

Records  
of the  
Genetics Society of America

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Number Seventeen

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PUBLISHED BY THE SECRETARY-TREASURER

M. R. Irwin, *Department of Genetics*

*The University of Wisconsin*

*Madison 6, Wisconsin*

1948

and celery. He died in the Memorial Hospital at Ithaca on December 8, 1947.

As an administrator, Emerson's frankness, honesty and modesty paved the way for fruitful cooperation with the departments of Botany, Vegetable Crops and Plant Pathology, so that Cornell came to be known as an international center of plant research. Largely as a result of such cooperative functional research, Emerson was elected to be the first Graduate Dean of Cornell University from the Agricultural faculty, an event which did much to integrate relations between that faculty and the one in Liberal Arts. Emerson served as Graduate Dean from 1925 to 1931. He was also faculty representative on the Board of Trustees of Cornell University in 1925-28.

Emerson was on the National Research Council in 1925-26. He was a member of the National Academy of Sciences, American Society of Naturalists (President, 1923), Genetics Society of America (President, 1933), American Society of Horticultural Science, and he was starred in the American Men of Science. He was also a member of Sigma Xi, Phi Beta Kappa and Gamma Alpha. In 1923-24, he was a member of the collecting party for maize germplasm in South America, sponsored by the U.S.D.A., in cooperation with Cornell University, and in 1935 he went to Yucatan for the Carnegie Foundation (archeology) to survey the food crops and agriculture of the Mayan peoples.

Dr. Emerson enjoyed a happy, wholesome married life with his family. He was married to Harriet Hardin of Lincoln, Nebraska, in 1898. Two daughters (Thera and Myra) and two sons (Sterling and Eugene) were born, all now living fruitful, competent careers. The Emerson home was ever open to graduate students and friends, with an easy, informal atmosphere. Emerson's hobbies of bowling and deer hunting were pursued with an energy equal to that devoted to his science. He possessed a tremendous reserve of physical and nervous energy. This, with his personal enthusiasm and drive for research, made him a natural teacher of renown. — E. W. Lindstrom.

### LEON JACOB COLE

June 1, 1877 - February 17, 1948

Leon Jacob Cole was a pioneer in the application of genetics to the problems of animal and plant breeding. His youthful ambition was to become a naturalist; and he later acquired an extensive formal training in zoology. Fate, however, directed him into agricultural science. The effectiveness of his long service in this field rested in a major degree on his interest in and knowledge of living things in general and the scholarly habits of mind he formed as a highly perceptive student of classical biology. In Cole's early days the basic sciences, aside from chemistry and perhaps physics, had received little recognition in the agricultural colleges. Cole was one of the able American

scientists by whose personal efforts biology was brought into organic relation with the work of these institutions.

Cole was born June 1, 1877 at Allegany, New York, and died at Madison, Wisconsin, February 17, 1948. He entered the University of Michigan in 1898 with advanced standing from Michigan Agricultural College and graduated in 1901 after specializing in zoology and botany. After serving for a year at Michigan as a graduate assistant in zoology, he entered Harvard University, which awarded him the Ph.D. degree in 1906. While still a student at Michigan, he was selected as a member of the Harriman Alaskan Expedition of 1899, an experience which deepened his interest in the natural sciences. His formal training was further supplemented by a summer's work at the Bermuda Biological Station in 1903, a zoological expedition to Yucatan in 1904 and a short stay at the Tortugas station in 1906. The other summers between 1901 and 1906 were spent at Woods Hole, Massachusetts, working on a biological survey for the U. S. Bureau of Fisheries.

Cole was fortunate in the personal associations he formed as a student. These included Professor W. J. Beal at Michigan Agricultural College, Jacob Reighard, Frank R. Lillie, H. S. Jennings, S. J. Holmes and Raymond Pearl at the University of Michigan. He studied for the doctorate at Harvard under E. L. Mark, and made the acquaintances at that institution of G. H. Parker, who exerted a lasting influence upon him, and of W. E. Castle, under whose guidance his first knowledge of genetics was gained.

