The Study of Man.[1]

By Prof. G. ELLIOT SMITH, F.R.S.

IN this address I propose to give a sketch of the progress that has recently been made in some of the manifold branches of study concerned with the nature and history of man and his achievements, and to suggest how they can be correlated and integrated as a real science of man with a distinctive discipline.

The recent discoveries of the remains of Rhodesian man and the Nebraska tooth have added a new species and a new genus to the human family, and two continents to the known domain of its extinct members. Intensive studies of the whole series of fossil remains and comparison with the living races of *Homo sapiens* have made it possible for us to construct a family tree of the Hominidæ, and to draw certain inferences as to the nature of the evolutionary changes that have occurred within the human family since it first came into existence. From such investigations it appears that some of the features regarded as distinctive of the highest races of men are temporary phases in the lower races; and, what is much more striking, many of the anatomical traits generally supposed to be peculiar to the human family are found in new-born gorillas and chimpanzees, but are lost by these apes before they attain their maturity. Prof. Bolk, of Amsterdam, has recently been studying this remarkable phenomenon,[2] and has attempted to interpret the facts by the Batesonian paradox that man has attained the human status and the higher races have advanced a stage beyond the lower, not by the acquisition of new characters, but by inhibiting the full development of his ancestral traits. I am unable to accept my distinguished friend's speculations. For man's mental powers and the brain that makes their manifestation possible cannot be explained simply as an unveiling of possibilities dormant in his ancestors, for they are positive additions to his equipment which represent his distinctive characteristic. There is, however, this germ of truth in Prof. Bolk's claim; the apes have in many respects departed further from the primitive ancestral type than man has in that they have become more highly specialised in adaptation to a particular mode of life. They have lost not only many primitive traits that man has retained, but also the plasticity and adaptability that played a decisive part in the attainment of man's mental pre-eminence.

I propose here to submit a tentative pedigree of man's Primate ancestry based upon the results of intensive studies in comparative anatomy and embryology, and discoveries in palæontology, and to use this as the basis for a study of the progressive changes in the brain, which prepared the way for the eventual emergence of those attributes of mind which distinguish man from all other living creatures.

In the course of this inquiry we shall see that during the process of evolution man's Primate ancestors wandered from America to Europe and Asia, and that such world-wide migrations have been continued by certain of their descendants ever since, providing the new environments which weeded out those members of the order that failed to adapt themselves to new circumstances or to specialise and drop out of the race for the attainment of a higher status. Nor did this migration cease with the advent of man himself. He has ever been a wanderer upon the face of the earth; and not until the invention of civilisation did certain groups of human beings become anchored in definite localities. One of the great sources of confusion in modern anthropological discussions is the failure to distinguish between the migration of population and the diffusion of culture: in other words due recognition is not given to the fact that a small group of people of a higher culture can impose the latter upon a large community without necessarily effecting any recognisable change in the physical characters of the people as a whole.

THE DISCOVERY OF TUTANKHAMEN'S TOMB.

When the programme for the British Association meeting was first tentatively drafted, more than six months ago, the attention of the world at large was fixed upon the Theban Valley of the Tombs of the Kings, and the name of the insignificant pharaoh Tutankhamen was on every one's lips. The officers of the Association then decided that the evening lecture should be devoted to an exposition of the scientific results of the exploration of Tutankhamen's tomb, and it was hoped that Lord Carnarvon would have presided at it. I need not dwell upon the tragic events which have made impossible the realisation of either of these proposals. Lord Carnarvon's death has dealt a very serious blow to Egyptian studies just at the moment when it is more than ever important that British prestige in Egypt as a serious patron of archæological study should be maintained and strengthened.

The work in Tutankhamen's tomb has yielded singularly little information of direct scientific value. Yet there are certain aspects of this dazzling illumination of the last phase of the eighteenth dynasty that are worthy of attention. I need not emphasise the value of this discovery in forcing upon the attention of the world the vastness of the achievements of the ancient Egyptians in the fourteenth century B.C. At a time when some of us have been trying to impress this fact upon students of anthropology one cannot refrain from acknowledging the debt to Mr. Howard Carter for having accomplished in one winter what we have been striving in vain to do at the British Association for more than twelve years. There is only one point in connexion with this discovery to which I can refer before I turn to consider other aspects of the study of man.

