

to account for the observed mortality. It was found that the toxicity increased with increasing cyanide concentration. In 130 out of 138 toxic samples the toxicity was completely removed by the addition of a small quantity of formaldehyde, which removed the cyanide present by forming with it innocuous compounds, but did not alter the tar acid or dissolved oxygen concentrations. The colour of the gills of smolts dying at the surface of the estuary waters was found to be markedly brighter than that of normal fish. It was shown experimentally that, of the poisons likely to be present in the estuary, cyanide alone produced this effect.

The evidence therefore points to the conclusion that cyanide is the factor mainly responsible for the death of fish in the Tees estuary. The importance of cyanides in the study of pollution has been noted by Lehmann,<sup>1</sup> but his work has attracted little attention in Great Britain.

A method whereby cyanide-containing effluents from coke ovens are rendered innocuous by the addition of spent pickle liquors is being worked out, and it is hoped that treatment on a works scale will soon be possible.

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<sup>1</sup> Lehmann, C., *Z. Fischerei*, 24, 401; 1926.

#### A New Series of Allelomorphs in Mice.

THERE appeared recently<sup>1</sup> a paper by P. J. Camidge and H. A. H. Howard on "The Hereditary Transmission of Hypoglycæmia in Mice" which contains facts of considerable interest to students of genetics. These authors had previously shown that the condition of high blood sugar in mice (hyperglycæmia with blood sugar values of 110-125 mgm. per 100 c.c. of blood) behaves as a simple recessive to the normal condition (about 80 mgm.).<sup>2</sup> They have now found mice with very low blood sugar value (about 60 mgm.), and this condition also behaves as a simple recessive to the normal. Segregation in both cases is clear, no intermediate values having been found.

The experimental evidence, allowing for a lower viability of hypoglycæmic animals, seems sufficient to justify the authors' conclusions that they have discovered another recessive gene influencing the blood sugar level of the blood. They seem, however, not to have noticed the important fact that the three blood sugar levels—high, low, and normal—appear from their evidence to be due to three allelomorphic conditions of the same gene. A summary of the crosses which show this follows:

High  $\times$  normal:  $F_1$ , normal;  $F_2$ ,  $\frac{3}{4}$  normal,  $\frac{1}{4}$  high (actually 81 : 28).

Backcross,  $F_1 \times$  high;  $\frac{1}{2}$  normal,  $\frac{1}{2}$  high (actually 45 : 44).

Low  $\times$  normal;  $F_1$ , normal;  $F_2$ ,  $\frac{3}{4}$  normal,  $\frac{1}{4}$  low (actually 45 : 10 + 5 dead).

Backcross,  $F_1 \times$  low;  $\frac{1}{2}$  normal,  $\frac{1}{2}$  low (actually 77 : 26 + 40 dead).

Low  $\times$  high;  $F_1$ , high;  $F_2$ ,  $\frac{3}{4}$  high,  $\frac{1}{4}$  low (actually 46 high, 10 low + 6 dead).

If the mice born dead are assumed to be hypoglycæmics, the results fit the expectations remarkably well. But the results of crossing low by high show that these conditions are not only allelomorphic with normal, but also are probably allelomorphic with each other as well. Normal, high, and low appear to form

a series of triple allelomorphs with dominance in the order given. This dominance order is unusual, if not unique, among multiple allelomorphic systems, since a high quantitative effect on blood sugar appears between two lower values. Further evidence from crosses of high by low and of each by the same normal stocks would seem desirable to test the possible influence of modifying genes in producing this unusual result.

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<sup>1</sup> *Proc. Roy. Soc. Med.*, vol. 23; 1930.

<sup>2</sup> *J. Genetics*, vol. 16; 1926.

THE case to which Prof. Dunn alludes is of very great interest in the question of the origin of dominance. It will be observed that the gene for normal blood sugar is dominant both to the hyperglycæmic and to the hypoglycæmic genes. In the "Genetical Theory of Natural Selection" (Chap. v), I had inferred that such dominance in opposite directions to different mutants must occur in quantitative characters, if dominance is, as I believe, a product of natural selection. With respect to the exceptional dominance of the one mutant gene over the other, it will be observed that this also follows the rule of the dominance of the more over the less viable condition. It is much to be hoped that further evidence of this observation will be obtained, using genetically normal, wild type mice; since the fact that in this cross an intermediate heterozygote would seem to be more advantageous than one with high blood sugar, suggests that the case may throw light on the mechanism by which the recessiveness of hypoglycæmia has been brought about.

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#### A Fertile Mule.

ON Nov. 24, 1924, a common mule on the farm of Mr. W. J. Kilian, of Weenen, Natal, gave birth to a male foal, and a detailed account of the occurrence was given in the *Annals of the Natal Museum*, vol. 5, pt. 5, 1926. The mule in question was bred by Mr. W. L. Eales, of Fullerton, Cape Province. It is a typical mule in every way, and has a considerable preponderance of the characters of the ass.

The foal was suckled by the mother mule. The foal grew rapidly and the adult animal is now a reliable riding horse, and from the accounts received it is practically indistinguishable from a pure horse.

The subject has again been brought to my notice, in that on Nov. 21 of this year the same mule, which is about fifteen years old, gave birth to a second male foal, and this foal was sired by a different stallion from that of the first foal. Thus, between the births of the two foals there has been an interval of seven years, although the mule has been repeatedly served. In the present foal the characters of the horse would appear to be markedly prepotent over those of the mule, just as in the case of the first foal.

It would seem as though South Africa were in some way favourable for mule-fertility, in that in 1904 the late Dr. Gunning, director of the Transvaal Museum, informed me that he was acquainted with an undoubted case in the Transvaal, but, so far as I am aware, the exact details were never published.

That the common mule may be sometimes fertile has been long disputed, although certain alleged cases have been quoted from America, but they mostly seem to lack strict authenticity. Also, on cytological grounds even the possibility of back-crossing