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DARWIN'S THEORY OF MAN'S DESCENT AS IT STANDS TO-DAY[1]

MY LORD MAYOR, MR. VICE-CHANCELLOR, LADIES AND GENTLEMEN,

My first duty as your president, and it is a very pleasant one, is to send the following message in your name to H.R.H. The Prince of Wales:

YOUR ROYAL HIGHNESS,

The British Association for the Advancement of Science, now assembled in Leeds to begin another session, can not allow your year of office to terminate without offering to you sincere and humble congratulations on the happy results which have attended your presidency. A year ago, in the historic city of Oxford, you did British science the signal honor of coming among us as our president; the meeting you then inaugurated set a standard which future gatherings will strive to emulate. The inspiring message you then addressed to us, and through us to men of science in every part of the empire, has already borne fruit. We are within sight of a closer union, for which the association itself has always striven, between men of science overseas and their colleagues at home, in their endeavor to solve problems of imperial concern. It is too soon as yet to assess the value of the harvest of science planted under your ægis, for the best vintages of science mature slowly, but of this we are certain: the interest Your Royal Highness has taken in the work of this association will prove a permanent source of encouragement for all who work for the betterment of life through increase of knowledge. To-night we proudly add your presidential banner to those of the great men of science who have presided over this association since its inception at York ninety-six years ago.

In olden times men kept their calendars by naming each year according to its outstanding event. I have no doubt that in future times the historian of this association, when he comes to distinguish the presidential year which opened so auspiciously in Oxford twelve months ago, will be moved to revert to this ancient custom and name it the Prince's Year. And I am under no misapprehension as to what will happen when our historian comes to the term which I have now the honor of inaugurating at Leeds; he will immediately relapse to the normal system of numerical notation. Nor will our historian fail to note, should he be moved to contrast the meeting at Oxford with

[1] The presidential address before the British Association for the Advancement of Science given at Leeds on August 31.

that which now begins at Leeds, that some mischievous sprite seems to have tampered with the affairs of this association. For how otherwise could he explain the fortune which fell to ancient Oxford, the home of history? To her lot fell a brilliant discourse on the application of science to the betterment of human lives, while Leeds, a city whose life's blood depends on the successful application of science to industry, had to endure, as best she could, a discourse on a theme of ancient history. For the subject of my address is man's remote history. Fifty-five years have come and gone since Charles Darwin wrote a history of man's descent. How does his work stand the test of time? This is the question I propose to discuss with you to-night in the brief hour at my disposal.

In tracing the course of events which led up to our present conception of man's origin, no place could serve as a historical starting-point so well as Leeds. In this city was fired the first verbal shot of that long and bitter strife which ended in the overthrow of those who defended the Biblical account of man's creation and in a victory for Darwin. On September 24, 1858—sixty-nine years ago—the British Association assembled in this city just as we do to-night; Sir Richard Owen, the first anatomist of his age, stood where I now stand. He had prepared a long address, four times the length of the one I propose to read, and surveyed, as he was well qualified to do, the whole realm of science; but only those parts which concern man's origin require our attention now. He cited evidence which suggested a much earlier date for the appearance of man on earth than was sanctioned by Biblical records, but poured scorn on the idea that man was merely a transmuted ape. He declared to the assembled association that the differences between man and ape were so great that it was necessary, in his opinion, to assign mankind to an altogether separate order in the animal kingdom. As this statement fell from the president's lips there was at least one man in the audience whose spirit of opposition was roused—Thomas Henry Huxley—Owen's young and rising antagonist.

I have picked out Huxley from the audience because it is necessary, for the development of my theme, that we should give him our attention for a moment. We know what Huxley's feelings were towards Owen at the date of the Leeds meeting. Six months before, he had told his sister that "an internecine feud rages between Owen and myself," and on the eve of his departure for Leeds he wrote to Hooker: "The interesting question arises: shall I have a row with the great O. there?" I am glad to say the Leeds meeting passed off amicably, but it settled in Huxley's mind what the "row" was to be about when it came. It was to concern man's rightful position in the scale of living things.

