egg. His prolific work on regeneration pointed up a number of important problems in this field also and aroused much other American work on the subject, while his attempts to explain the phenomena of regeneration and development on a common basis, and in a rational way, as by the hypothesis of the influence of mutual pressures, though not finally confirmed, showed that there were grounds for hope of solutions being obtained here by experimental means. Turning to problems of evolution, he joined with those who called for more empirical facts, welcomed the results of the experimental breeders, and, after a more purely critical period in these lines (as in his *Evolution and adaptation* and *Experimental zoology*), set about the spadework in earnest himself. The "Mutation Theory," initiated by de Vries, seemed to him to provide a way out for the origin of species because he was distrustful of the theory of natural selection. Thus, when it appeared that the fruit fly, *Drosophila,* was amenable to breeding studies, as shown in the work of Castle, Moenkhaus, Lutz, and (in the Columbia laboratory itself) Payne, Morgan eagerly seized on this material for finding out the facts at first hand. Everyone knows of his remarkable assiduity in finding mutations, from about 1909 to 1912, and of the facts that they did not, individually, establish new species after all and did not (as he, following Darwin on this point, had thought they might) show a qualitative relation to the conditions under which they occurred, or a tendency to be repeated more often in a given direction after having once occurred. Undaunted by these seeming negatives, however, Morgan deflected the direction of his search and studied the method of their inheritance once they had occurred.

It was this reorientation of his attack, together with a concentration of attention upon those variants that could be recognized more definitely, which enabled Morgan to follow the transmission of sex-linked genes in *Drosophila* and so to show that this conformed with the chromosomal pattern which Miss Stevens had found cytologically in that organism. From this preliminary (which, after all, was more or less paralleled in other forms) Morgan passed on to what undoubtedly stands as by far his greatest contribution: the setting up of the genetic case for crossing over. This involved the obtaining of data which showed, first, that different genes connected with the same pair of chromosomes (the X) undergo interchange, and second, that they do so with various frequencies, all of them below that of random relations—that is, they are "linked." It involved, further, the recognition that these facts are just what is to be expected on the "chiasmatype" theory which had already been proposed by Janssens, especially if, as Morgan himself pointed out should be the case, genes further apart have more crossing over between them. This served as the forerunner to a multitude of researches by numerous workers, at first mainly on the *Drosophila* material, which have served to vindicate the crossing-over theory and along with it the chromosome theory of heredity in general.

That the early findings of Morgan were so quickly followed up and generalized upon was due in no small measure to his having opened the doors of his laboratory and, indeed, of his mind to a group of coworkers, already trained in the chromosome theory by Wilson, who chose entirely their own leads and who would not have had the opportunity to carry on freely in most European or even American laboratories. Had Morgan been more of an authoritarian and less willing to be merely an equal member of the group in discussions, the younger workers would not have had the opportunity they needed for the further development of the subject, and Morgan's own mind would not have become so opened to the full implications of the facts found in the *Drosophila* work as to have led him finally to agree that, after all, they lead inevitably back to a theory of natural selection, now on a more rational basis and provided with an elaborate mechanism for its operation. Morgan was won to this point of view only against his own very active opposition, yet it is to his enduring credit that he was finally willing thus to alter his whole viewpoint in accordance with the empirical facts. Having done so, he was able through the series of hammer blows of his successive expositions of the subject to persuade the world of the truth of this point of view. However much the story of the formative period of the *Drosophila* work may be rewritten and reappraised in the future, there must remain agreement in regard to the fact that Morgan's evidence for crossing over and his suggestion that genes further apart cross over more frequently was a thunderclap, hardly second to the discovery of Mendelism, which ushered in that storm that has given nourishment to all of our modern genetics.

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Clarence Erwin McClung

1870-1946

C. E. McClung died suddenly on 17 January 1946 at the age of 75. Thus, one more of that group of brilliant zoologists who appeared on the horizon of American science at the turn of the century has passed on. He was born at Clayton, California, on 5 April 1870, but spent most of his earlier years in Kansas, where he grew up, received his education, and became established in his professional career. As a boy he

displayed an interest in chemistry and subsequently studied pharmacy at Kansas University, receiving the Ph.G. degree in 1892. After teaching chemistry and pharmacy at the University for a year, he entered the college and then continued in graduate work. He also pursued graduate studies for one semester under E. B. Wilson at Columbia University and for one summer with W. M. Wheeler at the University of Chicago. Kansas University awarded him the A.B. degree in 1896, the A.M. in 1898, and the Ph.D. in 1902.