The transition from biological to agriculture research began in 1907 when Cole was appointed Chief of the Division of Animal Breeding and Pathology at the Rhode Island Experiment Station. Although studies on inheritance and reproduction in the pigeon which were to become a principal interest in later years were begun at this time, his chief research at Rhode Island dealt with a serious and widespread disease in turkeys known as "blackhead." In 1908 Cole became instructor in zoology at Yale University, but continued for another year to collaborate in the work which he had begun at Rhode Island. H. L. Russell, under whose leadership the University of Wisconsin had entered upon a policy of "digging deeper the foundation on which the practical courses of agricultural colleges were built," persuaded Cole in 1910 to join the staff of the College of Agriculture to organize a new department of instruction and research first called "Experimental Breeding," but later this was changed to "Genetics." Cole served at Wisconsin for 37 years. He took leave in 1923-24 to serve temporarily as Chief, Division of Animal Husbandry, Bureau of Animal Industry, U. S. Department of Agriculture, and spent the summer of 1930 as research professor at Western Reserve University.

Recognizing the implications of the new science for the improvement of domesticated animals and cultivated plants, Cole set as his principal objective at Wisconsin the training of graduate students in applied genetics. He was notably successful in imparting to them something of his own idealism, breadth of biological interest, and

faith in scientific rather than empirical methods. The effectiveness of his efforts is attested by the numerous men who studied with him who now occupy positions of leadership, particularly in livestock and poultry improvement. Animal breeding, long straight-jacketed by tradition, was witnessing the advent of a generation of investigators who were being guided into new areas of thinking and practice by a rapidly growing body of genetic principles. Cole led in this movement.

Cole's early researches ranged over a wide field including ornithology, animal behavior and animal pathology. Following a collecting trip to Yucatan in 1904, he aided in monographing the birds, reptiles, amphibians and fishes of that country. Several papers were published on classification of the Pycnogonida; and he made an extensive study of the German carp in the United States. In 1909 he organized the American Bird Banding Association. His chief genetic interest became centered in pigeons and doves and led to numerous publications on color inheritances, anatomical and phynological defects, sex ratios, sex intergrades, species relationships, milk secretion, and egg laying. His latest work at Wisconsin was concerned with the genetics of ranch-bred mink and foxes.

Cole gave generously of his time to scientific organizations and to the cause of science at large. He was vice-president in 1917 of the American Society of Naturalists, president of the Wisconsin Academy of Arts and Sciences from 1924 to 1927, vice-president in 1940 of Section F of the American Association for the Advancement of Science, and also in 1940, president of the Genetics Society of America. He served on the advisory committee established in connection with the Birth Control Clinical Research Bureau and as collaborator for genetics with the Division of Bee Culture of the Bureau of Entomology and Plant Quarantine. For several years he was chairman of a National Advisory Committee of the Institute of American Poultry Industries. From 1935 to the time of his death he was a member of the editorial board of Genetics, and served for many years on the advisory Committee and later on the Council of the American Genetic Association.

In formal recognition of his achievements in teaching and research in animal breeding the American Society of Animal Production in 1939 presented his portrait to the Saddle and Sirloin Club in Chicago. He was awarded the Honorary Doctorate of Science by the Michigan State College of Agriculture and Applied Science. The Czechoslovakian Academy of Agriculture made him a corresponding member.

One finds it impossible to portray adequately Cole's work and influence. He was an exceedingly generous and kind man with a deep interest in people as persons. His contributions are now important elements in the activities of a wide circle of students and associates in whom he awakened new scientific interests.

Cole is survived by his wife, Margaret Belcher Goodenow, whom he married in 1906, and a daughter, Mrs. Margaret Husting. A son, Edward G. Cole, died May 25, 1948. — R. A. Brink.

inactivation of single genetic determinants.

