SCIENCE

FRIDAY, AUGUST 12, 1887.

WHAT AMERICAN ZOÖLOGISTS HAVE DONE FOR EVOLUTION.[1]

LADIES AND GENTLEMEN, — Eleven years ago I had the honor of reading before this association an address in which an attempt was made to show what American zoölogists had done for evolution. My reasons for selecting this subject were, first, that no general review of this nature had been made; and, second, that many of the oft-repeated examples in support of the derivative theory were from European sources, and did not carry the weight of equally important facts the records of which were concealed in our own scientific journals. Darwin was pleased to write to me that most of the facts I had mentioned were familiar to him, but, to use his own words, he was amazed at their number and importance when brought together in this manner. The encouragement of his recognition has led me to select a continuation of this theme as a subject for the customary presidential address, — a task which is at best a thankless if not a profitless one. Had I faintly realized, however, the increasing number and importance of the contributions made by our students on this subject, I should certainly have chosen a different theme.

Incomplete as is this record of ten years' work, I am compelled to present it. In the Buffalo address two marked periods in the work of the zoölogists in this country are recognized: the one period embracing the work of the topographers, the field-surveyors in the science; the other period dating from the advent of Agassiz, with the wonderful impulse he imparted to the study by his enthusiasm and devotion. A third period in American zoölogical science, and by far the most important awakening, dates from the publication of Darwin's 'Origin of Species.' Its effect on zoölogical literature was striking. The papers were first tinged with the new doctrine, then saturated, and now, without reference to the theory, derivation is taken for granted.

As zoölogists, we are indebted to Darwin for the wide-spread public interest in our work. Before Darwin, the importance of our special studies was far outweighed by the practical value placed upon science, in the application of which an immediate material gain was assured. Chemistry, physics, geology, were important only because a practical application of these sciences was capable of showing an immediate material return.

Agassiz, in his appeal to the State for appropriations for the great museum at Cambridge, insisted that there were higher dividends than money ones to be looked for in endowments for zoölogical museums, and these were intellectual dividends. While the force of this appeal will always remain true, the transcendent importance of the naturalist's studies from the standpoint of Darwin is widely recognized. Man now becomes an object of rigid scientific scrutiny, from the new position which has shed such a flood of light upon the animals below him. His habits, behavior, the physical influences of his environment and their effects upon him, transmission of peculiarities, through the laws of heredity, — all these factors are directly implicated in the burning questions and problems which agitate him to-day. Questions of labor, temperance, prison-reform, distribution of charities, religious agitations, are questions immediately concerning the mammal man, and are now to be seriously studied from the solid standpoint of observation and experiment, and not from the emotional and often incongruous attitude of the Church. To a naturalist it may seem well-nigh profitless to discuss the question of evolution, since the battle has been won; and, if there be any discussion, it is as to the relative merits and force of the various factors involved. The public, however, are greatly interested in the matter, as may be seen by a renewal of the fight in the English reviews; and the agitation is still kept up by well-meaning though ignorant advisers, who insist that science has not yet accepted the doctrine; and great church organizations meet to condemn and expel their teachers of science from certain schools of learning because their teachings are imbued with the heresy.

Dr. Asa Gray, in his discriminating biographical memoir of Darwin, says in regard to the 'doctrine of descent,' "It is an advance from which it is evidently impossible to recede: as has been said of the theory of the conservation of energy, so in this the proof of this great generalization, like that of all other great generalizations, lies mainly in the fact that the evidence in its favor is continually augmenting, while that against it is continually diminishing as the progress of science reveals to us more and more the workings of the universe." Let us examine, then, the evidences, trivial as well as important, that have been recorded by American zoölogists within the past ten years in support of the derivative theory.

Without further apology for the very imperfect character of this survey, let me at once begin by calling attention first to the testimony regarding the variation in habits, and evidences of reasoning-power, in animals. The establishment of individual variation in mental powers, change in habits, etc., lies at the foundation of Darwinism as furnishing material for selective action. There is no group of animals which exceeds the birds in varied and suggestive material for the evolutionist. It is a significant fact that the birds, which appeared to Cuvier and his contemporaries a closed type, — a group that seemed to fulfil the ideal conception of a class archetype as compared to other groups which had their open as well as obscure relationships,— should be, of all groups, the one that first yielded its exclusive characteristics. In fact, there is no group in which the barriers have been so completely demolished as in this apparently distinct and isolated class. An attentive and patient study of the birds has established almost every point defined by Darwin in his theory of natural selection. One has only to recall the marked reptilian affinities as shown in their embryological and paleontological history. Besides all these structural relationships, the birds possess, as a group, remarkable and striking illustrations of variation in color, size, marking, nesting, albinism, melanism, moulting, migration, song, geographical variation, sexual selection, secondary sexual characters, protective coloring; and in their habits show surprising mechanical cunning and ingenuity, curious and inexplicable freaks, parental affection, hybridity: indeed, the student need go no further than the birds to establish every principle of the derivative theory.