Two years later, in 1860, when this association met in Oxford, Owen gave Huxley the opportunity he desired. In the course of a discussion Owen repeated the statement made at Leeds as to man's separate position, claiming that the human brain had certain structural features never seen in the brain of anthropoid apes. Huxley's reply was a brief and emphatic denial with a promise to produce evidence in due course—which was faithfully kept. This opening passage at arms between our protagonists was followed two days later by that spectacular fight—the most memorable in the history of our association—in which the Bishop of Oxford, the representative of Owen and of orthodoxy, left his scalp in Huxley's hands. To make his victory decisive and abiding, Huxley published, early in 1863, "The Evidences of Man's Place in Nature," a book which has a very direct bearing on the subject of my discourse. It settled for all time that man's rightful position is among the primates, and that, as we anatomists weigh evidence, his nearest living kin are the anthropoid apes.

My aim is to make clear to you the foundations on which rest our present-day conception of man's origin. The address delivered by my predecessor from this chair at the Leeds meeting of 1858 has given me the opportunity of placing Huxley's fundamental conception of man's nature in a historical setting. I must now turn to another issue which Sir Richard Owen merely touched upon but which is of supreme interest to us now. He spent the summer in London, just as I have done, writing his address for Leeds and keeping an eye on what was happening at scientific meetings. In his case something really interesting happened. Sir Charles Lyell and Sir Joseph Hooker left with the Linnean Society what appeared to be an ordinary roll of manuscript, but what in reality was a parcel charged with high explosives, prepared by two very innocent-looking men—Alfred Russel Wallace and Charles Darwin. As a matter of honesty it must be admitted that these two men were well aware of the deadly nature of its contents, and knew that if an explosion occurred, man himself, the crown of creation, could not escape its destructive effects. Owen examined the contents of the parcel and came to the conclusion that they were not dangerous; at least, he manifested no sign of alarm in his presidential address. He dismissed both Wallace and Darwin, particularly Darwin, in the briefest of paragraphs, at the same time citing passages from his own work to prove that the conception of natural selection as an evolutionary force was one which he had already recognized.

As I address these words to you I can not help marvelling over the difference between our outlook to-day and that of the audience which Sir Richard Owen had to face in this city sixty-nine years ago. The vast assemblage which confronted him was convinced, al-

most without a dissentient, that man had appeared on earth by a special act of creation; whereas the audience which I have now the honor of addressing, and that larger congregation which the wonders of wireless bring within the reach of my voice, if not convinced Darwinists are yet prepared to believe, when full proofs are forthcoming, that man began his career as a humble primate animal, and has reached his present estate by the action and reaction of biological forces which have been and are ever at work within his body and brain.

This transformation of outlook on man's origin is one of the marvels of the nineteenth century, and to see how it was effected we must turn our attention for a little while to the village of Down in the Kentish uplands and note what Charles Darwin was doing on the very day that Sir Richard Owen was delivering his address here in Leeds. He sat in his study struggling with the first chapter of a new book; but no one foresaw, Owen least of all, that the publication of the completed book, *The Origin of Species,* fifteen months later (1859), was to effect a sweeping revolution in our way of looking at living things and to initiate a new period in human thought—the Darwinian period—in which we still are. Without knowing it, Darwin was a consummate general. He did not launch his first campaign until he had spent twenty-two years in stocking his arsenal with ample stores of tested and assorted fact. Having won territory with *The Origin of Species,* he immediately set to work to consolidate his gains by the publication in 1868 of another book, *The Variation of Animals and Plants under Domestication*—a great and valuable treasury of biological observation. Having thus established an advanced base, he moved forwards on his final objective—the problem of human beginnings—by the publication of *The Descent of Man* (1871), and that citadel capitulated to him. To make victory doubly certain he issued in the following year—1872—*The Expression of the Emotions in Man and Animals.* Many a soldier of truth had attempted this citadel before Darwin's day, but they failed because they had neither his generalship nor his artillery.