THE SEARCH FOR GOLD.

The vast quantity of gold actually found in the tomb is a point of special interest, for it raises problems of the utmost significance with reference to the part played by this relatively useless yellow metal in the history of civilisation. At a time when we have lost the use of gold as currency it is interesting to contemplate a stage

[1] Evening lecture delivered to the British Association Meeting at Liverpool, on September 14.

[2] L. Bolk, "The Part played by the Endocrine Glands in the Evolution of Man," *The Lancet*, September 10, 1921, p. 588.

in history before gold coinage was invented, although the metal was being used as tribute. Gold was the first metal used by man, and it was the arbitrary value attached to it for its supposed magical properties as an elixir of life that initiated the world-wide search for it which has now lasted for sixty centuries, although the motive for the search—in other words, the reason for attaching so peculiar a value to the soft yellow metal—has changed. The search for gold has been the most potent influence in the development and the spread of civilisation. From the pictures in the tomb of Tutankhamen's viceroy Huy, we learn that the gold was obtained from Nubia and the Soudan, and we are also shown the peculiar types of ships which brought this tribute down the Nile. The demonstration of the effects of such exploitation upon the Soudan has recently been revealed by the investigations of Prof. Reisner, which have provided us with an object lesson in the process of cultural diffusion such as has been happening in every part of the world since then. In modern times we have seen it in the Transvaal, in Australia, and in California—the settlement of relatively small bands of miners to get gold and incidentally to plant in hitherto waste places of the earth certain of the elements, good and bad, of our civilisation. In the Soudan thirty-five centuries ago the Egyptians were doing what our own people are now doing in the Transvaal. A relatively small band of people of higher culture were making use of the local population to exploit the gold to which the latter had previously attached no value. As the result of the settlement of cultured immigrants in their midst certain of their customs and beliefs were adopted by the indigenous inhabitants and blended with their own customs. In a report upon Prof. Reisner's work in the Soudan which I submitted to the British Association in 1915 (Report, p. 189) the facts relating to this racial and cultural mixture were summarised.

The geographical distribution of archæological remains and the features of the culture reveal to every one who is willing to read the plain story told by these facts, first emphasised by Mr. W. J. Perry, that the same process has been going on ever since the first civilisation was invented, and that it has been the chief motive for the diffusion of culture throughout the world. Whether one examines the distribution of the earliest monuments in Southern India, or the settlements mentioned in the Rig Veda in the North-West, the distribution of ancient settlements in Persia, Siberia, the Caucasus and Asia Minor, or further afield from the ancient East in Europe and the British Isles, in Africa to the Niger and Zimbabwe, in the lands of gold in Malaysia and Eastern Asia, and further still in America, we can read the same story, the same motive and the same result of the exploitation of the local natural resources by the native population under the direction of relatively small bands of alien immigrants.

Many other materials to which a magical or economic value was attached played a part in this process of exploitation. Resin, timber, pearls, copper, flint, jade, turquoise, lapis lazuli, amber, tin, and eventually all metals, were some of the more obtrusive lures that impelled men to embark upon any adventure, however hazardous: and the search for these things was responsible for the world-wide diffusion of culture.

The investigation of the details of these events throws new light upon ancient history and affords a convincing explanation of much that hitherto has been obscure in the history of civilisation.

Ancient Mariners.

Considerations of time will permit me to refer only to one aspect of this world-wide diffusion. The pictures of the boats used by Tutankhamen's viceroy reveal certain peculiar features which were adopted also in sea-going ships in the Mediterranean and Erythræan Seas. These distinctive methods of ship-building have been preserved until the present day in the Victoria Nyanza in East Africa and in certain parts of the Malay Archipelago. They are also revealed in quite unmistakable fashion in sculptures of the Early Bronze Age in Sweden. Here there is a specific illustration not only of the fact of the world-wide diffusion of culture but also of the chief means by which it was effected.