The many observations on the nesting habits of birds would form a curious chapter as illustrating the individual peculiarities of these creatures.

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Mr. J. A. Allen, in writing on the inadequate theory of bird's-nests, shows grave and important exceptions to Wallace's theory, though he subscribes heartily to his philosophy of bird's-nests. He expresses surprise that closely allied species of birds should oftentimes build divers kinds of nests, overlooking the fact that even closely allied varieties of man build entirely unlike houses.

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The behavior of wild birds when kept in confinement, and the attempts made in domesticating them, has always furnished an interesting field for study. The curious freaks and impulses which they often betray, the changes they show under the new conditions, indicate in some measure the plasticity of their organization.

Hon. John D. Caton, in an interesting paper on unnatural attachments among animals, records a curious fondness shown by a crane for a number of pigs; and in another paper on the wild turkey and its domestication, this writer has made some valuable records

[1] Abridged from the address to the American Association for the Advancement of Science, at New York, Aug. 10, 1887, by Prof. E. W. Morse of Salem, Mass., the retiring president of the association.

of the successive changes which take place in the bird during this process, — changes in color, during which the more conspicuous features of protective coloring are lost; changes in habit, in which are seen the undoing or relaxing of those features which indicate constant vigilance, from carrying itself in a semi-erect attitude, perching on the tallest trees, covering up the eggs carefully with leaves when off the nest, etc., to moving in a horizontal attitude, perching near the ground, covering the eggs but slightly or carelessly, etc., and losing that wildness which characterizes the bird in its wild state. At the breeding-season, however, the females became wild again, but this was a feature too deeply implanted to show modification in the time allotted to Mr. Caton's experiment. The same writer has also observed in the Hawaiian Islands the effects of reversion to a wild state, of different kinds of domestic animals which have from time to time been carried there. Among other animals, he was fortunate enough to observe the undoing stages in the domestic turkey, and the assumption of those features which characterize the wild bird.

A great many facts illustrating the plainest features of natural selection, protective coloring, mimicry, etc., have been recorded in our journals from time to time. A brief allusion may be made to a few of these. . . . Dr. R. E. C. Stearns has made some interesting notes on protective coloring in *Phrynosomæ*. Having collected these horned lizards (or toads, as they are commonly called) in central California, he has noticed, that, if the ground region they frequent is yellowish, the lizards are, without exception, of that color; if ashen gray, then that color is simulated; and this, without exception.

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An unquestionable fact has been finally established by recent methods of observation on the habits of insects and other animals, and that is, that individuals of the same species vary in intelligence; that they are not automata; that they are not impelled by a blind instinct to perform certain acts with unerring accuracy, but, on the contrary, that they vary, and often greatly vary, in their ability to provide for their young, in their skill to secure sufficient food, in their wit to avoid danger: in other words, they make blunders and mistakes, and involve their progeny and even their colony in ruin. This individual variation in intelligence is brought out very clearly by a patient series of observations made by Drs. G. W. and E. G. Peckham on the special senses of wasps. They not only repeated many of the experiments of Sir John Lubbock, but many new and ingenious experiments were devised. Their studies were for the purpose of investigating the mental power, sense of hearing, color, direction, memory, emotion, power of communication, general intelligence, etc. An interesting result of their painstaking work was the determination of individual differences as to the faculty of memory and power of distinguishing color and direction. This kind of study of the habits of insects has brought to light features of the most surprising character. The remarkable studies of Sir John Lubbock, Dr. Moggridge, and others in Europe, have been paralleled in this country not only by the observations above quoted, but notably by the labors of Rev. H. C. McCook in his studies of the American ants and spiders.

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Dr. Thomas Meehan describes a hornet that was gifted with great intelligence. He saw this insect struggling with a large locust in unsuccessful attempts to fly away with it. After several fruitless efforts to fly up from the ground with his victim, he finally dragged it fully thirty feet to a tree, to the top of which he laboriously ascended, still clinging to his burden, and, having attained this elevated position, he flew off in a horizontal direction with the locust. Dr. Meehan truly says, "There was more than instinct in this act: there was reasoning on certain facts, and judgment accordingly, and the insect's judgment had proved correct."