Will Darwin's victory endure for all time? Before attempting to answer this question, let us look at what kind of book *The Descent of Man* is. It is a book of history—the history of man, written in a new way—the way discovered by Charles Darwin. Permit me to illustrate the Darwinian way of writing history. If a history of the modern bicycle had to be written in the orthodox way, then we should search dated records until every stage was found which linked the two-wheeled hobby-horse, bestrode by tall-hatted fashionable men at the beginning of the nineteenth century, to the modern "jeopardy" which now flashes past us in country lanes. But suppose there were no dated records—only a jumble of antiquated machines stored in the cellar of a museum. We should, in this case, have to adopt Darwin's way of writing history. By an exact and systematic comparison of one machine with another we could infer the relationship of one to another and tell the order of their appearance, but as to the date at which each type appeared and the length of time it remained in fashion, we could say very little. It was by adopting this circumstantial method that Darwin succeeded in writing the history of man. He gathered historical documents from the body and behavior of man and compared them with observations made on the body and behavior of every animal which showed the least resemblance to man. He studied all that was known in his day of man's embryological history and noted resemblances and differences in the corresponding histories of other animals. He took into consideration the manner in which the living tissues of man react to disease, to drugs and to environment; he had to account for the existence of diverse races of mankind. By a logical analysis of his facts Darwin reconstructed and wrote a history of man.

Fifty-six years have come and gone since that history was written; an enormous body of new evidence has poured in upon us. We are now able to fill in many pages which Darwin had perforce to leave blank, and we have found it necessary to alter details in his narrative, but the fundamentals of Darwin's outline of man's history remain unshaken. Nay, so strong has his position become that I am convinced that it never can be shaken.

Why do I say so confidently that Darwin's position has become impregnable? It is because of what has happened since his death in 1882. Since then we have succeeded in tracing man by means of his fossil remains and by his stone implements backwards in time to the very beginning of that period of the earth's history to which the name Pleistocene is given. We thus reach a point in history which is distant from us at least 200,000 years, perhaps three times that amount. Nay, we have gone farther, and traced him into the older and longer period which preceded the Pleistocene—the Pliocene. It was in strata laid down by a stream in Java during the latter part of the Pliocene period that Dr. Eugene Dubois found, ten years after Darwin's death, the fossil remains of that remarkable representative of primitive humanity to which he gave the name *Pithecanthropus,* or ape-man; from Pliocene deposits of East Anglia Mr. Reid Moir has recovered rude stone implements. If Darwin was right, then as we trace man backwards in the scale of time he should become more bestial in form—nearer to the ape. That is what we have found. But if we

regard *Pithecanthropus* with his small and simple yet human brain as a fair representative of the men of the Pliocene period, then evolution must have proceeded at an unexpectedly rapid rate to culminate to-day in the higher races of mankind.

The evidence of man's evolution from an ape-like being, obtained from a study of fossil remains, is definite and irrefutable, but the process has been infinitely more complex than was suspected in Darwin's time. Our older and discarded conception of man's transformation was depicted in that well-known diagram which showed a single file of skeletons, the gibbon at one end and man at the other. In our original simplicity we expected, as we traced man backwards in time, that we should encounter a graded series of fossil forms—a series which would carry him in a straight line towards an anthropoid ancestor. We should never have made this initial mistake if we had remembered that the guide to the world of the past is the world of the present. In our time man is represented not by one but by many and diverse races—black, brown, yellow and white; some of these are rapidly expanding, others are as rapidly disappearing. Our searches have shown that in remote times the world was peopled, sparsely it is true, with races showing even a greater diversity than those of to-day, and that already the same process of replacement was at work. To unravel man's pedigree, we have to thread our way, not along the links of a chain, but through the meshes of a complicated network.

