

SCIENCE

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PHYSICAL ANTHROPOLOGY.*

PHYSICAL anthropology is that branch of the broader field of anthropology which treats of physical man. It has nothing to do with man as a social being; it is not

* A lecture delivered at the Field Columbian Museum, March 20, 1897.

concerned with the products of his hands or of his brain; it deals neither with technology, language, government, law, sociology, folk-lore nor religion; it treats of man as an animal.

We may for the sake of convenience consider four views of the subject. These are:

- (a) the scope of physical anthropology;
- (b) the problems of physical anthropology;
- (c) physical anthropology in its relation to museum exhibition; and (d) the importance or value of physical anthropology.

(a) *The Scope of Physical Anthropology.*

Physical anthropology assumes that man is an animal; is a member of the brute world, and it follows that man is to be studied as other animals are studied. It is then a part of zoology, which has for its study the entire animal world; and in this world man demands the most attention and the closest scrutiny, for he is both the most important and the most widely distributed of all animals. Applying the methods of zoological investigation to man, physical anthropology asks of his ancestry, of the time of his appearance on earth, of his kinds or varieties or species, of the comparative fertility of races, of the fertility of hybrids, of the laws of heredity and descent, and of the nature and influence of food, climate and environment upon man, and finally of man's relation to other animals.

It becomes evident at once that in the various investigations which are instituted in the study of physical man we must have the assistance of other studies which are closely related. Thus by the aid of paleontology we may hope for light on the problem of man's first appearance, both in time and place, and also on the problem of man's ancestors, for paleontology is simply the study of zoology in geological times; it is the archaeology of zoology. Again, by the aid of embryology, we may hope to learn something of man's origin, for it is one of the laws of biology that the developmental history of the individual is an epitome of the developmental history of the race. With the aid of anatomy, the study of gross structure, we are able to compare the varieties of men and so classification and division become possible, and by means of comparative anatomy we can compare man's structure with that of other animals and thus learn of relationships. With the aid of physiology and experimental psychology we are enabled to judge of the comparative physical functions and mental activities of the different races. It must be added that no one or even all of these studies combined is physical anthropology. The data which they severally and collectively furnish make possible the broader, more comprehensive study of physical man.

It is well also that we remind ourselves that the study of physical anthropology has only recently become a possibility. The time was not so very long ago when man rebelled at the thought that he had anything in common with the animals; he forgot or overlooked the fact that his entry into and exit from this world were like other animals, that his life was and is a struggle for existence, that his physical nature was so like that of animals that the same laws of evolution which produced the one must have produced the other, must have produced all, must govern all. And

so the skeptics of the scientific and unscientific world cried: Produce your missing link! The 'missing link' is dead, and almost forgotten, but in his stead has arisen, from the study of paleontology, embryology and comparative anatomy, an array of facts which unite man to the animal world in a manner so close and intimate as to admit of no questioning. As one anatomist* says: "Blood relationship and not some unknown plan of creation forms the invisible bond which unites organisms in various degrees of similarity, and in this great family man must find his place. He forms but a link in the chain, and has no right to consider himself an exception."

It may seem strange that after physical anthropology has been declared to be that part of zoology which deals with man that there should be any need to speak of the *methods* which are essential to its proper study. But the field offers such large opportunities for superficial work, and so much of that sort has been done that we may well devote a few minutes to the consideration of this subject. We hear so much of 'reversions,' 'simian traits' and 'anthropoid characters' that we are bewildered, and after all the evidence is in we can only conclude that man's ancestors were wonderfully and fearfully made. There is, indeed, in the different races of men, or in any one of them, an enormous amount of variation. A naturalist† asks: "Are not Esquimaux and Bushmen, Samoyedes and Australians, American Indians and Fantis much further apart than any two species of monkeys, of larks or butterflies?" While an anatomist,‡ speaking of the shoulder-blade, says: "I do not know what range of

* Wiedersheim: *Structure of Man*, p. 2.

† Sir Henry Haworth: *Natural Science*, Sept., 1896, p. 185.