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The delicate balance of conditions between organisms, whether it be between individuals of the same species or between widely separated groups, is an important feature in the question of survival. Prof. S. A. Forbes, in a thoughtful study of certain species of *Entomostraca* in Lake Michigan and the surrounding waters, calls attention to the important part played by these minute crustaceans, showing how they furnish almost the entire food for young fishes, larger crustaceans, and even insect larvæ. He writes, "*Mollusca*, one would say, could afford to be indifferent to them, since they neither eat them nor are eaten by them, nor seem to come in contact with them anywhere, through any of their habits or necessities. But for this very reason these two classes afford an excellent illustration of the stringent system of re-actions by which an assemblage of even the most diverse and seemingly independent organisms is held together. . . . If there were no *Entomostraca* for young fishes to eat, there would be very few fishes indeed to feed upon *Mollusca*, and that class would flourish almost without restraint; while, on the other hand, if there were no *Mollusca* for the support of adult fishes, *Entomostraca* would be relieved from a considerable part of the drain upon their numbers, and would multiply accordingly." He is much struck with the fact that in the larger bodies of water the species of *Entomostraca* show an inferior development in numbers, size, and robustness, and in reproductive power. Their smaller number and size are doubtless due to the relative scarcity of food.

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The effect of mechanical strains as producing morphological effects has been treated in a masterly way by Dr. John A. Ryder. . . . Prof. A. Hyatt, in an exhaustive study, shows, among other things, the effect of gravitation as accounting for the form of the mollusk-shell, citing examples from all the classes, and even drawing examples from other sub-kingdoms, to support his views.

Prof. E. D. Cope, in a memoir on archæsthetism, considers the hypothesis of use and effort, the office of consciousness, etc. He attempts to show that consciousness is primitive, and a cause of evolution. He sustains his thesis by a series of arguments, which, if not beyond my grasp, would be too extensive to present here. I can only repeat the regret I expressed in the Buffalo address; namely, that neither Professor Cope nor Professor Hyatt have yet been induced to present to the public an illustrated and simple outline of their theories. Such a demonstration, I am sure, would be acceptable not only to the public, but to many scientific students as well. While these two eminent naturalists believe fully in the derivative theory, they insist that Darwin's theory is inadequate to explain many of the phenomena and facts which they encounter in their studies. Darwin has distinctly said in his first edition of the 'Origin of Species,' "I am convinced that natural selection has been the main but not the exclusive means of modification;" and in his sixth edition of the same work, in quoting these words, he laments that he is still misunderstood on this point. The theory of acceleration and retardation of these authors is, if I understand it rightly, a very plain case of natural selection. It was inevitable that those individuals that matured the quickest were better prepared to defend themselves, were quicker in the field, were able to give their offspring an earlier start in the season, were in every way more fitted to survive, than those which matured later. It is assumed that this is a law, when, to my mind, it seems the simplest result of natural selection. Instead of overriding it, it is only a conspicuous result and proof of it.

A parallel case may be seen in the increase in size of the brain in the vertebrates, and conspicuously in the higher vertebrates, since their first appearance in geological history. The individual brain clearly varies in size; and it does not require a great effort to perceive how, in the long-run, the greater brain survives in the complex struggle for existence. Associated with the greater development, parts that were freely used for locomotion before, now are compelled to perform additional service, and through the law of use and effort, which all admit as an important factor, organs are modified in structure, the anterior portion of the body assumes a new aspect; and it was on the character of these parts and aspects that Professor Dana was led to formulate his comprehensive and ingenious principle of cephalization. It is a result, and not a cause. And so I believe, though with great deference to Cope and Hyatt, that the laws of acceleration and retardation, exact parallelisms, inexact parallelisms and still more inexact parallelisms, and many other laws and theories advanced by these gentlemen, are not causes, but effects, to be explained by the doctrine of natural selection and 'survival of the fittest.'

The connecting links and intermediate forms which the sceptical

public so hungrily demand are continually being discovered. Great gaps are being closed up rapidly; but the records of this work, being published in the journals of our scientific societies, are hidden from the public eye as much as if they had been published in Coptic. So rapidly have these missing links been established, that the general zoölogist finds it difficult to keep up with the progress made in this direction. He can hardly realize the completion of so many branches of the genealogical tree.

