# SCIENCE

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**MSS. intended for publication and books, etc., intended for review should be sent to Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.**

## *PROFESSOR THOMAS HARRISON MONTGOMERY, JR.*

THOMAS HARRISON MONTGOMERY, JR., was born in New York City March 5, 1873, and died in Philadelphia March 19, 1912. Within this brief span of years he accomplished much; by the strength and manliness of his character he exerted a deep influence on all who knew him, by the extent and value of his scientific work he has left a lasting impress on his chosen science of zoology. This biographical sketch has been prepared as a tribute to the memory of a friend and colleague and in the hope that a more intimate acquaintance with his life and work may be welcomed by all who knew him either in person or through his writings.

In inheritance and education Professor Montgomery was unusually favored; he came of a distinguished family and his environment and training were of the best. The Montgomery family came to America from Ayrshire and settled in New Jersey in 1701. Among the paternal ancestors of Professor Montgomery were many distinguished clergymen, lawyers and business men. One of his great-great-grandfathers was William White, "the first bishop of English consecration in the United States." Through his mother, Anna Morton, he was descended from a line of distinguished physicians and scientists; his grandfather, Dr. Samuel George Morton, was one of the founders of the modern science of anthropology and was president of the Academy of Natural Sciences of Philadelphia from 1849 to 1851. Professor Montgomery sometimes spoke of Dr. Morton in a way which indicated that he had been deeply

influenced by the example of his life and work.

His father, Thomas Harrison Montgomery, was president of the Insurance Company of North America from 1882 until his death in 1905. He was a gentleman of unusual culture and ability, deeply interested in the work of churches, charitable organizations and educational institutions, and the author of several publications on genealogical and historical subjects, among which the most notable was a book of nearly six hundred pages entitled "A History of the University of Pennsylvania from its Foundation to A.D. 1770." In recognition of his scholarly ability the University of Pennsylvania conferred upon him the honorary degree of Litt.D. He had a large family, six sons and three daughters, and his influence over his children and their admiration for him deeply impressed all who came into their family circle. Professor Montgomery summed up his "Memoir" of his father in these words:

> One can paint certain traits of this large and rich character, but it is difficult to make a just portrait. A man of virile and broad mind, of very catholic tastes; a respecter of knowledge and a contributor to it; true and generous to all; with unimpeached personal honor; self-deprecatory but always compelling respect; ever active in work and economical of time, striving to do his best; a wise and tender husband and father, and a noble Christian gentleman. A man of religion that has no harshness but is filled with sweetness and hope and charity.

In his education and environment Montgomery was no less favored than in his inheritance. When he was nine years old his father removed to the country near West Chester, Pa., and here his real education began in the fields and woods about his country home. It was particularly in the study of birds that the mind of this naturalist was formed and moulded. Not later than his twelfth year he began to make a systematic study of the birds found in the vicinity of his home and by the time he was fifteen he had a collection of about 250 bird skins, and a record of each specimen giving the date and locality, food, measurements, and, under "remarks," many observations on anatomical and ecological features. By the time he was seventeen his collection had grown to about 450 bird skins, and his observations entered in his notebooks form many pages, perhaps volumes,[1] of interesting and discriminating observations on the migrations, habitats, breeding and nesting habits, food and methods of getting it, care of young, songs and notes, and many other details of the life of birds. Other notebooks contain detailed drawings of dissections, skeletons and general anatomical features. Intermingled with these observations on birds are many expressions of delight in the beauties of nature, in the splendor of the woods in winter, the joys of an early summer morning, the majesty of a thunderstorm, etc.

His formal schooling began at Dr. Worrall's School in West Chester; afterwards he attended the Episcopal Academy in Philadelphia, where he graduated at the age of sixteen. In the fall of 1889 he entered the University of Pennsylvania and continued there until the end of his sophomore year. While at the university his only biological work was a course of lectures by Cope on recent and fossil vertebrates which gave him a deep and lasting interest in comparative anatomy and paleontology. Supplementary to his work at the University he spent much time at the Academy of Natural Sciences of Philadelphia, studying in the museums and library, and there he developed that omnivorous

[1] The earliest notebook I have seen is headed "Note Book No. 5," and dates from his seventeenth year.

taste for all kinds of zoological literature which was one of his strong characteristics. He once said to the writer that while he was at Berlin he read the whole series of the Naples *Jahresberichte,* and as his memory was unusually retentive he soon acquired a very broad acquaintance with the literature of his science.