‡ Professor T. Dwight: *The Range and Significance of Variation in the Human Skeleton*. Boston, 1894, p. 23.

variation a great series of the scapulæ of the larger felidæ might present, but a small one shows nothing like that of the human race, and I might even add that of the Caucasian."

But because certain parts of man's skeleton bear close resemblance to the gorilla, other parts to the chimpanzee, still others to the orang and gibbon, does it follow that man, in his race history, has been successively a gibbon, an orang, a chimpanzee and a gorilla? Surely it would seem no one would claim for man such a pedigree as this, but this has been done, if not openly, it at least has been tacitly implied. And hence the need of definite scientific methods which make such reasoning impossible. Naturally, all the methods of zoological investigation are not applicable in the study of the human species, but at least two are of the utmost value; they are the statistical, or mathematical, and the morphological. The use of the statistical method in anthropology, and its extension in zoology, is due very largely to Mr. Francis Galton. Its basis is an application of the laws of chance, and Galton has devised special apparatus to illustrate its application. The method is of great value in comparative studies, such, for example, as the various indices, which are determined from measurements on the skull. Thus, if we take the length of the skull in a thousand individuals, and arrange the results according to their distribution, we shall have a curve, the character of which will be determined by the uniformity of the individuals measured. If they are all of one race, and that race is free from admixture with other races, we shall expect to find a curve which is high in the center and of a uniform character. If, on the other hand, the race is a mixed one the curve will be broad in proportion to its height and will be irregular in its course. In other words, the character of the curve is largely determined by

the number of disturbing causes. Just as in Galton's apparatus, the character of the curve described by shot which falls upon a compartment, striking in its passage pins, will be determined by the height from which it falls and the number of pins it encounters in its passage. By means of these curves, that is, by the use of the statistical method, the greater part of anthropometric investigations are shown.

In the second method, the morphological, we deal with form and arrangement, and the unit is not the individual, but the species. The method proceeds by homology and it recognizes in variation an indication of the slow modification of the race or species. In other words, morphology is simply an extension of comparative anatomy. It calls to its aid embryology and histology, or the study of minute structure. A character which appears occasionally in man and is always present in the apes is not to be called 'simian' until its pedigree has been carefully determined and it can be shown to have been a transmitted character or an actual reversion. A close adherence to the methods of morphology may not unravel all the problems which are presented in man's structure, but it will make impossible many of the so-called deductions which thus far have been put forth in the name of physical anthropology.

(b) *Problems of Physical Anthropology.*

We have to consider in this place not so much what has been done as what remains to be done, for, although much has been accomplished, the field of investigation still remains very broad. In the first place, we do not yet know the exact lines of man's descent. His cousins are pretty well known, but his immediate ancestors are not yet discovered. There is yet to be learned even the approximate time of man's appearance *as man* upon earth. That time has been stated within the last year by one writer to

have been 15,000 years ago, by another to have been 200,000 years ago. The extreme antiquity of man's appearance is no longer questioned, for in Europe his remains have been found associated with the bones of long extinct mammals. Further evidence of his great antiquity has been found in Africa, Asia and America, and only recently remains have been found in Java which have up to this time defied the best anatomists of Europe to determine whether they belong to man or to some extinct ape. At any rate, they may be characterized as the most human-like of the apes so far known, or the most ape-like of any man yet discovered. But the real importance of the find in Java lies in the fact that we may hope for further discoveries which may throw light on man's origin. There are still vast areas of Quaternary and Tertiary deposits in Asia, Africa and the islands of the Indian Ocean which await investigation, and it is not too much to hope that the next twenty-five years will see greater advances in our knowledge of man's past history than we have seen in the last century.