We made another mistake. Seeing that in our search for man's ancestry we expected to reach an age when the beings we should have to deal with would be simian rather than human, we ought to have marked the conditions which prevail amongst living anthropoid apes. We ought to have been prepared to find, as we approached a distant point in the geological horizon, that the forms encountered would be as widely different as are the gorilla, chimpanzee and orang, and confined, as these great anthropoids now are, to limited parts of the earth's surface. That is what we are now realizing; as we go backwards in time we discover that mankind becomes broken up, not into separate races as in the world of to-day, but into numerous and separate species. When we go into a still more remote past they become so unlike that we have to regard them not as belonging to separate species but different genera. It is amongst this welter of extinct fossil forms which strew the ancient world that we have to trace the zigzag line of man's descent. Do you wonder we sometimes falter and follow false clues?

We committed a still further blunder when we set out on the search for man's ancestry: indeed, some of us are still making it. We expected that man's evolution would pursue not only an orderly file of stages, but that every part of his body—skull, brain, jaws, teeth, skin, body, arms and legs—would at each stage become a little less ape-like, a little more man-like. Our searches have shown us that man's evolution has not proceeded in this orderly manner. In some extinct races, while one part of the body has moved forwards another part has lagged behind. Let me illustrate this point because it is important. We now know that, as Darwin sat in his study at Down, there lay hidden at Piltdown, in Sussex, not thirty miles distant from him, sealed up in a bed of gravel, a fossil human skull and jaw. In 1912, thirty years after Darwin's death, Mr. Charles Dawson discovered this skull and my friend Sir Arthur Smith Woodward described it, and rightly recognized that skull and jaw were parts of the same individual, and that this individual had lived, as was determined by geological and other evidence, in the opening phase of the Pleistocene period. We may confidently presume that this individual was representative of the people who inhabited England at this remote date. The skull, although deeply mineralized and thick-walled, might well have been the rude forerunner of a modern skull, but the lower jaw was so ape-like that some experts denied that it went with the human fossil skull at all, and supposed it to be the lower jaw of some extinct kind of chimpanzee. This mistake would never have been made if those concerned had studied the comparative anatomy of anthropoid apes. Such a study would have prepared them to meet with the discordances of evolution. The same irregularity in the progression of parts is evident in the anatomy of *Pithecanthropus,* the oldest and most primitive form of humanity so far discovered. The thigh-bone might easily be that of modern man, the skull-cap that of an ape, but the brain within that cap, as we now know, had passed well beyond an anthropoid status. If merely a lower jaw had been found at Piltdown an ancient Englishman would have been wrongly labelled "Higher anthropoid ape"; if only the thigh-bone of *Pithecanthropus* had come to light in Java, then an ancient Javanese, almost deserving the title of anthropoid, would have passed muster as a man.

Such examples illustrate the difficulties and dangers which beset the task of unravelling man's ancestry. There are other difficulties; there still remain great blanks in the geological record of man's evolution. As our search proceeds these blanks will be filled in, but in the meantime let us note their nature and their extent. By the discovery of fossil remains we have followed man backwards to the close of the Pliocene—a period which endured at least for a quarter of a million years, but we have not yet succeeded in tracing him through this period. It is true that we have found fossil teeth in Pliocene deposits which may be those of

an ape-like man or of a man-like ape; until we find other parts of their bodies we can not decide. When we pass into the still older Miocene period—one which was certainly twice as long as the Pliocene—we are in the heyday of anthropoid history. Thanks to the labors of Dr. Guy E. Pilgrim, of the Indian Geological Survey, we know already of a dozen different kinds of great anthropoids which lived in Himalayan jungles during middle and later Miocene times; we know of at least three other kinds of great anthropoids which lived in the contemporary jungles of Europe. Unfortunately we have found as yet only the most resistant parts of their bodies—teeth and fragments of jaw. Do some of these fragments represent a human ancestor? We can not decide until a lucky chance brings to light a limb-bone or a piece of skull, but no one can compare the teeth of these Miocene anthropoids with those of primitive man, as has been done so thoroughly by Professor William K. Gregory, and escape the conviction that in the dentitions of the extinct anthropoids of the Miocene jungles we have the ancestral forms of human teeth.