The New Vision in Anthropology.

The investigation of the factors involved in this demonstration of the unity of civilisation brings to light the motives that prompted its origin, and provides us with a new insight into the real meaning of customs and beliefs. It contains the germ of a new method of approach to the problems of psychology, and a means whereby in time the unification of anthropology will be effected and a real science of man created.

During the last twelve years there has been a profound change in most of the fields of investigation concerned with the study of man. Not only has there been a rich harvest of new facts and a fuller understanding of the meaning of such knowledge as we possess, but also there has begun to emerge a radically new attitude toward the problems awaiting solution. Hitherto the investigator who concerns himself with the problems of human structure and function, of the races of man, of the fossil remains of man, of evolution and inheritance, as a rule has refused to discuss customs and beliefs, arts and crafts, social organisation, and the psychological aspects of anthropology which are now commonly called cultural. The two branches of anthropology have been cultivated in water-tight compartments, and the fact that the results achieved in each of them have far-reaching significance for the interpretation of the problems of the other is as a rule totally ignored.

During recent years some of the more far-seeing students of man have been insisting upon what the late Dr. Rivers called the unity of anthropology and the urgency of the need for more co-operation between the different fields of research.[3] Until such integration is effected there can be no real science of man. In this address I propose to give a sketch of the new trends in anthropological thought, and to suggest how they may be unified and focussed upon a definite aim, the interpretation of man's history and human conduct.

Perhaps a simple illustration will explain the value of the correlation of physical and cultural studies. Twelve years ago, when attempting to interpret the

[3] W. H. R. Rivers, "The Unity of Anthropology," *Journ. Royal Anthropological Institute*, 1922; also B. Malinowski on the same subject, NATURE, Sept. 1, 1923, p. 314.

results of the study of ancient Egyptian remains, I plotted out on a map the geographical distribution of an alien people with easily recognisable distinctive features that began to make its way into the Egyptian Delta about 3400 B.C.[4] This people, which played a definite part in Egypt, Babylonia, Crete, and the Mediterranean, and especially in Britain, could be traced without much difficulty to its homeland in Western Asia. Having reached this stage in interpreting the facts, I was greatly perturbed to find that this same unmistakable type was found widespread throughout Polynesia. Having failed to get any help or encouragement from anthropologists, either on the physical or the cultural side, to pursue this subject further, I had no alternative than to resort to ethnological studies to see whether I could not discover cultural evidence to shed some light upon the undoubted facts of race, concerning which I was satisfied that I had unshakable evidence of a widespread migration of people. In Polynesia I found the same general associations between the distribution of these distinctive people and the practices of megalith-building and mummification as I had previously found in the Mediterranean area and Western Asia; and when the evidence came to be studied intensively it seemed to establish upon unshakable foundations the fact of the unity of civilisation and the world-wide diffusion of culture in early times. This conclusion of course has been warmly contested during the last ten years, during which, however, its opponents have repeatedly shifted their ground and taken up new lines of defence. While there is not a scrap of doubt as to the ultimate issue, it is clear that there will be a prolonged conflict such as in the past was necessary to convince people that the earth was not flat, or that man was really evolved from a Simian ancestor.

There are two points in connexion with this theory that I want specially to mention:—(*a*) Its bearing upon the problems of physical anthropology, and (*b*) its relation to psychology. If it can be demonstrated that at certain scattered localities widespread throughout the world the germs of the common civilisation were planted by immigrants, the recognition of the presence of the latter at some places and not at others is a fact of cardinal importance to the student who is attempting to interpret the puzzling results of the intensive study of race in localised areas. When one is dealing with regions like Oceania, where the population is the result of relatively recent immigrations, probably none of them more than twenty centuries old, such considerations are clearly the essence of the whole problem.

I need say no more in justification of the fundamental importance of the close correlation of the work in physical and cultural anthropology. They are parts of one and the same problem, which cannot be solved unless both classes of evidence are given their proper value.