There is another problem awaiting solution and it is, to a certain extent, bound up with the one just considered; it is the old question, put in a new form, of the single or multiple origin of man—monogenism or polygenism. The facts as at present known are these: With the exception of the Java find and possibly one or two skulls found in Europe, man seems to be not only *man*, but go back as far into the past as we can, we find the several types of mankind already existing as we know them to-day. On the most ancient of the Egyptian monuments we see depicted in a distinct manner the Egyptian Fellaah, the Hadandowah and the Negro. If we consider the skulls which have been found in Europe and America along with bones of extinct mammals we have the long heads and the short heads—the types which appear to-day, and which

furnish much of the basis of anthropological classification. Where or when did the lines begin to diverge? Was it due to a plurality in man's ancestry or was it due to environment? And why have the types of ancient times persisted down to the present day? We do not know yet why the skin of the negro is black, any more than we know why it remains black; nor do we know why his hair in cross section is long and narrow in shape, while that of the Indian is circular.

These questions and riddles are simply part and parcel of the great problem of heredity, and if the study of anthropology does no more than solve that, it will amply have earned its title to recognition. A distinguished English anthropologist declares that even to-day there may occasionally be noted the reappearance of physical types which existed in Europe contemporaneously with the cave-bear and the mammoth; while one of America's foremost anatomists has declared that in the occasional appearance of a third trochanter we have a survival of a structure which is an essential feature of the horse and the rhinoceros. When we know precisely what heredity means, what can be inherited and what can not, then we may hope to know more of man's origin and of his destiny.

But the subjects of investigation are not only to enquire into the past; they include the men, the races of to-day. Surely the field is broad enough here, and no one who has explored even a corner of it doubts its importance and interest. But how much do we know of it? The physical history of the races of Europe has only been written within the last five years and it is far from complete. What do we know of the peoples of Africa or of the aborigines of America? Not nearly as much as we know of the mammals or of the butterflies of these countries. Yet in these peoples we have, if we would but look, a picture

full of suggestion as to man's primitive condition. It is as if the geologist could visit some remote spot and behold the earth as it existed in Tertiary times. Would he neglect the opportunity? In many of the peoples of Africa and Oceania we find types of bodily structure which are not described in the anatomical text-books of Gray or Quain. There we may see important differences from the European type in cranial capacity, in the size and structure of the brain, in the relative lengths of the arm and leg, in the pelvis, in the musculature of the hand and foot, in fact in the entire bodily structure; and these differences are significant. In the heart of Africa are dwarfs that in bodily structure and mental calibre are very far removed, indeed, from the European. In other parts of the world dwarf races have lately been discovered. Are they the survivals of primitive times, or are they the degenerate offspring of a once vigorous ancestry? These are a few of the subjects still awaiting investigation.

The field is surely broad, but how little cultivated! The proper study of mankind may be man, but curiously enough man does not seem to have cared to study mankind. As one of America's foremost students of anthropology has pointed out, man 'has never seriously and to the best of his abilities made a study of his own nature, its wants and its weakness, and how best he could amend the one and satisfy the other.' The reason for this is hard to discover, but for the present we are most concerned in the consequences; and to illustrate the extent to which a lack of the desire to study man will lead, we may take a single example. Among the general instructions to the officers of the Challenger Expedition we find the following: * "Every opportunity should be taken of obtaining

photographs of native races to one scale; and of making such observations as are practicable with regard to their physical characteristics, language, habits, implements and antiquities. It would be advisable that specimens of hair of unmixed races should in all cases be obtained." And what was the result? From an expedition which in its importance ranks only after that of Columbus and Magellan; which consumed years of time and cost the British government in round figures \$600,000—from this expedition the total contribution to the knowledge of the races of men were some notes by two of the officers, a few unsatisfactory photographs, a few bones of skeletons and *sixty-four* skulls! There is a serious side to such a neglect of opportunity as this.

In 1803 Tasmania's population was 7,000; to-day there is not a single representative left. In 1842 the Maoris of New Zealand numbered 140,000; to-day there are less than 30,000. When Macaulay's New Zealander gazes on the ruins of London there will be no New Zealander; the name 'Maori' even will be as unfamiliar then as is now the name of some obscure Germanic tribe of the times of Tacitus. What is true of New Zealand is rapidly becoming true of all the islands of the Pacific; it is true of nearly all the North American continent and for large areas of the Southern.