MARSHAK, A., New York University, New York, N. Y.: The genetic significance of a nuclear precursor to desoxyribonucleic and ribonucleic acids. — Isolated nuclei incubated at 37°C without added enzyme release nucleic acid but do not do so at 0° to 2°C. When the animal from which the nuclei are isolated is given P<sup>32</sup> this nucleic acid has a specific activity 13 times greater than that of the RNA of the larger cytoplasmic particles (mitochondria) and 9 times greater than that of the smaller particles (microsomes). It is also greater than that of the phospholipids and the phosphate esters. Since the proportion of P<sup>32</sup> held by the nucleus as compared with the rest of the cell remains practically constant from 2 hours to 5 days after administration, the high specific activity cannot be due to accumulation but to rapid turnover of the nucleic acid involved. The fraction extracted from the nucleus by methods for obtaining RNA has a specific activity approaching that of the nucleic acid in question and may therefore be similar or identical with it, but both differ from the RNA of the cytoplasm.

In both mitotic and non-mitotic cells the P<sup>32</sup> appears first in this fraction. In mitotic cells it is subsequently accumulated in DNA while in non-mitotic cells it passes into the RNA of the cytoplasm. Because the nuclear nucleoprotein contributes to the formation of both the hitherto known nucleic acids by transferring constituents at least as complex as nucleic acids, and because it has properties in common with both, it is considered to be their precursor.

These findings indicate that plasmagens and other cytoplasmic constituents containing nucleic acid cannot be independent of nuclear activity. They also predict that cells will be found containing no DNA. A strain of bacteria with no DNA has been isolated. Asterias eggs show no detectible amounts of DNA in the meiotic stages and through the 2 cell stage of the embryo.

MARTIN, A. JR., J. N. DENT, and L. JOSEPH, University of Pittsburgh, Pittsburgh, Penna.: Effects of Beta-rays on Habrobracon juglandis. — A technique for exposing *Habrobracon juglandis* females to Beta-rays has been developed and utilized. Wild-type females exposed to dried radioactive phosphorous produce abnormal progeny with a frequency of approximately 25 percent, while untreated females produce abnormalities at the rate of about 5 percent. Some of the abnormalities in the test material have proved to be mutations, while none of the abnormalities in the controls have been transmitted to their offspring. Frequency of abnormalities does not vary appreciably between progeny of treated virgins and non-virgins. Abnormalities occurring most frequently are those of the wings, antennae, and feet in that order. Mutations of wings and antennae have been checked through three generations. Reduplication of the right primary wing breeds true but with varying degrees of penetrance, even to the point of overlapping with wild-type. Wrinkled wings (primary and secondary) and drooping

series of experiments using the same technique and substituting barbituric acid, chemically similar to the pyrimidines, for RNA in the medium described previously, it was found that this substance, when present in concentrations of 1 mg./ml. or 0.1 mg./ml. delayed pupation of wild type flies to 20 to 50 percent longer than flies grown on the control medium with RNA. As with benzimidazole, vestigial flies were inhibited to a lesser degree than were wild flies. Barbituric acid in a concentration of 1 mg./ml. produced a 20 percent increase in the egg-pupa time of vestigial flies. This delay was partially overcome by the addition of RNA 1 mg./ml. but not by the addition of adenine 1 mg./ml. Since the previous experiments had shown that adenine is an almost complete substitute for RNA, the fact that RNA but not adenine overcame the growth inhibition of barbituric acid suggests that the latter inhibits because it is a structural analogue of the pyrimidines and that the inhibition is reduced by the pyrimidines present in the RNA.