One of the greatest obstacles that has barred the way to such collaboration has been the persistent refusal on the part of ethnologists to distinguish between diffusion of culture and migration of people. The confusion that has arisen from this issue has had far-reaching effects not merely upon the interpretation of the early history of civilisation, but also by implication in creating a bias in favour of the untenable hypothesis that there is a necessary connexion between race and culture.

The proof of the fact of this widespread diffusion of ancient culture is provided (*a*) by the positive evidence that it did occur; (*b*) by the fact that in the history of custom and invention knowledge invariably has spread in the way we postulate, and has ever been the chief incentive to progress in the new foci; and (*c*) by the psychology of invention. If then, it is asked, the fact of diffusion is so certain, why is there so intense an opposition to its admission? Why do the majority of anthropologists cling to a theory that is so obviously false? Their attitude and methods of evasion become more intelligible if one goes back three centuries ago and studies the arguments of the people who refused to admit the error of the flat-earth hypothesis. If it be urged that the opposition in that case was essentially theological, it can be claimed that mediæval theology has not a monopoly of dogmatism against the advancement of science. The errors of ethnological doctrine that still hold the field are largely the outcome of certain incidents in the sixties of the nineteenth century, as the result of which (*a*) the terms used by biologists in the Darwinian controversy were misunderstood and misapplied, and (*b*) in the conflict with such apologists as Archbishop Whately and the Duke of Argyll[5] the ethnologists not only made claims that recent research has shown to be wholly indefensible, but also laid down these false doctrines with all the pontifical air of infallibility which unconsciously they seem to have adopted from their theological opponents. In recent times the attempt has been made to bolster up this false claim by certain specious psychological arguments; and the best hope for ridding anthropological science of so serious a hindrance to progress is to be found in the adoption of serious psychological methods in the investigation of customs and beliefs and the interpretation of the history of civilisation. Nor would the benefit of this closer correlation between ethnology and psychology be one-sided. Psychology has at least as much to gain as ethnology. For the investigation of the meaning of myth and folk-lore, of custom and belief, is coming to play an increasing part in the study of human behaviour. The further development of this tendency is certain to be the chief factor in ridding anthropological studies of the encumbrances of error which still hamper their growth.

MAN'S DISTINCTIVE ATTRIBUTE.

The study of man can only become transformed into a real science when man's really distinctive attribute, the nature of the human mind, is made the chief subject of anthropological inquiry. The value of psychology as the great integrating factor in anthropology has recently been explained with great lucidity by Dr. Malinowski, and in the rest of my address I want to suggest that the extent of its possibilities for effecting co-ordination is even much wider than the claims he made for it. Psychology can become the bond of union between all branches of anthropological inquiry and the medium whereby a distinctive dis-

[4] "The Ancient Egyptians," 1911 and 1923.

[5] Andrew D. White, "A History of the Warfare of Science," etc., vol. i., p. 305 (1920 ed.).

cipline can be developed to justify the creation of a real science of man.

The full recognition of the mechanism of the diffusion of culture involves a new orientation in psychological investigation, for it points the way to the true explanation of the origin of folk-lore and myth and of custom and belief; and it throws a new light upon the springs of human action and upon the problems of social and political organisation and of education. The outcome of this new movement in ethnology will be to effect a closer bond of union with real psychology and through psychology with the biological sciences that are essential for the full appreciation of the meaning of mental evolution.

It is too often forgotten by students of man's evolution that the fundamental distinctive feature of the human family is the nature and range of the powers of mind, which differentiate it from all other living creatures. The chief aim of the interpreter of this evolution should be to offer some explanation of how these distinctively human attributes were acquired.