It is useless to go to strata still older than the Miocene in search of man's emergence; in such strata we have found only fossil traces of emerging anthropoids. All the evidence now at our disposal supports the conclusion that man has arisen, as Lamarck and Darwin suspected, from an anthropoid ape not higher in the zoological scale than a chimpanzee, and that the date at which human and anthropoid lines of descent began to diverge lies near the beginning of the Miocene period. On our modest scale of reckoning, that gives man the respectable antiquity of about one million years.

Our geological search, which I have summarized all too briefly, has not produced so far the final and conclusive evidence of man's anthropoid origin; we have not found as yet the human *imago* emerging from its anthropoid encasement. Why, then, do modern anthropologists share the conviction that there has been an anthropoid stage in our ancestry? They are no more blind than you are to the degree of difference which separates man and ape in structure, in appearance and in behavior. I must touch on the sources of this conviction only in a passing manner. Early in the present century Professor G. H. F. Nuttall, of Cambridge University, discovered a trustworthy and exact method of determining the affinity of one species of animal to another by comparing the reactions of their blood. He found that the blood of man and that of the great anthropoid apes gave almost the same reaction. Bacteriologists find that the living anthropoid body possesses almost the same susceptibilities to infections, and manifests the same reactions, as does the body of man. So alike are the brains of man and anthropoid in their structural organization that surgeons and physiologists transfer experimental observations from the one to the other. When the human embryo establishes itself in the womb it throws out structures of a most complex nature to effect a connection with the maternal body. We now know that exactly the same elaborate processes occur in the anthropoid womb and in no other. We find the same vestigial structures—the same "evolutionary postmarks"—in the bodies of man and anthropoid. The anthropoid mother fondles, nurses and suckles her young in the human manner. This is but a tithe of the striking and intimate points in which man resembles the anthropoid ape. In what other way can such a myriad of coincidences be explained except by presuming a common ancestry for both?

The crucial chapters in Darwin's *Descent of Man* are those in which he seeks to give a historical account of the rise of man's brain and of the varied functions which that organ subserves. How do these chapters stand to-day? Darwin was not a professional anatomist and therefore accepted Huxley's statement that there was no structure in the human brain that was not already present in that of the anthropoid. In Huxley's opinion the human brain was but a richly annotated edition of the simpler and older anthropoid book, and this edition, in turn, was but the expanded issue of the still older original primate publication. Since this statement was made thousands of anatomists and physiologists have studied and compared the brain of man and ape; only a few months ago Professor G. Elliot Smith summarized the result of this intensive enquiry as follows: "No structure found in the brain of an ape is lacking in the human brain, and, on the other hand, the human brain reveals no formation *of any sort* that is not present in the brain of the gorilla or chimpanzee. . . . The only distinctive feature of the human brain is a quantitative one." The difference is only quantitative but its importance can not be exaggerated. In the anthropoid brain are to be recognized all those parts which have become so enormous in the human brain. It is the expansion of just those parts which have given man his powers of feeling, understanding, acting, speaking and learning.

Darwin himself approached this problem not as an anatomist but as a psychologist, and after many years of painstaking and exact observation, succeeded in convincing himself that, immeasurable as are the differences between the mentality of man and ape, they are of degree, not of kind. Prolonged researches made by modern psychologists have but verified and extended Darwin's conclusions. No matter what line of evidence we select to follow—evidence gathered by anatomists, by embryologists, by physiologists or by

psychologists—we reach the conviction that man's brain has been evolved from that of an anthropoid ape and that in the process no new structure has been introduced and no new or strange faculty interpolated.