WALLBRUNN, HENRY M., University of Chicago, Chicago, Ill.: Genetics of Betta splendens I. — The color of the Siamese fighting fish is due to pigments in melanophores, erythrophores, and xanthophores, and to light refracted by crystals in guanophores. In my stock I have found no xanthophores. Three colors of guanophores corresponding to the two homozygous and heterozygous cases occur. I have named the locus G; GG giving steel-blue; gg, green; and the heterozygote, Gg, blue. The G locus determines the color produced by guanophores, but their distribution is determined by at least two other loci. Locus a, and locus s determine the extent of guanophore distribution on the fins and body, respectively. The aa fish have solid blue, steel-blue, or green fins because of the great density of guanophores which overlie the ever-present erythrophores and often-present melanophores. AA fish have large, pure red fin areas with guanophores in restricted but definite areas. Aa fish are either identical with or very similar to AA. Exact determination has been impossible up to the present, because of complications due to the S gene which has a slight effect on the fin guanophores as well as on the body. The s locus proved to be more easily worked out in fish with no melanophores which are homozygous c; scc fish have a sparse body covering of guanophores. SScc have a much denser covering of guanophores and also an uneven clumping of them so that some scales and spots in the fins are darker than surrounding areas. Sscc fish have a more even color distribution but approach SS more closely than ss.

WATSON, J. D., Indiana University, Bloomington, Indiana: Inactivating mutations produced by X-rays in bacteriophages. — Luria reported in 1947 that reactivation by multiple infection, such as he discovered for ultraviolet inactivated bacteriophages, could not be detected after X-ray inactivation. In reinvestigating this problem, we found that X-rays, besides inactivating phage, also suppress the ability

of phage to infect bacteria, one "adsorption suppressing" hit occurring on the average for every three inactivating hits. Because of this, reactivation is difficult to detect by the multiple-infection technique. We tested for it by infecting individual bacteria with one particle T2r<sup>+</sup> inactivated by X-rays and one particle T2r inactivated by ultraviolet. A significant proportion of these bacteria liberate a mixture of active T2r<sup>+</sup> and active T2r, which proves that X-rayed phage can participate in genetic recombination and reactivation. Similar conclusion was reached by infecting bacteria with one active particle T2r<sup>+</sup> and one X-rayed particle T2r. Finally, reactivation was also detected by mixed infection with one particle each of X-ray inactivated T2r<sup>+</sup> and T2r. Quantitatively, we found that for equal numbers of inactivating hits, the contribution of an X-ray inactivated particle to reactivation is lower than that of an ultraviolet inactivated one. The relative contribution of X-ray and ultraviolet inactivated particles is constant in all types of experiments listed above. This result is considered as evidence that one X-ray hit produces on the average more lethal mutations than one ultraviolet hit, thus giving the first experimental evidence for an actual difference in the spatial domain within which the genetic effects of one hit of each type can be exerted.

WHITING, P. W., University of Pennsylvania, Philadelphia, Pa.: Simultaneous (?) mutations in an inbred stock of Habrobracon. — In December 1944 three changes were noted in a closely inbred stock (sex alleles xa/xb) which had been under observation for over three years and in which wild type and orange eye color and the female-sterile traits glass and sex-linked fused were being maintained. (1) A minus modifier appeared changing fused to semifused, midway between wild type and fused in the male, weakly fertile in the female. This modifier proves to be linked in the orange group. (2) There was a sudden drop in fecundity of the females. Records of 40 with normal life span showed nine sterile, 10 with less than 10 progeny each and only 7 with over 30. After further breeding normal fecundity was recovered. (3) There was a marked increase in ratio of diploid males to females, - 23:24 (95.8 percent relative viability) in one "large" fraternity. Twelve small fraternities totalled 42:63 (66.7 percent). As fecundity was recovered, the ratio of diploid males to females dropped, 40 fraternities showing 693:1735 (39.9 percent). Subsequent selection showed 15 with 239:412 (58.0 percent) and unselected material showed 41 with 219:674 (32.5 percent). Culture temperature tests with this material proved inconclusive. At 29°C. 14 fraternities showed 90:235 (38.3 percent relative viability); at 22°C. 15 showed 84:201 (41.8 percent); at 32°C. 14 showed 276:780 (35.4 percent). Counts within the stock previous to the mutation had shown only 19:1292 (1.5 percent).

WHITTINGHILL, MAURICE, Department of Zoology, University of North Carolina, Chapel Hill, N. C.: The effects of methyl-bis(b-chloroethyl)amine upon recombination values in Drosophila melanogaster. —