In the summer of 1891 he accompanied his father on a trip to Europe, and, fascinated by the possibilities for the study of anatomy and zoology in Germany, he persuaded his father to allow him to stay there for the remainder of his university course. He entered the University of Berlin in the autumn of that year, devoting attention particularly to human anatomy and morphological zoology. He applied himself with great energy and enthusiasm to his work and matured very rapidly as a student and investigator. It had been his intention to go to Leipzig for a portion of his university course, but his work in Berlin kept him so busy and so satisfied that he remained there for three years, taking the degree of Ph.D. in 1894, when he was but twenty-one years old. His preceptors in Berlin were Waldeyer, O. Hertwig, F. E. Schulze, Schwendener, Möbius, Dames, Heider, Korschelt and Jaeckel. He prepared his thesis under the direction chiefly of Schulze. Student associates at Berlin whom he often mentioned and who left a deep impress upon him were Fritz Schaudinn, afterward famous for his study of pathogenic protozoa, and F. Purcell, at present director of the Capetown Museum, South Africa.

As indicative of the strong hold which studies of evolution had made upon him may be mentioned the three theses which he defended on the occasion of taking his degree: "I. Für die Phylogenie ist das Studium des Nervensystemes von der grössten Wichtigkeit." "II. Die Nächsten jetzt lebenden Verwandten des *Limulus* sind die Arachnoiden." "III. Vogelarten, die periodisch lange Wanderungen durchmachen, haben keine geographischen Varietäten."

Whereas his earlier studies had been devoted largely to birds, his work at Berlin was chiefly on other classes of animals. His inaugural dissertation was an anatomical and histological description of a new genus and species of nemertean worm found at Berlin, and this was the first of a series of ten papers which he wrote on this group of animals. However, his interest in ornithology did not flag, and in several letters to Witmer Stone he expresses his great interest in the work of the American Ornithological Union, of which he had been elected a member, and his regret that he was unable because of the pressure of other work to continue his study of birds while abroad. Just before he took his degree he wrote to Mr. Stone:

> I have done absolutely no ornithological work in Germany, and will probably never have the time for it in the future. I have been studying especially comparative anatomy and embryology, but I have not yet lost my little taste for collecting and general field work, though that is now for me simply a happy bygone.

Nevertheless, after his return from Germany he continued for some time to record his observations on birds in his "Ornithological Field Notes," and he later published five papers based largely on these observations; up to the time of his death his interest in birds and in general field work never waned.

He returned to this country early in 1895 and for the next three years occupied a research room at the Wistar Institute of Anatomy in Philadelphia, where he continued to work unremittingly at his researches. During the summer of 1895 he studied in the laboratory of Alexander Agassiz at Newport and at the U. S. Fish

Commission Station at Woods Hole. In the summer of 1896 he worked for a while at the marine laboratory of the University of Pennsylvania at Sea Isle City, N. J. The summer of 1897 he spent at the Marine Biological Laboratory, Woods Hole, and thereafter nearly every summer of his life was spent there, except for four summers, when he was in Texas.

In 1897 he was appointed lecturer in zoology at the University of Pennsylvania; in 1898 he was advanced to an instructorship and in 1900 to an assistant professorship. During the years 1898 to 1903 he was also professor of biology and director of the museum in the Wagner Free Institute of Science in Philadelphia. In 1903 he was called to the professorship of zoology in the University of Texas, where he remained until 1908, when he became professor of zoology and head of that department at the University of Pennsylvania, and in this position he continued until his death in 1912.

He was a trustee of the Marine Biological Laboratory and clerk of the corporation of that institution from 1908 until his death, and during the same period he was co-editor of the *Journal of Morphology*. He was a member of the American Association for the Advancement of Science, the American Society of Naturalists, the American Society of Zoologists, of which he was president in 1910, the American Philosophical Society, the Academy of Natural Sciences of Philadelphia and the Texas Academy of Sciences, of which he was president in 1905.

This bare catalogue of the positions of responsibility and honor which he held indicates how rapidly he rose to prominence in his science, but it does not indicate the means by which he achieved distinction. It remains to describe his unusual qualities as an investigator, as a teacher and organizer, and as a man.

