animals endowed with a true sense of hearing emit, no doubt began with imperative verbs differing only in their variety and fuller meaning from instinctive cries. But when names were invented, at first by the definition of a visual experience for which a verbal symbol was devised, it became possible for men to communicate the one with the other in sentences of two words after the manner of Alfred Jingle in *Pickwick Papers*.

But it required a much more elaborate cultivation of the acoustic territories of the cortex before real sentences were devised by the syntactic process of linking together a series of words to express a meaning which was not simply that of the individual words or the combination of them, but, so to speak, a glorified word with an individuality and a meaning of its own and a rhythm of enunciation somewhat akin to music. As a complement to this power of controlled expression of highly complex acoustic symbols, which is made possible by physiological dispositions in the temporal area, there is a wider understanding of the significance of the symbolism so elaborated, which apparently is made possible by the development of the parietal area (supramarginal convolution). This semantic aspect of speech—the capacity for understanding the deeper significance of words and the wider meaning of the whole sentence—is really part of the process of true comprehension of the aim and purpose of speech, thought, and action. It is dependent upon the complete integrity of the cortical connexions linking the tactile with the visual and acoustic areas. The functions of this parietal territory are as significant for the real understanding of events as the prefrontal territories are for the attainment of muscular skill, although in all its activities almost every part of the cortex plays its part.

When Man began really to examine the objects around him he did not neglect the study of himself.

The information he acquired of the world included a knowledge of his own body and the estimation of the aesthetic qualities of his fellows, for vision came to acquire an increasing influence in his selection of sexual mates; and it is possible that in the case of the Human Family Darwin's claim for sexual selection may find much ampler confirmation than most biologists are inclined to attach to it in the case of other organisms. No one can question the appeal of physical beauty to mankind, and it is difficult to believe that an attraction so universal and deep-seated could possibly have been devoid of effect in the process of transmuting the uncouth form of an Ape into the graceful figure of a human being.

But Man did not examine merely the physical form of himself and mankind in general; he studied the behaviour of his fellows, and by introspection examined his own thoughts and feelings, and constructed his conceptions of time, space, and materials. In his attempts to interpret what he saw and learned by experiment he tried to understand such of the forces of nature as seemed to affect his welfare. Out of such gropings there emerged the earlier theories of physics and biology, which became stereotyped by tradition. At every stage of his progress toward a fuller enlightenment such speculations became for the vast majority of mankind a simple device for escape from the necessity of thinking. But if such traditional evasions were a source of comfort to the many, they have ever been a hindrance to the real thinker striving after a consistent and really satisfying explanation of natural phenomena and human history.

BIBLIOGRAPHICAL NOTE

As this little book will be used as a guide by many students not familiar with anthropological literature, perhaps I should indicate where fuller particulars concerning the evidence discussed here can be obtained. The most generally useful book of reference is the English version of Marcellin Boule's *Fossil Men* (Edinburgh, 1923), although the views expressed by the distinguished French savant are not in all cases in agreement with those set forth here.

Other useful works are :

A. Smith Woodward, *A Guide to the Fossil Remains of Man* (British Museum, 3rd edition, 1922).

W. J. Sollas, *Ancient Hunters*, 2nd (or, if ready, 3rd) edition (London, 1914).

H. Fairfield Osborn, *Men of the Old Stone Age* (latest edition, New York).

A. Keith, *Antiquity of Man* (London, 1915).

William K. Gregory, *The Origin and Evolution of the Human Dentition* (reprinted from *The Journal of Dental Research*, 1920 and 1921).

Charles F. Sonntag, *The Morphology and Evolution of the Apes and Man* (London, 1924).

Gregory's and Sonntag's works contain extensive bibliographies.

INDEX