The field for the study of physical man is broad, but the scene is ever changing, and it behooves us to-day, if we would not merit the just condemnation of the ages to come, to observe, to record, to make use of the camera, the phonograph, the calipers and the color-scale. But how often on any of the great scientific expeditions is there any one fitted by previous training to observe correctly and accurately the races of men that may be encountered? Recall, if you please, the numerous expeditions which have penetrated Africa, crossed Asia and

* I am indebted for this information to *Natural Science*, Vol. VII., No. 41, Special 'Challenge' Number, pp. 7 and 74.

traversed the islands of the Pacific, and we find men competent to observe and collect reptiles and birds and fishes and mammals, to study botany and geology, but how often is anthropology represented? Surely no one doubts that previous training is just as essential in the one case as in the others. But there is already an attempt in some countries to remedy this. In London, Paris and Berlin one can receive instruction from competent teachers as to the best methods of recording and observing, as well as a knowledge of what is best to observe and record. As a result of this, a widespread interest is being manifested in anthropological matters by army and naval officers, as well as by the civilians of the European countries, and there is growing up in each of the great Continental cities storehouses of information about the peoples of the different parts of the world. Not only that, but the universities are awakening to the importance of the study of man. As a sign of the times, we may read in one of the February numbers of *Nature*: "Dr. A. C. Haddon is this term giving two well-attended classes (one elementary and one advanced) in physical anthropology at the Anatomy School." And what is true of Cambridge is true to a greater or less extent of fifteen other European universities.

In America, while general instruction in anthropology has for number of years been given in several universities, a special course in physical anthropology is offered by Dr. Boas in Columbia for the first time this year, and in the University of Chicago courses covering the entire field of physical anthropology have been given by Professor Starr since its foundation.

(c.) *Physical Anthropology in Relation to Museum Exhibition.*

Up to the present time there is no museum or section of museum which adequately or worthily represents the subject of physical

anthropology. There are museums of zoology, of botany, of geology and of anatomy, but no museum which shows the races of men as they should or might be shown. Obviously, it will be beyond the limit of our time to treat, with any degree of fullness, of the possibilities of a museum of physical anthropology, but we can at least attempt to lay down the general lines on which a museum should be built, and which ought to be possible of accomplishment.

The ideal museum of physical anthropology then will have at least three sections or divisions. In the first should be shown the instruments and apparatus which are used for making and recording the various observations which are taken both on the living subject and on the cadaver or skeleton. By the use of charts and diagrams the methods of tabulating and recording these observations may be shown. There ought, furthermore, to be in this section a room or rooms in which an individual who applies can be measured or tested according to the accepted standards of anthropometry and psychometry. Such facilities would serve a twofold purpose. To the subject they tend to awaken an interest in himself and may be useful in indicating physical and psychical defects or weaknesses which may be easily remedied. From personal interest in the subject to a broader and more thorough understanding of the aims and methods of anthropology, is a matter of easier accomplishment after the individual has had even this slight introduction to the science. On the other hand, these observations on the living subject, when made in sufficient quantities, enable the observer to draw valuable deductions in regard to vital phenomena, such as the laws of growth, sexual differences, the influence of nationality, of climate, of nourishment and of occupation, together with the effect of all these on stature, on lung capacity, on strength, on mental activities, etc. Much

has been done along these lines that is valuable, but many important problems have yet to be investigated, the solution of which will help not a little to a more correct understanding of the possibilities and limitations of human life.

In the second section of this ideal museum the aim will be to interpret and explain physical man. Naturally, the subject is treated in the broadest and most general way, the object being primarily to exhibit man as a zoological unit; but there must be many sub-sections or divisions. In one group we may properly begin with the embryological history of man. Such an exhibit is not only possible, but, owing to the improved methods of museum display, can be made very attractive as well as instructive. Not only can man's interuterine life be shown by means of alcoholic specimens, but this may be thoroughly well illustrated, and even the early stages rendered visible, with the aid of the wax and plaster models, which are now made with the greatest exactness and scientific accuracy. With such assistance, many of the most interesting facts of man's history can be made clear. For example, as the various stages of embryonic life are unfolded, we see as it were an epitome of man's past history, for it is one of the laws of biology that the developmental history of the individual is a résumé of the developmental history of the race. By the illustration of this law, as man is seen to pass successfully from the stage of a single cell, through that of a jelly-fish, when later he has the gill pouches of a fish, and the freely projecting tail of mammals, the fact is burned in that man is but a 'link in the chain.'