With his usual facility of expression Sir James Frazer puts this view with great force. It is all the more welcome because he, who so freely uses the theory of the independent evolution of belief, reproves another ethnologist for too exclusive a devotion to biological methods of interpretation and for forgetting "the part that human thought and will have played in moulding human destiny." He says that some of his colleagues "would write the history of man without taking into account the things that make him a man and discriminate him from the lower animals. To do this, to adopt a common comparison, is to write the play of 'Hamlet' without the Prince of Denmark. It is to attempt the solution of a complex problem while ignoring the principal factor which ought to come into the calculations. It is, as I have already said, not science but a bastard imitation of it. For true science reckons with all the elements of the problem which it sets out to solve. . . . In particular, the science which deals with human society will not, if it is truly scientific, omit to reckon with the qualities which distinguish man from the beasts." [6]

It should, then, be the fundamental aim of any movement to integrate the forces of anthropological inquiry to provide an explanation of how man acquired his distinctive position and how precisely his behaviour was modified by the attainment of such heightened powers of discrimination and ability to profit from his experience.

The Evolution of the Human Brain.

Intensive research in comparative anatomy and embryology and discoveries in palæontology have made it possible for us to reconstruct man's pedigree with a confidence that hitherto would not have been justifiable. Using this scheme as a foundation, we can determine precisely what structural changes, especially in the brain, were effected at each stage of the progress of the Primates toward man's estate; and in the light of the information afforded by physiology and clinical medicine we are able in some measure to interpret the meaning of each of the stages in the attainment of the distinctively human attributes of mind.

[6] "Totemism and Exogamy," 1910, p. 98.

In an address delivered at the Dundee meeting of the British Association eleven years ago, and elsewhere on several occasions since then, I have discussed this problem: but I make no apology for returning to its consideration again. For, as I have said already, it is the fundamental question in the study of man; and recent research has cleared up many difficult points since I last spoke on the subject.

Even before the beginning of the Tertiary period the trend had already been determined for that particular line of brain development, the continuation of which eventually led to the emergence of man's distinctive attributes. Moreover, man, as I said in 1912, is "the ultimate product of that line of ancestry which was never compelled to turn aside and adopt protective specialisations, either of structure or mode of life, which would be fatal to its plasticity and power of further development."

Vision the Foundation of Man's Mental Powers.

The first step was taken when in a very primitive and unspecialised arboreal mammal vision became the dominant sense, by which its movements were guided and its behaviour so largely determined. One of the immediate results of the enhancement of the importance of vision was to awaken the animal's curiosity concerning the things it saw around it. Hence it was prompted to handle them, and its hands were guided by visual control in doing so. This brought about not merely increased skill in movement, but also the cultivation of the tactile and kinæsthetic senses, and the building up of an empirical knowledge of the world around it by a correlation of the information obtained experimentally by vision, touch, and movement. The acquisition of greater skill affected not merely the hands but also the cerebral mechanisms that regulate all movements; and one of the ways in which this was expressed was in the attainment of a wider range and an increased precision of the conjugate movements of the eyes, and especially of a more accurate control of convergence. This did not occur, however, until the flattening of the face (reduction of the snout) allowed the eyes to come to the front of the head and look forward so that the visual fields overlapped. Moreover, a very complicated mechanism had to be developed in the brain before these delicate associated movements of the eyes could be effected. The building-up of the instrument for regulating these eye-movements was the fundamental factor in the evolution of man's ancestors, which opened the way for the wider vision and the power of looking forward that are so pre-eminently distinctive of the human intellect. Our common speech is permeated with the symbolism that proclaims the influence of vision in our intellectual life.

The first stage in this process seems to have been the expansion of the prefrontal cortex and the acquisition of the power of voluntarily extending the range of conjugate movements of the eyes and focussing them upon any object. Then came the laborious process of building up in the mid-brain the instrument for effecting these complex adjustments automatically,[7] so that the animal was then able to fix its gaze upon an object and

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

to concentrate its attention upon the thing seen rather than upon the muscular act incidental to the process of seeing it. This represents the germ of attention and of mental concentration in general. But the power of automatically moving the eyes with such accuracy that the images of an object upon the two retinæ could be focussed with precision upon exactly corresponding spots made possible the acquisition of stereoscopic vision, the ability to appreciate the form, size, solidity, and exact position in space of objects. It also prepared the way for the development in each retina of a particularly sensitive spot, the macula lutea, which enabled the animal to appreciate the texture, colour, and other details of objects seen with much more precision than before. Hence probably for the first time in the history of living creatures an animal acquired the power of "seeing" in the sense that we associate with that verb. The attainment of these new powers of exact vision further stimulated the animal's curiosity to examine and handle the objects around it and provided a more efficient control of the hands, so that acts of increasing degrees of skill were learned and much more delicate powers of tactile discrimination were acquired. Out of these experiments also there emerged a fuller appreciation of the nature of the objects seen and handled and of the natural forces that influenced the course of events.

