DISCUSSION AND CORRESPONDENCE

THE PRODUCTION OF MUTATIONS BY X-RAYS IN HABROBRACON

MULLER[1] has shown that mutations, both lethal and visible, may be produced in *Drosophila melanogaster* by means of X-rays. Weinstein[2] has repeated and confirmed Muller's findings. Other investigators have by the same means subsequently induced germinal modifications in plants, of which some at least appear to be genic.

Early in 1927 similar tests were made at Muller's suggestion with the parasitic wasp, *Habrobracon juglandis* (Ashmead). No results were at first obtained, and it appeared that dosages adequate to sterilize the flies had little or no effect on the wasps. Further work with greatly increased dosages resulted in reduced fertility and at least one visible mutation (small head). There was also evidence of lethal mutations, but these were not checked by linkage, as was done in Drosophila.

After an interruption of some months, the work has been resumed with advantage of knowledge in regard to adequate dosage gained from the previous experiments. There have already resulted three visible mutations; one affecting the eyes, one the wings and one the body as a whole. The last is semilethal and linked with the locus for orange eye. Many lethals have apparently been produced as evidenced by decrease in (haploid) males, but no attempt has been made to follow out their method of inheritance. The heredity of the visibles is being traced.

It is significant that among the offspring of the relatively few treated wasps these mutations (including four visibles) have been found, while in previous work involving several hundreds of thousands of individuals not more than seven visibles have been detected.

Induction of sterility in Habrobracon shows some remarkable differences from what occurs in Drosophila. Experiments to test the meaning of these differences are now in progress.

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PLIOCENE URODELES IN WESTERN KANSAS

FOR the past four years, Mr. H. T. Martin, of the paleontological department of the University of Kansas, has been excavating and investigating a deposit of Lower Pliocene sand in Sherman County, Kansas. The work has been carried on in a cut where the drainage into the Smoky Hill River has made a gully about seventy-five feet deep in the surrounding prairie. The particular stratum worked is about twenty feet below the level of the prairie, and consists of a deposit of fine, silty sand in which a rich series of mammal remains are found, together with some skeletal fragments of birds, reptiles and amphibia, the latter occurring in large numbers.

When, in the course of the excavating, small bones were found in the sand, sieves were procured and used and about five tons of sand were carefully sifted to make more certain the collecting of this material. By this means the remains of over a hundred individuals of urodele amphibia were recovered. The skeletal material, although completely disarticulated, is perfectly preserved and completely fossilized and in such excellent condition that the bones can be studied and articulated as though they were fresh skeletal elements.

The condition of the bones shows that there has been no washing and little movement of any kind in the sands since they were deposited, for thin, paper-like bones such as parasphenoids are perfectly preserved.

A few natural articulations remain intact. Three stapes were recovered from the sand-filled cavity of the otic capsules, while in four specimens the stapes were ankylosed in position on the lips of the foramen ovale. Of one hundred and eighty angulars, the calcified articulars were in place in twenty-one specimens.

All parts of the axial and appendicular skeleton have been found and identified with the exception of small carpal and tarsal elements and some of the bones of the digits. All the elements of the skull were also obtained with the exception of the palatines and nasals, but since these are exceeding thin and delicate, only the merest chance would make their recovery possible and sieving would only serve to break them to pieces.

The deposits in which this amphibian material was found are typical of the early Pliocene. The age of these specimens must be judged from the animals associated with them in the sands; since, as pointed out above, it is apparently impossible that there could have been any washing or transposing of material, one is forced to the conclusion that the skeletons of the amphibia and the other animals were laid down in the sands at about the same time.

The following early Pliocene animals were found associated with these amphibia:—Aphelops, Pliohippus, Prosthenops, Procamelus, Pliauchenia, Dromo-

[1] Muller, H. J., "Artificial Transmutation of the Gene," SCIENCE, Vol. 66, pp. 84–87, 1927.

[2] Weinstein, Alexander, "The Production of Mutations and Rearrangements of Genes by X-rays," SCIENCE, Vol. 67, pp. 376–377, 1928.