In these days our knowledge of the elaborate architecture and delicate machinery of the human brain makes rapid progress, but I should mislead if I suggested that finality is in sight. Far from it; our enquiries are but begun. There is so much we do not yet understand. Will the day ever come when we can explain why the brain of man has made such great progress while that of his cousin the gorilla has fallen so far behind? Can we explain why inherited ability falls to one family and not to another, or why, in the matter of cerebral endowment, one race of mankind has fared so much better than another? We have as yet no explanation to offer, but an observation made twenty years ago by one on whom nature has showered great gifts—a former president of this association and the doyen of British zoologists—Sir E. Ray Lankester—deserves quotation in this connection: "The leading feature in the development and separation of man from other animals is undoubtedly the relative enormous size of the brain in man and the corresponding increase in its activities and capacity. It is a striking fact that it was not in the ancestors of man alone that this increase in the size of the brain took place at this same period—the Miocene. Other great mammals of the early Tertiary period were in the same case." When primates made their first appearance in geological records, they were, one and all, small-brained. We have to recognize that the tendency to increase of brain, which culminated in the production of the human organ, was not confined to man's ancestry but appeared in diverse branches of the mammalian stock at a corresponding period of the earth's history.

I have spoken of Darwin as a historian. To describe events and to give the order of their occurrence is the easier part of a historian's task; his real difficulties begin when he seeks to interpret the happenings of history, to detect the causes which produced them and explain why one event follows as a direct sequel to another. Up to this point we have been considering only the materials for man's history, and placing them, so far as our scanty information allows, in the order of their sequence, but now we have to seek out the biological processes and controlling influences which have shaped the evolutionary histories of man and ape. The evolution of new types of man or of ape is one thing, and the evolution of new types of motor cars is another, yet for the purposes of clear thinking it will repay us to use the one example to illustrate the other. In the evolution of motor vehicles Darwin's law of selection has prevailed; there has been severe competition and the types which have answered best to the needs and tastes of the public have survived. The public has selected on two grounds —first for utility, thus illustrating Darwin's law of natural selection, and secondly because of appearance's sake; for, as most people know, a new car has to satisfy not only the utilitarian demands of its prospective master but also the esthetic tastes of its prospective mistress, therein illustrating Darwin's second law—the law of sexual selection. That selection, both utilitarian and esthetic, is producing an effect on modern races of mankind and in surviving kinds of ape, as Darwin supposed, can not well be questioned. In recent centuries the inter-racial competition amongst men for the arable lands of the world is keener than in any known period of human history.

The public has selected its favored types of car, but it has had no direct hand in designing and producing modifications and improvements which have appeared year after year. To understand how such modifications are produced the enquirer must enter a factory and not only watch artisans shaping and fitting parts together but also visit the designer's office. In this way an enquirer will obtain a glimpse of the machinery concerned in the evolution of motor cars. If we are to understand the machinery which underlies the evolution of man and of ape, we have to enter the "factories" where they are produced—look within the womb and see the ovum being transformed into an embryo, the embryo into a foetus and the foetus into a babe. After birth we may note infancy passing into childhood, childhood into adolescence, adolescence into maturity and maturity into old age. Merely to register the stages of change is not enough; to understand the controlling machinery we have to search out and uncover the processes which are at work within developing and growing things and the influences which coordinate and control all the processes of development and of growth. When we have discovered the machinery of development and of growth we shall also know the machinery of evolution, for they are the same.

If the simile I have used would sound strange in Darwin's ear, could he hear it, the underlying meaning would be familiar to him. Over and over again he declared that he did not know how "variations" were produced, favorable or otherwise; nor could he have known, for in his time hormones were undreamt of and experimental embryology scarcely born. With these recent discoveries new vistas opened up for students of evolution. The moment we begin to work out the simile I have used and compare the evolutionary machinery in a motor factory with that which regulates the development of an embryo within the womb, we realize how different the two processes are. Let