Professor Cope, who has accomplished so much in this direction, says, "Those who have, during the last ten years, devoted themselves to this study, have been rewarded by the discovery of the course of development of many lines of animals; so that it is now possible to show the kind of changes in structure which have resulted in the species of animals with which we are familiar as living on the surface of the earth at the present time. Not that this continent has given us the parentage of all forms of animal life, or all forms of animals with skeletons, or vertebræ, but it has given us many of them. To take the *Vertebrata*, we have obtained the long-since extinct ancestor of the very lowest vertebrates. Then we have discovered the ancestor of the true fishes. We have the ancestor of all the reptiles, of the birds, and of the mammals. If we consider the mammals, or milk-givers, separately, we have traced up a great many lines to their points of departure from very primitive things. Thus we have obtained the genealogical trees of the deer, the camels, the musk, the horse, the tapir, and the rhinoceros, of the cats and dogs, of the lemurs and monkeys, and have important evidence as to the origin of man."

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The discovery in the western tertiaries of multitudes of huge and monstrous mammals, and, earlier still, of gigantic and equally monstrous reptiles, naturally led at once to an inquiry as to the cause of their extinction. . . . Among the most interesting discoveries connected with these creatures is the determination by Professor Marsh that these early mammals, birds, and reptiles had brains of diminutive proportions. . . . "The small brain, highly specialized characters, and huge bulk, rendered them incapable of adapting themselves to new conditions, and a change of surroundings brought extinction. The existing proboscidians must soon disappear for similar reasons. Smaller mammals, with larger brains, and more plastic structure, readily adapt themselves to their environment, and survive, or even send off new and vigorous lines. The *Dinocerata*, with their very diminutive brain, fixed characters, and massive frames, flourished as long as the conditions were especially favorable, but with the first geological change they perished and left no descendants."

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Prof. A. E. Verrill, in a lecture at Yale College entitled 'Facts Illustrative of the Darwinian Theory,' shows what an important factor parental instinct is in the evolution of species. He regards the lack of parental care "as one of the probable causes, though usually overlooked, of the extinction of many of the large and powerful reptiles of the mesozoic age, and of the large mammals of the tertiary." He says, "The very small size of the brain, and its low organization, in these early animals, are now well known, and we are justified in believing that their intelligence or sagacity was correspondingly low. They were doubtless stupid and sluggish in their habits, but probably had great powers of active and passive resistance against correspondingly stupid carnivorous species. But, unless the helpless young were protected by their parents, they would quickly have been destroyed; and such species might, in this way, have been rapidly exterminated whenever they came in contact with new forms of carnivorous animals, having the instinct to destroy the new-born young of mammals, and the eggs and young of oviparous reptiles. Thus it would have come about, that the more intelligent forms, by the development of the parental instinct for the active protection of their young against their enemies, would have survived longest, and therefore would have transmitted this instinct, with other correlated cerebral developments, to their descendants."

Prof. John Fiske, in his 'Cosmic Philosophy,' arrived at a similar conclusion in regard to early man. He showed, that, when variations in intelligence became more important than variations in physical structure, then they were seized upon to the relative exclusion of the latter.

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The wide-spread public interest in Darwinism arose from the fact that every theory and every fact advanced in proof of the derivative origin of species applied with equal force to the origin of man as one of the species. The public interest has been continually excited by the consistent energy with which the Church, Catholic and Protestant alike, has inveighed against the dangerous teachings of Darwin. Judging by centuries of experience, as attested by unimpeachable historical records, it is safe enough for an intelligent man, even if he knows nothing about the facts, to promptly accept as truth any generalization of science which the Church declares to be false, and, conversely, to repudiate with equal promptness, as false, any interpretation of the behavior of the universe which the Church adjudges to be true. In proof of this sweeping statement, one has only to read the imposing collection of facts brought together by Dr. White, the distinguished president of Cornell University, which are embodied in his work entitled 'The Warfare of Science,' as well as two additional chapters on the same subject which have lately appeared in the *Popular Science Monthly*.

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Only the briefest reference can here be made to a few of the numerous contributions on the subject of man's relationship to the animals below him. The rapidly accumulating proofs of the close relation existing between man and the *Quadrumana* make interesting every fact, however trivial, in regard to the structure and habits of the higher apes.

