	Black agouti white belly	Black	Dilute black agouti white belly	Brown agouti white belly	Dilute black	Dilute brown agouti white belly	Brown	Dilute brown	Total
Observed	31	30	10	19	23	21	16	13	163
Expected	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	163.2

If the pairs of genes are considered separately, we find that there are 94 animals with gene B(black) and 69 without it. There are 96 with gene D(intensity) and 67 with d(dilution), while there are 81 with A^w (agouti white belly) and 82 with a (non-agouti). Obviously the chief excess is found in black or intense animals. When these two genes are found together it appears that there are 61 animals, while those with (b) and (d) number 34. Those with (B) and (d), 33, and those with (b) and (D), 35. A somewhat similar excess of animals which had both (B) and (D) was observed in a cross reported by the writer and Phillips,[6] between color varieties within the species *M. musculus.* It is probable that it depends upon death of recessive color combinations rather than upon any linkage or other gametic disproportion.

The "vested" variety is an extremely interesting phenomenon. What perhaps is a somewhat similar condition in that it involves a "weakening" of the agouti pattern was observed by Detlefsen in the case of the guinea pig hybrids referred to above. In his material almost complete disappearance of "ticked" hairs was observed on the dorsal surface in some hybrids. The same phenomenon has been observed in the mice.

Morgan reports a weakened condition of the black factor in F_1 generation mice produced in a cross between a small Japanese-waltzing male and a larger brown non-waltzing female. It is interesting to note that Japanese-waltzing mice are, by many, believed to be descended from *M. wagneri* (see Gates[7]).

At all events we have in three crosses, two of which *do,* and one of which *may* involve specific differences, distinct evidence of "weakened" activity of three epistatic genes introduced by males of the smaller species or variety.

This suggests an interesting line of reasoning as follows:

In addition to the qualitative attributes which distinguish it, each gene may have a quantitative potentiality adapted by natural selection to the size of the body which its activity must cover.

Since activity of genes in development is undoubtedly related in some way to liberation of energy, and since liberation of energy means previous storing of energy, it seems likely that a species will by natural selection eliminate those individuals wasteful enough to build more of such potential activity than is commonly called upon. This would follow since surplus material would require additional food and storage space and would tax more than was necessary the systems by which waste products of metabolism were eliminated.

When a species cross is made resulting in an F_1 hybrid of distinctly larger size than that of the small parent species, the genes of the latter adapted in their physiological activity to covering only a certain more or less limited body area, may find themselves unable to act over the whole of the body of the larger hybrid, and as a result the recessive gene would partially express itself. Such was actually the case in the three crosses referred to. The rôle of the cytoplasm in determining the degree or extent to which the gene may act is also possibly a matter of great importance in this connection. Data on reciprocal crosses in the three cases in question are not as yet available.

The principle of the quantitative limits of gene activity will, if established, be an interesting line of research to follow in size inheritance and in many other genetic problems of birds and mammals.

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[6] *Am. Nat.* (1913) 47, 760–765.

[7] *Publ. Carnegie Inst. of Wash.* (1926) No. 337.

THE ABSORPTION SPECTRUM OF MERCURY AT HIGH PRESSURE ADMIXED WITH NITROGEN[1]

A CONSPICUOUS feature of the absorption spectrum of mercury, as shown by Mohler and Moore,[2] is the appearance of a train of eighteen flutings reaching their optimum range of 2770–2930 A at 420° C. (2100 mm.).

In the present work, when 13 mm. of pure nitrogen gas was admitted to the same 40 cm. quartz absorption tube before sealing off and spectra photographed using the same source of radiation (a high potential discharge in hydrogen), this system of flutings was extended on the red to 3087 A at temperatures of 215–305° (28–215 mm. Hg) and on the violet to

[1] Publication approved by the Director of the U. S. Bureau of Standards, Department of Commerce.

[2] Mohler and Moore, *J. Optical Soc. Am.* 15, p. 74 (1927).

2666 A at 425–530° (1820–7250 mm. Hg). The longer wave length bands (3087, 3063, 3042, 3000, 2980, 2962, and 2944 A) show an average frequency separation of 225 cm.$^{-1}$, nearly double the intervals obtained with pure vapor. Some 32 bands were found within the range 2919–2666 A at higher pressures, with a wave length separation of 12 A at the beginning and 5 A at the end of the series. Seventeen of these bands within the range 2762–2666 A represent a definite extension on the short wave length side to those previously reported.