He was an unusually active investigator in many fields, and a ready and prolific writer. His life as an author extended only from 1894 to 1912, eighteen years in all, but in that time he made many valuable contributions to science and published one large book and more than eighty papers. His breadth of view and of sympathy is indicated by the numerous branches of zoology to which he contributed. Sixteen of his papers were devoted primarily to taxonomy, five to distribution, eleven to ecology and behavior, sixteen to morphology, twenty-five to cytology, eight to phylogeny and one to experiment. He had just begun on experimental work during his last year, and there is no doubt that he would have contributed largely to this branch of zoology had he lived. His breadth of view is shown also if one considers the groups of animals studied. His earliest publications dealt with nemertean worms, on which he wrote ten papers; his observations on birds are given in five papers, and those on other vertebrates in two; he published ten papers on hairworms, two on rotifers, fourteen on spiders, three on insects, twenty-five on cytology, of which fifteen dealt with insects alone, and sixteen on phylogeny and general topics (see bibliography).

Most of this work was very good and some of it was remarkable for its influence. Among his most important contributions must be mentioned particularly his various papers on the habits of spiders (Nos. 31, 37, 38, 41, 42); his studies on the nucleolus (Nos. 47, 48, 50); and his extensive studies on spermatogenesis (Nos. 49, 51–71). In the latter field a discovery of really epoch-making importance was his observation of the conjugation of separate chromosomes in preparation for the maturation divisions, and his clearly reasoned conclusion that one chromosome of each pair is of paternal and the other of maternal origin.

Another discovery of the utmost importance was that in certain Hemiptera an odd number of chromosomes may be present in the divisions of the spermatocytes, but he just missed the discovery that this phenomenon is associated with the determination of sex, though after this discovery was made by McClung, Stevens and Wilson, his later work did much to confirm it. His discrimination of the different kinds of chromosomes and his terminology for these (62) has been widely accepted and now forms part of the science of cytology. His studies on nucleoli, particularly his great work on the morphology of the nucleolus (48), contain a wealth of observations on these structures in a great number of animals, and this work did much to establish the conclusion that the nucleolus is a relatively unimportant part of the nucleus. When he had reached this conclusion he turned his attention at once, and with characteristic directness, to those parts of the cell which he considered most important, viz., the chromosomes.

It was in studies of natural history and general zoology that he took greatest delight and his work in these lines was particularly valuable. His early training gave him a fondness for, and facility in, taxonomic and faunistic work. He described many new species of nemerteans, hairworms, rotifers and spiders; he made faunistic lists of these animals as well as of birds and certain insects; he loved museum work and had the systematist's veneration for "type specimens." But his taxonomic work was much more than a bare description of species; it usually involved a thorough study of the anatomy and histology of the forms described, and to this he added, whenever possible, a study of their life histories and habits. He maintained that taxonomy of the right sort was one of the most inclusive and fundamental branches of zoology, since it involved practically all other branches of the science.

His studies on the behavior of animals are especially important. With great patience and enthusiasm he would spend days and nights studying the habits of different animals. His observations on the feeding habits of owls (13) are a model of their kind, and his studies of the habits of spiders (31, 37, 38, 41, 42) are worthy of the great masters of natural history, whose best works they recall.

He was a naturalist before he was a laboratory scientist, and he looked forward to the time when he could direct all his researches to the study of spiders as Wheeler had done for ants. The character and methods of his work were his own and in many instances can be traced back to his early training as a naturalist. He allowed no one to bring him "material" for study; indeed, the animals he studied were never mere "material" to him, but he did his own collecting. To all his friends the many newly turned stones in the fields about Woods Hole were a sign that Montgomery had been collecting there.

Although he held tenaciously to the value of the old zoology, he was quick to grasp the importance of work in new fields and bold and independent in entering them and in reaping their harvests. This applies especially to his work in cytology, for which he had made no special preparation, but in which he probably achieved his greatest successes. He clearly distinguished large problems from small ones, and he went straight to the center of each. He was keen in seeing the theoretical significance of his observations, and critical but just in estimating the value of the work of others. He was peculiarly independent in his work and was not in the habit of discussing it with others nor of asking advice, and it often happened that

even his intimate friends did not know his conclusions on important matters until after they had appeared in print.

He was primarily a naturalist and had no patience with experimental work done by men who had no intimate acquaintance with the animals studied; he characterized such experimentalists as "Versuchstiere," and hated their so-called "problems." Later he came to be an enthusiastic advocate of the experimental method as a supplement to, but not as a substitute for, observational studies, and in his new laboratory he had made extensive provision for such work.