Another subsection will be devoted to the skeleton. No matter where the skeleton is to be placed or what part it is to play in the exhibit of other branches of zoology, in physical anthropology its place is *not* in the closet, but in full sight; and one museum

at least in America has ably demonstrated that the skeleton can be made as beautiful, as attractive and as interesting as any subject of a natural history exhibit.* Furthermore, the skeleton may or may not be morphologically valuable;† it forms an extremely important part in any exhibit of man. Of all the bodily systems it is easiest preserved and the most enduring; it alone of the body furnishes us with our knowledge of extinct and fossil man.

The first object in the exhibit of the skeleton is to make easily familiar the names, positions and relative importance of the various members, individual bones and parts of bones; in other words, there should first be an illustrated text-book of normal human osteology. The visitor is then prepared for something better and we may next show the development of the skeleton. First to be shown would be the foetal skeleton in ligamentous preparations, and then a series of articulated skeletons, ranging in age from birth to full maturity, terminating with the skeleton of old age. The attempt may next be made to show the range of variation of the skeleton, not for the European race, but for man, drawing for our material upon all races. This series can be made of the greatest interest, and when properly formed and labeled is of the utmost importance. We should have in this group two series, one showing the descriptive variations or those which can easily be detected by the eye and readily and fully described in the labels; the second series illustrates those variations which are best described by terms of mathematical precision. As an example of the first series we may mention, to take the skull alone, the variations in the sutures or lines of articulation of the bones, their degree of serration, the time in life of closure, the

* The Wistar Institute of Anatomy and Physiology in Philadelphia.

† Cf. Minot's *Human Embryology*, p. 422.

influence of the shape of the head by premature closure, anomalous sutures such as the persistent frontal or subsagittal or interparietal, and, finally, the supernumerary bones which appear occasionally in certain sutures. As examples of the second series we may illustrate such craniometrical observations as the variations in the cubic capacity of the skull, or the cephalic index—the relation of the length to the breadth of the skull; or, of other parts of the skeleton, the various forms of pelvic and scapular indices. Still another but minor group should illustrate the diverse forms of artificially deformed skulls which are found in various parts of the world, and along with them should be shown the cradleboards, bandages and other appliances which were used to produce such deformation.

If we include the teeth in our exhibit of the skeleton there is much that can be shown. Thus we would have illustrated the time of eruption of the milk and permanent teeth, the degrees and causes of wear, the appearance of the jaws due to loss of teeth, and the changes which have taken and are taking place in man's dentition. Still another series or subsection presents in one comprehensive view the skeleton of man by the side of those of his first and second cousins, from the gorilla down to the lowest lemurs, including the models or casts of the earliest human bones which have yet been found. In fact, the limits are very wide to this section which is devoted to the skeleton. Many of the changes which have taken place in man's gradual acquisition of the upright position can be shown and made most instructive; such modifications can still be seen in the pelvis, the bones of the arms and legs, the shoulder-blade, and in the gradual shifting of the great body cavities, as seen in the variation in the number of ribs and vertebræ and the gradual shortening of the breast-

bone. This, by no means, exhausts the interesting and instructive changes which can be rung on the skeleton and its component members. But all of this requires an unlimited supply of material from widely distinct races; it also requires, for purposes of illustration, free access to the skeletons of apes and other mammals, and even of lower vertebrates.