us imagine for a moment what changes would be necessary were we to introduce "embryological processes" into a car factory. We have to conceive a workshop teeming with clustering swarms of microscopic artisans, mere specks of living matter. In one end of this factory we find swarms busy with cylinders, and as we pass along we note that every part of a car is in process of manufacture, each part being the business of a particular brigade of microscopic workmen. There is no apprenticeship in this factory, every employee is born, just as a hive-bee is, with his skill already fully developed. No plans or patterns are supplied; every workman has the needed design in his head from birth. There is neither manager, overseer nor foreman to direct and coordinate the activities of the vast artisan armies. And yet if parts are to fit when assembled, if pinions are to mesh and engines run smoothly, there must be some method of coordination. It has to be a method plastic enough to permit difficulties to be overcome when such are encountered and to permit the introduction of advantageous modifications when these are needed. A modern works manager would be hard put to it were he asked to devise an automatic system of control for such a factory, yet it is just such a system that we are now obtaining glimpses of in the living workshops of nature.

I have employed a crude simile to give the lay mind an inkling of what happens in that "factory" where the most complicated of machines are forged—the human body and brain. The fertilized ovum divides and redivides; one brood of microscopic living units succeeds another, and as each is produced the units group themselves to form the "parts" of an embryo. Each "part" is a living society; the embryo is a huge congeries of interdependent societies. How are their respective needs regulated, their freedoms protected and their maneuvers timed? Experimental embryologists have begun to explore and discover the machinery of regulation. We know enough to realize that it will take many generations of investigators to work over the great and new field which is thus opening up. When this is done we shall be in a better position to discuss the cause of "Variation" and the machinery of evolution.

If we know only a little concerning the system of government which prevails in the developing embryo we can claim that the system which prevails in the growing body, as it passes from infancy to maturity, is becoming better known to us every year. The influence of the sex glands on the growth of the body has been known since ancient times; their removal in youth leads to a transformation in the growth of every part of the body, altering at the same time the reactions and temperament of the brain. In more recent years medical men have observed that characteristic alterations in the appearance and constitution of the human body can be produced by the action of other glands—the pituitary, thyroid, parathyroid and adrenals. Under the disorderly action of one or other of these glands individuals may, in the course of a few years, take on so changed an appearance that the differences between them and their fellows become as great as, or even greater than, those which separate one race of mankind from another. The physical characters which are thus altered are just those which mark one race off from another. How such effects are produced we did not know until 1904, when the late Professor E. H. Starling, a leader amongst the great physiologists of our time, laid bare an ancient and fundamental law in the living animal body—his law of hormones. I have pictured the body of a growing child as an immense society made up of myriads of microscopic living units, ever increasing in numbers. One of the ways—probably the oldest and most important way—in which the activities of the communities of the body are coordinated and regulated is by the postal system discovered by Starling, wherein the missives are hormones—chemical substances in ultra-microscopic amounts, despatched from one community to another in the circulating blood. Clearly the discovery of this ancient and intricate system opens up fresh vistas to the student of man's evolution. How Darwin would have welcomed this discovery! It would have given him a rational explanation to so many of his unsolved puzzles, including that of "correlated variations." Nor can I in this connection forbear to mention the name of one who presided so ably over the affairs of this association fifteen years ago—Sir E. Sharpey-Schafer. He was the pioneer who opened up this field of investigation and has done more than anyone to place our knowledge of the nature and action of the glands of internal secretion on a precise basis of experimental observation. With such sources of knowledge being ever extended and others of great importance, such as the study of heredity, which have been left unmentioned, we are justified in the hope that man will be able in due time not only to write his own history but to explain how and why events took the course they did.

In a brief hour I have attempted to answer a question of momentous importance to all of us—What is man's origin? Was Darwin right when he said that man, under the action of biological forces which can be observed and measured, has been raised from a place amongst anthropoid apes to that which he now occupies? The answer is yes! and in returning this verdict I speak but as foreman of the jury—a jury which has been empanelled from men who have devoted a lifetime to weighing the evidence. To the best of my ability I have avoided, in laying before you the

evidence on which our verdict was found, the rôle of special pleader, being content to follow Darwin's own example—Let the truth speak for itself.