Lord Rayleigh[3] has announced the occurrence of fifty absorption bands in the region 2697–3055 A with a long column of vapor. Altogether 42 such bands were found in the present work with 13 mm. of nitrogen, and the increase of 24 (42–18) indicates that nitrogen does exert a specific rôle, although it may not be a determining factor with a long vapor column. A shorter band at 2528 A, however, was always obtained with mercury-nitrogen mixtures and appears to be very definitely conditioned by the presence of this gas. This new band was seen within the temperature limits 230–430° C. with 13 mm. of gas, but appeared only at temperatures less than 250° (77 mm. Hg) with 30 cm. of gas. In runs made with a 90 cm. Pyrex tube provided with quartz windows, the 2528 band invariably was found to appear at temperatures below which the resonance broadening on the violet did not become greater than 9 A, thus overlapping and fusing with this band. Nitrogen pressures of 13 mm., 30 and 50 cm. were used in these trials. Pressure conditions, however, were much less definite than with exposures taken with the 40 cm. quartz tube.

Data procured from the present photographs on resonance widths at various temperatures confirm R. W. Wood's[4] first qualitative observations on the symmetrical broadening of resonance absorption at intermediate pressures, and asymmetrical broadening (*i.e.*, towards the red only) at higher pressures for mercury vapor admixed with a foreign gas. It is evident, however, that widths found at lower temperatures (150–250°) are misleading if no allowance is made for the 2540 and 2528 bands. The present measurements show that resonance broadening increases with the pressure of nitrogen. At 350° with 30 cm. of nitrogen, a maximum displacement of 32 A to the violet was obtained. The displacements toward the violet with 13 mm. of nitrogen are only 2–4 A in excess of blank trials made without gas. Broadening toward the violet in the presence of nitrogen is a very complex phenomenon, but bears no evident relation to the appearance of new spectral bands. Nitrogen, even at high pressures, does not seem to hasten markedly the rate of broadening on the red at high temperatures. Born and Franck's[5] concept of three body collisions may be applicable in this connection, for it is clear that a red quantum will suffice to raise the Hg atom to the $^3P_1$ state if the impacting nitrogen molecule or mercury atom contributes the necessary energy difference at the expense of their own translational energy. Such a picture is dynamically impossible for broadening on the violet.

The action of nitrogen in developing new spectral bands admits of no clear-cut interpretation. The 2528 band, evidently characteristic of mercury-nitrogen mixtures since it appeared with all pressures of nitrogen, can not be correlated with the additional flutings obtained only with 13 mm. of nitrogen. Paul D. Foote, in his very recent quantitative treatment of the mechanisms involved in the quenching of resonance radiation by foreign gases,[6] has pointed out that Hg_2 molecules are produced by collision of excited mercury and normal mercury atoms and that the presence of nitrogen favors this process. In this case the extension of the fluting system may be ascribed to the increase in the concentration of Hg_2 resulting from the combined effect of the nitrogen and the radiation used as a source. This consideration, it must be noted, explains only the extension of the fluting series observed in pure mercury.

There is, however, another possibility. One might expect that high pressures of nitrogen and high temperatures would favor the production of unstable or quasi-stable HgN_2 molecules. Possibly such coupling occurs only between nitrogen molecules and excited mercury atoms. Foote's work suggests, further, that an optimum pressure of nitrogen produces a maximum number of $^3P_0$ Hg atoms. The life of the $^3P_0$ state is inversely proportional to the pressure of nitrogen. An equilibrium eventually must be set up between the number of $^3P_0$ atoms produced and destroyed by nitrogen. Such considerations make it appear possible that the additional flutings on the red represent the vibrational spectra of HgN_2 molecules formed in this way. The absence of these bands with higher pressures of nitrogen is then a necessary consequence of quenching, by the gas, of $^3P_0$ Hg atoms. Obviously these hypotheses suggest many experiments, but circumstances made it impossible for the writer to continue the research.

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[3] Rayleigh, *Nature* 119, p. 778 (1927).

[4] Wood, *Astrophys. J.* 26, p. 41 (1907).

[5] Born and Franck, *Zeits. f. Physik.* 31, p. 411 (1925).

[6] Foote, *Phys. Review* 30, p. 288, September, 1927.