But of the first general section we have considered only one system of man's structure; the others should have their proper amount of attention. Here we meet with a real difficulty; the other systems are only prepared and exhibited at considerable labor and expense, and, worst of all, we can not have such free command of material from all races from which to draw. We can dig up the bony remains of the Papuan, but he refuses to be dissected. There is, however, much that can be shown. Take the muscular system; by means of alcoholic and dried preparations, and by following a definite scheme, we can hope to show some of the variations which demand 900 pages for their description at the hands of a French anatomist.* By a careful arrangement we can demonstrate that certain muscles are peculiar to man, those which are required by his upright position and especially by the extended use to which he puts his hands; that he retains other muscles which he no longer needs, as, for example, some of the muscles of his ears and feet; and, finally, that there are occasionally present muscles which, in general, man has lost, but which still survive in an extremely rudimentary condition in some men, such as the caudal or tail muscles.

With the *nervous system* the problem of exhibition becomes at once less difficult again, and the possibilities of museum display are very great. Those who were fortunate enough to have visited the Section

* Testut : *Les anomalies musculaires chez l'homme*. Paris, 1887.

of Neurology* in the Anthropological Building at the World's Fair need not be told of the pleasure which may be derived from a thoroughly well arranged exhibit of the nervous system. In the ideal museum it will be possible to read the story of the development of a man's brain, from its lowly beginning as an infolding of the outer germ layer to that complete organ of the adult which in its structural form so closely resembles the brain of the higher apes, but which in its potentialities and possibilities is as far removed as man himself is from the brute creation. But there is more than mere development to be shown. Even the brain of the adult is subject to great variation from the normal, and all these variations are interesting from the standpoint of morphology. Then there is the correlation of the brain to the skull which must be shown, along with the casts of the cavity of the skull. The subject is by no means exhausted yet, but enough has been said to point out, although imperfectly, the possibilities which this system lends to museum purposes.

Of the other four great systems of physical man I shall stop for only one, and in that shall select a single example. I refer to the variations in the arch of the aorta, the great blood vessel which leads from the heart. In all the systems or parts of systems of man's structure there is none, perhaps, which betrays his humble origin so well or so convincingly as the variations which we find here. It is not that in the embryological development of the circulatory system in general we can trace man's pedigree from a condition more primitive than that of the fishes, but that, to return to our example, in the adult variations of the aorta we may find a single aortic arch on the left side, the normal condition; or a single arch on the right side, the condition

of birds; or a right and left, or double arch, the condition in reptiles.

In all of these four great systems, to say nothing of man's outer covering, such as the skin and hair, there are similar interesting facts, which, by means of corrosive and injection preparations or preservative fluids, may be exhibited in an attractive manner and serve as illustrations for the text-book of humankind.

In the third section we do not consider man, but men; not the species man, but the varieties of men; and hence we may characterize this section as special or ethnic. The aim is to present, as compactly and attractively as possible, a bird's-eye view of all the groups of people from all parts of the world. Such an exhibit, properly made, carefully installed, and fully and accurately labelled, ought easily to excel in interest any exhibit that can be made of any department of science. An exhibit, for example, of a group of casts of Australians, true to life in color, expression, form and dress, is just as much more interesting than a group of stuffed kangaroos as a group of live Australians is of more interest than a group of live kangaroos; and for proof of the correctness of the latter observation one need only take a single glance at the distribution of a crowd at a circus.

As to details, of course, there will be much divergence of opinion, but we cannot go very far astray if we follow, as a general rule, a geographical order. There will be times, to be sure, when it will not be practicable or wise to do this, but if we begin with the dark-skinned races, such as the Negrittoes, Papuans, Australians, and Negroes of Africa, we can readily pass over to the brown or insular peoples of the Pacific, such as the Malays, Indonesians, etc. We can next take up the continent of America, and then, passing over into Asia by the northwest coast, can cross Asia and so finally traverse Europe. In this manner

* Under the able direction of Professor H. H. Donaldson, of the University of Chicago.

we shall not only have circumnavigated the globe, but have done it in an orderly manner, and at the same time have kept near to the line of the physical development of the races.

Naturally, when we come to select the groups and tribes to be represented there will be more difference of opinion, but the main point is to select such groups as are *types*, those which show decided variation from their neighbors, either in color, in stature, in hair, or in physiognomy. The limit to be put on the number of the groups will, of course, be determined very largely by the means at our command for this purpose, but certainly an exhibit which includes less than sixty groups would be incomplete and more or less unworthy of the subject.