Interest in zoology arose through contacts with S. W. Williston, who introduced young McClung to animal histology and vertebrate paleontology. At the suggestion of Prof. Wheeler he undertook a study of the spermatogenesis of *Ziphidium fasciatum,* a "long-horned" grasshopper. In this material "a peculiar nuclear element," which others working on different insects had considered to be a nucleolus, was shown by McClung to be a chromosome. Although not the first to discover that this element was distributed to one-half the spermatozoa, apparently he was the first to see the significance of this fact in relation to sex determination. This interpretation, first announced in 1901, brought him world-wide recognition and initiated a lifetime of researches on the chromosomes and their relation to taxonomy and evolution.

In addition to his numerous papers on chromosomes, Dr. McClung's publications reveal a wide range of interests including pharmacy, paleontology, microtechnique, photography, and a variety of educational and philosophical subjects. Interest in the microscope and in the techniques related to it resulted in the design of a "McClung Model" research microscope and in the publication of the *Handbook of microscopical technique,* prepared with the help of a group of collaborators.

As a teacher, Dr. McClung sought to develop the natural capabilities of each student. In the elementary course in zoology, which he taught at Kansas University, he introduced "unknowns" to arouse the spirit of inquiry which most young people possess but which is too often suppressed by current methods of college instruction. As editor of the *Journal of Morphology* from 1920 until his death, he labored to help authors, especially the younger ones, to appreciate the best methods of writing scientific papers.

Dr. McClung's keen intellect, genial personality, and administrative ability brought him many responsibilities both inside and outside the universities which he served. At Kansas University he was made chairman of the Department of Zoology in 1901 and curator of vertebrate paleontology in 1902, and he served as acting dean of the Medical School from 1902 to 1906. He was also chairman or member of many administrative committees.

In 1912 Dr. McClung was called to the University of Pennsylvania as director of the Zoological Laboratory. Here, through committee assignments and in other ways, he worked for progressive changes in curricula and improvements in facilities for graduate studies and research.

At the Marine Biological Laboratory, Woods Hole, Massachusetts, Dr. McClung became trustee in 1913, a member of the investigative staff in 1914, and served as chairman or member of the committees on new permanent buildings, endowment, the library, and the executive committee.

In 1917 Dr. McClung was made chairman of a zoology committee of the Division of Biology and Medicine of the National Research Council and in 1919 became the first chairman of the new Division of Biology and Agriculture, which he helped to organize. He was also a member of the Division of Educational Relations of the Research Council. He was the first president of the Union of American Biological Societies (1922–30), which, with other organizations, sponsored *Biological Abstracts,* and from 1925 to 1938 he served as president of the latter's board of trustees.

Various interests and responsibilities took Dr. McClung abroad. In the summer of 1924, accompanied by Dr. Schramm, then editor of *Biological Abstracts,* he toured Europe in the interests of this new abstracting service. The academic year 1927–28 was spent in travel, research, and writing in Europe. In 1930 he was the delegate of the U. S. Government, the American Philosophical Society, and the National Academy of Sciences at the International Congress of Biology at Montevideo. In 1933–34 he went to Japan as visiting professor at Keio University, Tokyo, returning through Europe. In 1939 he made a collecting trip to South Africa and completed a second trip around the world.

Among the executive offices held by Dr. McClung were also the following: president, Central Branch, American Society of Zoologists (1910), combined Zoological Society (1914), American Naturalists (1927), National Society of Sigma Xi (1917–21), Beta Beta Honorary Biological Fraternity (1936 onward); vice-president, Section F (Zoology), AAAS (1926). He was a member of the American Philosophical Society and of the National Academy of Sciences.

A degree of Doctor of Science was awarded to Dr. McClung by the University of Pennsylvania in 1940 and by Franklin and Marshall College in 1942. During 1940–41 he was acting chairman of the Department of Zoology at the University of Illinois, and in 1943 he became acting chairman of the Department of Biology at Swarthmore College.

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