With the acquisition of this new power of learning by experimentation, events in the world around the animal acquired a fuller meaning; and this enriched all its experience, not merely that which appealed to the senses of sight and touch, but hearing also. Thus in the series of Primates there is a sudden expansion of the acoustic cortex as soon as stereoscopic vision is acquired, and the visual, tactile, motor and prefrontal cortex also feel the stimulus and begin rapidly to expand. This increase of the auditory territory is expressed not only in a marked increase of acoustic discrimination but also by an increase in the power of vocal expression. At a much later stage of evolution the fuller cultivation of these powers conferred upon their possessors the ability to devise an acoustic symbolism capable of a much wider range of usefulness than merely conveying from one individual to another cries expressive of different emotions. For when true articulate speech was acquired it became possible to convey ideas and the results of experience from individual to individual, and so to accumulate knowledge and transmit it from one generation to another. This achievement was probably distinctive of the attainment of human rank, for the casts obtained from the most primitive brain-cases, such as those of Pithecanthropus and Eoanthropus, reveal the significant expansion of the acoustic cortex. This new power exerted the most profound influence upon human behaviour, for it made it possible for most men to become subject to tradition and to acquire knowledge from their fellows without the necessity of thinking and devising of their own initiative. It is easier to behave in the manner defined by convention than to originate action appropriate to special circumstances.

Within the limits of the human family itself the progressive series of changes that we have witnessed in man's Primate ancestors still continue; and as we compare such a series of endocranial casts as those of Pithecanthropus, Eoanthropus, *Homo rhodesiensis*, *Homo neanderthalensis*, and *Homo sapiens*, we can detect a progressive expansion of the parietal, prefrontal, and temporal territories, which are associated with the increasing powers of manual dexterity and discriminative power, of mental concentration and of acoustic discrimination.

The study of such factors of cerebral development will eventually enable us to link up the facts of comparative anatomy with psychology, and enable us the better to understand human behaviour. Such wider knowledge will, in time, help us to co-ordinate the principles that underlie customs and beliefs, and from such researches there will eventually emerge a distinctive discipline and a more strictly scientific method.

For the full realisation of this vision, what is necessary above all is that the universities should recognise the importance of this new conception of humane studies and take an active part in building up a science of man that is more scientific than what at present are known as the humanities and more human than biology. The fundamental aim of all education is the fuller understanding of the forces of Nature and of human behaviour. The necessity for attacking the latter problem with more directness and precision is urgent; and it is impossible to exaggerate the importance of a fuller cultivation in our universities of the study of the nature of man and of the springs of human conduct. It lies at the root of all knowledge and the intelligent control of all human affairs. I need not emphasise the tremendous practical importance of such studies to an Empire such as ours at the present time. The Pan-Pacific Conference held in Australia recently is an earnest of the realisation of this fact by statesmen and administrators and of the usefulness of collaborating with men of science to acquire an understanding of subject peoples and their social problems. This policy of peaceful development of the Pacific is a good augury for the fuller recognition of the value of anthropology to the world at large.

Some Bearings of Zoology on Human Welfare.[1]

By Prof. J. H. ASHWORTH, D.Sc., F.R.S.

THE bearings of zoology on human welfare—as illustrated by the relation of insects, protozoa, and helminthes to the spread or causation of disease in man—have become increasingly evident in these later years, and are familiar to every student of zoology or of medicine. At the time of the last meeting of the British Association in Liverpool (1896), insects were suspected of acting as transmitters of certain pathogenic organisms to man, but these cases were few, and in no single instance had the life-cycle of the organism

[1] From the presidential address delivered to Section D (Zoology) of the British Association at Liverpool on September 13.