Dr. Arthur E. Brown has made some interesting experiments with the monkeys at the Zoölogical Gardens in Philadelphia. He found that the monkeys showed great fear, as well as curiosity, when a snake was placed in their cage, though they were not affected by other animals, such as an alligator and turtle. On the other hand, mammals belonging to other orders showed no fear or curiosity at a snake. These experiments, repeated in various ways, lead him to only one logical conclusion, — "that the fear of the serpent became instinctive in some far-distant progenitor of man by reason of his long exposure to danger, and death in horrible form from the bite, and it has been handed down through the diverging lines of descent which find expression to-day in the genus *Homo* and *Pithicus*."

The same author, in an exceedingly interesting description of the higher apes, says, "Mr. A. R. Wallace once called attention to the similarity in color existing between the orang and chimpanzee and the human natives of their respective countries. It would, indeed, seem as if but half the truth had been told, and that the comparison might be carried also into the region of mind; the quick, vivacious chimpanzee partaking of the mercurial disposition of negro races, while the apathetic slow orang would pass for a disciple of the sullen fatalism of the Malay."

Dr. Brown has also given a description of the grief manifested by a chimpanzee on the death of its mate. His grief was shown by tearing his hair or snatching at the short hair on his head. The yell of rage was followed by a cry the keeper had never heard before, — a sound which might be represented by 'hah-ah-ah-ah-ah' uttered somewhat under the breath, — and with a plaintive sound like a moan.

Mr. W. F. Hornaday read at the Saratoga meeting of this association an exceedingly interesting paper on the habits of the orang as observed by him in its native forests. He says, "Each individual of the Borneo orangs differs from his fellows, and has as many facial peculiarities belonging to himself alone as can be found in the individuals of any unmixed race of human beings." After recounting the many traits of the orang, heretofore regarded as peculiar to man, he says, "Let any one who is prejudiced against Darwinian views go to the forests of Borneo; let him there watch from day to day this strangely human form in all its various phases of existence; let him see it climb, walk, build its nest, eat and drink, and fight like human 'roughs'; let him see the female suckle her young and carry it astride her hip precisely as do the cooly women of Hindostan; let him witness their human-like emotions of affection, satisfaction, pain, and childish rage, — let him see all this,

and then he may feel how much more potent has been the lesson than all he has read in pages of abstract ratiocination.

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Prof. Alexander Graham Bell has presented a memoir to the National Academy on the formation of a deaf variety of the human race, in which he shows by tables a series of generations of certain families in which, the progenitors being deaf-mutes, this peculiarity becomes perpetuated in many of the descendants. Recognizing fully the laws of heredity, natural selection, etc., he shows that the establishment of deaf-mute schools, in which a visual language is taught which the pupils alone understand, tends to bring them into close association with each other; and that naturally, with this seclusion, acquaintance ripens into friendship and love, and that statistics show that there is now in process of being built up a deaf variety of man.

Dr. W. K. Brooks, animated by the cogency of Professor Bell's reasoning, is led to prepare an article entitled 'Can Man be Modified by Selection?' In this paper he discusses the startling proposition of Professor Bell, and recognizes the convincing proof which he furnishes to show that the law of selection does place within our reach a powerful influence for the improvement of our race. The striking character of the tables of facts presented by Professor Bell, and the significant suggestions of Dr. Brooks, lead one to consider how far the influence of selection has had to do with the character of great communities, as to their intelligence or ignorance. When we see nations of the same great race-stock, — one showing a high percentage of illiterates, a high death-rate, degradation and ignorance, while just across the borders another nation, apparently no better off so far as physical environments are concerned, with percentage of illiterates and death-rate low, intelligent and cleanly, — we are led to inquire if here a strict scientific scrutiny with careful historical investigation will not reveal the cause of these conditions. Can it be proved beyond question that the illiteracy and degradation of Italy and Spain, up to within recent years at least, is the result of centuries of Church oppression and the Inquisition, destroying at once, or driving out of the land, all independent thinkers, and at the same time forcing her priests to lead celibate lives, and inducing others of cultivated and gentle minds to lead cloister lives? Is it also a fact, as Alphonse de Candolle asserts, that by far the greater number of distinguished scientists have come from Protestant pastors? He gives a significant list of eminent men whose fathers were Protestant pastors, saying, that had they been priests of another religion, leading celibate lives, these men would not have been born.

It is considered an intrusion into matters which do not concern science when such inquiries are made, but the scientist has very deeply at heart the intellectual and moral welfare of the community. If the cause of degradation and ignorance, of poverty, of contagious disease, or of any of the miseries which make a nation wretched, can be pointed out by scientific methods, then it is the stern duty of science to step in and at least show the reasons, even if the remedy is not at once forthcoming. The men who would be reformers and agitators, and who by their earnestness and devotion get the attention of multitudes, are unfit for their work if they show their ignorance, as most of them do, of the doctrines of natural selection and derivation.