He was a very rapid worker, and as he wrote up his results at once and published them without delay he always had several papers in press, and at his death it was found that he had left but little work unfinished. One notable exception is a textbook of cytology for which he had completed eleven chapters, leaving the rest of it in outline. It is to be hoped that this valuable work will be completed and published. In it he manifests that unusual mastery of the literature of the subject which was one of his leading characteristics, and which particularly fitted him for such a task.

As a teacher and organizer he was successful in a rare degree. His enthusiasm was balanced by critical judgment, and he was an inspiring and exacting teacher. His intimate acquaintance with the materials and literature of zoology, his positive and clear-cut opinions on most subjects, a sense of humor and a certain picturesqueness of language made him a most instructive and entertaining lecturer; also he had marked ability to direct and stimulate graduate students in research work. His plans for the development of zoology at the University of Pennsylvania were very comprehensive, including almost every great branch of the science.

During the last three or four years of his life, his greatest work was the new zoological laboratory at the University of Pennsylvania, which will ever be a monument to his energy, ability and foresight. He and his colleagues worked on the plans almost a year, and all details of construction, equipment and furniture were carefully planned. Almost another year was spent in constructing the building, and the labor of moving into it and getting things into working order had scarcely been finished when he was stricken with his last illness. He deeply regretted the loss of time from his researches which the construction of the building involved, but as the plans and building were completed rapidly, this lost time was reduced to a minimum, and he expected to enjoy for many years the facilities which he had so laboriously secured.

Although he often spoke of the time lost from his researches while the building was on hand, it is nevertheless a fact that during those years he published almost as many papers as during any previous period of equal length, while the number of papers published during the last year of his life was as great as in any other year, with a single exception. He realized that the new laboratory must be justified by the research work done in it, and the responsibility of "making good" rested heavily upon him. Undoubtedly during those last few years he worked beyond his strength, and when the fatal disease attacked him he had not resistance enough to overcome it.

He was stricken with pneumonia on February 15, 1912, and after a long struggle, in which hope many times alternated with despair, he succumbed on March 19, only a few days after his thirty-ninth birthday. His death, which occurred on the opening day of the celebration of the centenary of the Academy of Natural Sci-

ences of Philadelphia, cast a shadow over that event. From boyhood days his interest in the Academy had been keen and he had taken an active part in the preparations for the centennial celebration and had contributed an important paper on "Human Spermatogenesis" for the commemoration volume of the *Journal* of the Academy; this paper, which was his last contribution to science, appeared as the first article in the commemoration volume, which was issued some time after his death. His funeral was attended by many people from a distance, who had been present at the Academy's Centennial, as well as by his colleagues and students. His body was borne by his family and a few intimate friends to its last resting place on a hill overlooking the beautiful Schuylkill Valley and the great city with which his life had been so intimately identified.

His influence on science has reached many who never knew him and will last long after his personality is forgotten, and yet it is as the person, the man of honor and fidelity, of high ideals and courage and courtesy, that his friends love to remember him.

In person he was unusually tall and slender, with a serious but kindly face, and his general appearance gave the impression of great vigor of mind and will rather than of body. He was, however, capable of great physical endurance and was rarely ill. He matured early and appeared older than he really was and this appearance was strengthened by the way in which he regarded himself.

In 1901 he married Priscilla, daughter of John and Elizabeth Braislin, of Crosswicks, N. J. To them were born three sons, Thomas, Hugh and Raymond, and the pleasure which he took in the society of his wife and boys, and his devotion to them, demonstrated that he was a man of affection as well as of intellect, a loving husband and father as well as a distinguished scientist.