There is next to be determined the exact character or nature of the material which is to be included in each group. This again must, to a large extent, be a matter of expediency or possibility. For some groups an abundance of material will be available; for others we must be content with a scant amount. But still it will be possible to keep in mind a standard below which it will be unwise to fall. There should be on the one side the group of casts, colored and dressed with the utmost accuracy and scientific precision. From these figures can be studied the color, shape, size, hair, facial expression, relative length of limbs, shape of hands, feet, etc., as accurately as from the living subject. This should include at least three figures—the man, woman and child. By their side we may show the mounted skeletons, the scaffolding of the body. On the opposite side are series of skulls, shoulder-blades, pelves, long bones, etc., selected in such a manner as to present the typical osteological characters of the group we are representing. At the center and in the back are type photographs, anthropometric charts, diagrams of sections

of hair, etc., and a map showing the exact geographical distribution of the group. Other maps or charts showing the physiography, fauna, flora and climate should be added whenever possible. Every object exhibited is to have its own individual label, and there is, of course, to be in the center a comprehensive label which sets forth in brief, concise language the chief characteristics of that particular group.

In other words, as the first section illustrates the aims, objects and methods of physical anthropology, as the second section defines and exhibits the species man and sets forth his position in the animal world, so this, the third section, is an illustrated text-book of races and peoples, of ethnography.

But we are not yet concluded with our scheme for an ideal museum, for so far provision has only been made for the casual visitor and the thoughtful student; provision must also be made for the investigator. A museum which fails to have its study series can never be considered complete. The museum can not, it does not, aim to supplant the universities, but it should aim to supplement them. It should clearly be borne in mind that the museum of to-day, if it is to be worthy the name, must be built up from the results of field exploration and investigation. No systematic or comprehensive scheme for a scientific museum can be carried out from random gifts and occasional purchases. Accessions from such sources as these may in time grow into vast *curio halls*, but never into the scientific museum worthy the building which houses it, or the time of its care-takers.

It is rare, indeed, that it is possible or desirable to place on permanent exhibition all the material which may be gathered from any single expedition. The duplicates, thus acquired, are too often regarded as encumbrances, fit only for purposes of exchange, or, if that be impossible, they are

piled away in the attic, or even, worse still, in the bottom compartments of the exhibition cases, there to grow mouldy or to be eaten up by the moths. But in the real museum such duplicate specimens, and those not suitable for exhibition purposes, are carefully assorted and those which may be of interest to the student or investigator are arranged in suitable compartments in well lighted rooms, where they may be readily available for study. Such series represent the 'stack' of a great Library; they make possible rearrangement and extension of the exhibition series, and, best of all, they give to the museum, in direct proportion to their fullness, completeness and permanency, and serve the purpose of awakening not a local, but a national interest. Such series would contribute largely to obviate the necessity of American students going abroad for material for study.

(d) *The Importance or Value of Physical Anthropology.*

And now, last of all, we have to consider this question: Is the study of anthropology worth the time, and is its proper exhibition worth the cost and labor? In other words, what is the ultimate aim of physical anthropology, what can it teach, what is its value?

The aim of physical anthropology is to *know* physical man, to unravel the mysteries of his nature. It follows the individual throughout the entire course of his life. It enquires into his origin and his evolution down to the present day. It enquires into the varieties of man and asks for the causes which have made these varieties; why are some men black, why are others white, and, more difficult to answer, it asks why the black remain black and the white remain white. Its aim is to enquire into the condition of physical progress, to study the effects on man of soil and climate; in short,

of environment. It enquires into the laws of heredity and descent, into the laws of health and disease, and it asks for the factors which make for longevity and robustness, a sound mind in a sound body.