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In drawing to a close this very imperfect summary of what American zoölogists have accomplished for evolution, many other distinguished contributors might have been mentioned. The work of eminent physiologists and paleontologists has hardly been considered; nor has the long array of botanical facts for Darwin, as revealed in the fascinating study of the relations which exist between flowering plants and insects, contrivances for cross-fertilization, means of plant-dispersion, etc., and the distinguished botanists connected with this work, received attention here. Indeed, the proper limits for an address of this nature have been far exceeded.

Suffice it to say, that all these students have worked from the standpoint of derivative doctrines. A still greater triumph to Darwinism are the evidences of gradual conversion still going on among a few isolated workers who still remain stubborn, yet yielding to the pressure of these views by admitting features that ten years ago they repudiated.

There are two points to be emphasized here in closing: and one is, that American biological science stands as a unit for evolution; and the other is, the establishment of a great generalization which shows, that, when intelligence became a factor in animals, it was seized upon to the relative exclusion of other characteristics. This generalization offers an unassailable argument to-day for a wider, broader, and deeper education for the masses. The untold misery and suffering of the working-classes as witnessed in their struggles of the last two years would have been avoided had the rudiments of social science, even a knowledge of the value and significance of simple statistics, been appreciated by them.

The startling paper of Dr. Seaman (*Science*, viii. No. 190) on the social waste of a great city shows the blundering, criminal way in which municipalities are controlled by coteries ignorant alike of Science and the beneficent mission she stands waiting to enter upon.

PREHISTORIC CHRONOLOGY OF AMERICA.[1]

The prehistoric period of America dates back from the discovery of the several parts of the continent; and the problem is to reconstruct the history of the various nations who inhabited both Americas in this period. A review of the means at our command to accomplish this, divides them into six classes: —

I. *Legendary.* — This includes the legends or traditions of the native tribes. These often bear a strong resemblance to Semitic or other Oriental myths, but the similarity is a coincidence only, and those writers have been led astray who count it for more. The annals of the Mexicans, the Mayas of Yucatan, and the Quichuas of Peru, carry us scarcely five hundred years before the voyage of Columbus, although the contrary is often stated. The more savage tribes practically remembered nothing more remote than a couple of centuries.

II. *Monumental.* — The most famous monuments are the stone buildings of Mexico, Yucatan, and Peru. By many these are assigned an antiquity of thousands of years; but a calm weighing of the testimony places them all well within our era, and most of them within a few centuries of the discovery. The celebrated remains of Tiahuanuco in Peru are no exception. Much more ancient are some of the artificial shell-heaps along the coast. They contain bones and shells of extinct species, in intimate connection with stone implements and pottery. They furnish data to prove that the land was inhabited several thousand years ago.

III. *Industrial.* — The industrial activity of man in America may be traced by the remains of his weapons, ornaments, and tools made of stone, bone, and shell. In most of the deposits examined, specimens of polished stone and pottery testify to a reasonably developed skill; but in the Trenton gravels and a few other localities, genuine palæolithic remains have been found, putting man in America at a date coeval with the close of the glacial age, if not earlier. The vast antiquity of the American race is further proved by the extensive dissemination of maize and tobacco, — tropical plants of southern Mexico, which were cultivated from the latitude of Canada to that of Patagonia.

IV. *Linguistic.* — It is believed that there are about two hundred radically different languages in North and South America. Such a confusion of tongues could only have arisen in hundreds of centuries. The study of these languages, and of the gradual growth of their dialects, supplies valuable data for the ancient history of the continent.

V. *Physical.* — The American race is as distinctively a race by itself as is the African or white race. Although varying in many points, it has a marked fixedness of ethnic anatomy, and always has had. The oldest American crania, collected from the most ancient quaternary deposits, are thoroughly American in type.

VI. *Geologic.* — As the discovery of implements in glacial deposits locates man on this continent at least at the close of the glacial epoch, this carries his residence here to about thirty-five thousand years ago. But there is no likelihood that he came into being on this continent. He could not have developed from any of the known fossil mammalia which dwelt here. More probably some colonies first migrated along the preglacial land-bridge which

[1] Abstract of an address before the Section of Anthropology of the American Association for the Advancement of Science, at New York, Aug. 10–17, 1887, by Dr. Daniel G. Brinton, vice-president and chairman of the section.