In his ornithological notebooks he has revealed his heart as in no other of his writings. Intermingled with the observations which he records are many passages evidently intended only for his own eye, and it seems almost like intruding into private matters to make them public, and yet they reveal so fully his inner motives and the philosophy of his life that it seems to the writer that the sketch which has here been drawn would be sadly incomplete without some reference to them. Under date of September 22, 1898, he gives a list of the summer birds still to be seen near his country home, and then after some comments on the beauties of the changing seasons, writes some ten pages on what might very properly be called the religion of a naturalist. Unfortunately limits of space do not permit the publication in full of this passage, but the following extracts are taken from it:

> In the make-up of the naturalist belongs as much appreciative interest as keen perceptive ability. In a word the naturalist must feel himself at one with nature. . . . The faintly heard note of a bird, the first odor of spring in the air, the moaning of wind in the spruces, or the wondrous insect humming on an August night—these are what set a train of vague but deliciously keen memories and longings in motion—a mental state which is the purest and most spiritual. Whoever has a true and tender love for the natural may experience at least the unexplained joy produced by such yearnings. . . . Such yearnings are the sublime in the experience of the naturalist. . . .
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> To me there are memories more precious than all others, memories of elated mental states associated with enthusiastic appreciation of the natural. . . . Analysis of such states may be possible, but shall one tear apart the web of his best dreams? . . .
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> What is the basis of such longings? Many would regard them as trivial or foolish, but the many are not naturalists. I recall with startling vividness when as a small boy I first heard the cat-bird's song in Central Park, New York City;

that was the first song that ever stirred me, but it left a yearning ineradicable as long as the mind lasts. Another time on the top of a small oak tree, on a bitterly cold winter day, I saw a pine finch, the only morsel of living nature in sight; the peculiar happiness of that moment will never be forgotten. The mating note of the red-winged blackbird, when it first arrives in the spring, or the tremulous note of the white-throated sparrow; at twilight the rich variety of notes of the screech owl; cold nights on the coast of Maine with the plover lined along the shore; or titmice in the pine forests of Germany;—such associations and innumerable others, appear to the memory time and time again, . . . and they are always an unexplained joy.

Perhaps such associations are hallowed merely in comparison with the tedium of life's little cares. This is very probably the case, but it in no wise lessens the joy. Man must work, he is paid by the work rather than by the hire, and his enjoyment is found in his work. But far above the plane of such enjoyment is the wonderful ecstasy produced by yearnings whose object is unknown. In human nature the wonderful thing is the multiplicity of characters, and the infinite number of changes and moods in each character. One of these is the character of the poet and naturalist. A naturalist may not be "born" one, for this is a loose expression. But he must become one in his earliest, purest and most impressionable years; let a few years go by, and the clay is too hard for the mould. Once a naturalist always a naturalist, the zeal of a naturalist never dies, but he must not be fettered in his pursuits. The cravings of which we have spoken are the poetic, spiritual side of the naturalist—the naturalist in contradiction to the *Naturforscher*. . . . One may become an excellent morphologist or physiologist, a clear elucidator of phenomena, and yet be without any poetic spirit. Or one may derive his most hallowed impressions from presentations in the laboratory, while another gets them from observation of objects in the field. One can only postulate that for certain natures vague naturalistic sensations are productive of the greatest joy. I too can testify to the keen joy experienced when after months of toil and many failures one attains the solution of a difficult problem. But in my case such a joy does not make as lasting an impression as does the pleasure from the mental states spoken of above; and surely the strength of a joy may be measured by the length of its duration.

He loved to spend many hours alone in fields and woods observing living creatures and feeling himself to be "a modest but integral part of nature" and yet he was not a mystic nor a recluse, but a jovial and delightful comrade who took great pleasure in association with intimate friends. He had a fund of dry humor with which he lightened up serious subjects of conversation and yet on such occasions he never let himself go beyond proper and dignified bounds. He was a firm friend and a good hater—a man who was reserved and strenuous, but tender and sympathetic; and above all one whose chief motive in life was an absolute devotion to truth. His great will power was one of his most striking characteristics. His ability to concentrate all his energies upon his work was remarkable; at such times nothing diverted him and he allowed himself no relaxation. His powers of self-control in all personal relations were equally remarkable; although his nature was intense he was always master of himself. He was a strong and virile man—and yet he was not domineering nor self-willed and he preserved an exquisite balance between self-contained dignity and charming courtesy toward others. He was always kind and sympathetic, and it was from real kindliness of nature, as well as from good breeding that those qualities arose which to many of his friends seemed to entitle him in a peculiar degree to "the grand old name of gentleman."

He was for a few years consciously and joyously a part of that nature which he so much loved. He has left to men the record of a life devoted to science and enlightenment, and to his family and friends the memory of a true and noble soul.

Edwin G. Conklin

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## *Forecast of the Birmingham Meeting of the British Association*[1]

The meeting of the British Association for the Advancement of Science, which will

[1] From the London *Times*.