Physical anthropology teaches us that all men are not born equal; that every child at birth is "endowed with the heritage transmitted from innumerable ancestors, and is already rich in personal experiences from its prenatal life; that these combined decide the individual's race and strain, and potentially incline, if they do not absolutely coerce, his tastes and ambitions, his fears and hopes, his failure or success."* It teaches us that man has acquired, and only recently, his upright position, and that he is not yet perfectly adapted to it; that the evolution of sex has gone on further in man than in other mammals; that the entire structure is slowly and progressively modified from birth to adult age; that then retrogressive changes set in which, in some respects, are infantile in character. It teaches not only that there has been a gradual evolution of man's physical nature, but that influences are still at work which will produce yet further changes and modifications; that the man of the future will not be like the man of to-day.

The aim of physical anthropology is to know physical man, and herein lies its value; for when we know man then can we answer some of the problems which confront man, and on the proper solution of these problems rests the destiny of nations and the ultimate destiny of man himself. These problems are many, and demand immediate answer. Morphology, the study of variation, is the hand-maid of pathology, and a knowledge of the causes of disease will aid materially in its prevention. With a larger and more enlightened view of the effects of environment, we can hope to see

* Brinton: *The Aims of Anthropology*, SCIENCE, Vol. 11., 1895, p. 241; Proc. A. A. A. S., Vol. 44, p. 2.

solved the problem of acclimatization, a problem which so far has baffled physicians, and which has even been declared insoluble; but which, if ever solved, will change the complexion of the earth's surface and inaugurate a new era in the history of mankind. A broader knowledge of physical man will throw light on that most intricate and obscure problem of miscegenation or race-intermarriage, a problem which, it has been declared, is exceeded by no other in its effects on the 'future prosperity or failure of the human species.'

The study of physical anthropology teaches us that not only are all men not born equal, but that tribes and races and nations are inevitably doomed to give way and perish before the advance of their more fortunate fellow-men; that the time is not far distant when a certain few races will have peopled the globe, when no survivor of the native population will exist on a territory which covers an area of twenty-five million square miles and which, four hundred years ago, contained one hundred million inhabitants.

To know physical man, his past history, his present possibilities, his future destiny—such is the aim and value of physical anthropology, but not least in value is to teach him his place in nature.

GEORGE A. DORSEY.

FIELD COLUMBIAN MUSEUM.

THE ASSOCIATION OF AMERICAN ANATOMISTS.

THE ninth annual session of the Association was held in the Columbian University Scientific School, Washington, D. C., Tuesday to Thursday, May 4 to 6, 1897, in conjunction with the other societies comprising the Congress of American Physicians and Surgeons.

Dr. Frank Baker, President of the Association, presided at the several meetings. The following members were present at

some time during the session: Baker, Bevan, Blake, Bosher, Browning, Carr, Dawbarn, Gerrish, Gill, Hamann, Hewson, Hodge, Hunt, Huntington, Hutchinson, Kemp, Lamb, Leidy, Mears, Miller, Mixter, Moran, Parkhill, Reisinger, Roberts, Shepherd, West and Wilder—28 in all.

The Association was called to order by the President who delivered an address, which will be printed in *SCIENCE*.

Dr. D. S. Lamb, Secretary and Treasurer, submitted his report for the period which had elapsed since the last session, December 27 and 28, 1895, which was accepted. The following are extracts: "No meeting was held in December, 1896, in view of the fact that this Association is a member of the Congress of American Physicians and Surgeons, which meets in this city in May every third year. The Executive Committee believes that if we should meet both in December and the following May the short interval between the meetings would imperil the success of the May meeting, at the same time regretting that by postponing the December meeting we lose the opportunity of attending the sessions of the Society of American Naturalists and the affiliated societies. This is the second time this postponement has occurred and in the nature of things seems inevitable every third year.

"Since the last meeting three members have died. Sir George Murray Humphry, an honorary member, professor of surgery and late professor of anatomy in the University of Cambridge, England, died September 24, 1896. He is perhaps best known as the author of a classic work on 'The Skeleton.' Dr. Charles Heitzmann, of New York City, at one time lecturer on morbid anatomy in the University of Vienna, and who afterwards conducted a Histologic and Pathologic Laboratory in New York City, author of a work on anatomy, having occasion to go to Europe for his health, resigned September