ARTHUR KEITH

EDWARD BRADFORD TITCHENER

THE recent death of Professor Edward Bradford Titchener, of Cornell, at the age of sixty, removes one of the most prominent figures in American psychology. Professor Titchener came to this country in 1892, when experimental methods were first beginning to find favor and psychological laboratories were being started in all our leading universities. An Englishman by birth, and a graduate of Brasenose College, Oxford, he studied under Wundt at Leipzig, and had just obtained his doctor's degree when called to Cornell.

On assuming this position Professor Titchener at once adopted a program which has been followed at Cornell ever since. He established a psychological laboratory and made experimental psychology the keystone of the departmental courses. Under his direction, Cornell soon became one of the most productive universities in psychological research. Many of our leading investigators owe their training to Titchener, and the Cornell laboratory has served as model for many departments elsewhere.

While not following Wundt's system in every particular, Professor Titchener held rigidly to the Leipzig ideals. Psychology meant to him introspection by trained subjects or observers, under carefully controlled conditions, with exact measurement of the stimuli and of the observer's responsive activities. He had no sympathy with the behavioristic type of psychology which has grown up in the past fifteen years. For Titchener psychology was the investigation of consciousness—of conscious, subjective experiences. He measured "responses" as a means of obtaining quantitative values for the introspective data; but he did not consider the study of behavior as part of the science of psychology. He set himself the task of analyzing the elementary data of experience—the structure of mind or consciousness—and pursued this analysis systematically throughout his career. The achievements of the Cornell laboratory in this direction are universally recognized by psychologists of every school. No one has challenged the thoroughness nor the scientific accuracy of this work, though certain behaviorists have queried the value of introspective results as contributions to science. The time has not yet come to pass judgment on this question. But the title of Professor Titchener to rank as leader in the analytic or structural investigation of psychology is unassailable. For many years this method and system have been generally known as the Titchenerian psychology.

Titchener's writings are numerous and were always carefully prepared. He is the author of several text-books on general psychology, both elementary and advanced, the best known being his "Text-book of Psychology" published in 1910. His most important contribution is his "Experimental Psychology," a comprehensive laboratory manual in four volumes (1901–05). Among his works on special topics may be mentioned the "Elementary Psychology of Feeling and Attention" (1908) and "Experimental Psychology of the Thought Processes" (1909). No less important are his editorial contributions. For many years he served as American editor of the English magazine *Mind* (1894–1920), for a time the sole mouthpiece of psychology in Britain. Since 1895 he has been closely identified with *The American Journal of Psychology,* first as associate editor under Stanley Hall (1895–1920), and after Hall's retirement as editor-in-chief (1921–25). To this and other journals he was a frequent contributor of systematic articles, experimental reports, discussions and reviews. The wide range of his contributions is no less remarkable than his clear style and the breadth of his knowledge.

Professor Titchener was an omnivorous reader in the field of psychology. His acquaintance with the older writers extended to medieval and ancient times. He would frequently refer quite incidentally to contributions or hints in some classic source bearing upon a topic on which he or another was working. At the same time he kept fully abreast with current literature. One could not mention in his presence any recent periodical article, however trivial, that he did not show himself perfectly familiar with its contents.

Nor were his interests confined to psychology. He devoted much time to the kindred science of anthropology, and had gathered a large collection of idols, masks, drums and other folk-relics. More recently he developed an interest in numismatics. In connection with this latter avocation he undertook the study of several new languages, including Arabic and Chinese. He was highly appreciative of art in all its forms, particularly music. For a time he served as "professor in charge of music" at Cornell.

In his own field, psychology, there seems to have been a constant conflict between his broad general outlook and his narrower ideals. Professor Titchener's aim was to concentrate the entire research work of his department upon certain definite problems, one topic being taken up at a time, and leading eventually and logically to the next. He was averse to investigation along independent lines by his students and to discussion of extraneous problems in the courses in his department.