ZOOLOGY: R. PEARL

Females: $\frac{G_{2n+2} - 3^n - 1}{B_{2n+1}}$; thus 4/8, 18/32, 76/128, etc.

$\frac{G_{2n} - 1}{B_{2n}}$; thus 1/4, 3/16, 9/64, etc.

$\frac{G_{2n+1} - 3^n - 1}{B_{2n+1}}$; thus 2/8, 8/32, 34/128, etc.

Males and females equal in number.

In all these series the proportions of any given sort gradually approach a limit; thus in the last case (24) the limit for $A-$ is 2/3; for $a-$, 1/3; for AA it is 2/3; for aa, 1/3; for Aa the limit is 0.

In the full paper there is a systematic presentation of formulae for the proportions in any generation, resulting from any of the main types of breeding, and with any of the common types of parental population, giving eighty-two numbered sets of formulae. In each case the limit approached is given, together with the number of generations of breeding required to come within 1% of that limit. The complete paper appears in the first number of Genetics.

ON THE EFFECTS OF FEEDING PITUITARY BODY (ANTERIOR LOBE) SUBSTANCE, AND CORPUS LUTEUM SUBSTANCE TO GROWING CHICKS

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Received by the Academy, December 17, 1915

In connection with the studies of Pearl and Surface on the effect of pituitary substance on the function of egg production in the domestic fowl it seemed desirable to see whether the initial activation of the ovary could be accelerated by means of this substance. A pullet of a good producing strain hatched at the proper time and well grown will begin to lay when from five to six months of age ordinarily. Can such pullets be brought to sexual activity and laying any earlier if regularly fed pituitary substance?

Forty-five pure-bred Barred Plymouth Rock pullets, all hatched the same day (April 29, 1915) were divided into three lots of 15 each. They were so chosen that the total weights of the three lots, and thus the average weight per bird, were identical at the beginning of the experiment. Further great pains were taken to get birds of the same stage of maturity and physiological development so far as could be determined. Each bird in one lot (A) received per os 0.082 g. per day of pituitary body substance.
(anterior lobe) substance. This was administered in No. 2 gelatine capsules with lactose as a diluent. Each bird in the second lot (B) received per os the same amount (0.082 g.) per day of dessicated corpus luteum substance from pregnant cows, again administered in No. 2 gelatine capsules with lactose as a diluent. Finally lot C was a control, the birds receiving no capsules. All the birds were housed in the same house, and given the same food and care except for the capsule feeding as above noted.

The experiment began August 13, 1915. The growth of the birds is shown in the table.

Table showing the weights at various intervals of birds fed pituitary body (anterior lobe) substance and of those fed corpus luteum substance.

<table>
<thead>
<tr>
<th>DATE</th>
<th>LOT A. (PITUITARY)</th>
<th>LOT B. (CORPUS LUTEUM)</th>
<th>LOT C. (CONTROL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total weight</td>
<td>Mean weight per bird</td>
<td>Total weight</td>
</tr>
<tr>
<td>kilos</td>
<td>grams</td>
<td>kilos</td>
<td>grams</td>
</tr>
<tr>
<td>Aug. 13.</td>
<td>Initial weight...</td>
<td>16.78</td>
<td>1112.2</td>
</tr>
<tr>
<td>Aug. 28.</td>
<td></td>
<td>22.09</td>
<td>1472.6</td>
</tr>
<tr>
<td>Sept. 4.</td>
<td></td>
<td>23.81</td>
<td>1578.6</td>
</tr>
<tr>
<td>Sept. 11.</td>
<td></td>
<td>24.68</td>
<td>1645.0</td>
</tr>
<tr>
<td>Sept. 18.</td>
<td></td>
<td>25.72</td>
<td>1714.6</td>
</tr>
<tr>
<td>Sept. 25.</td>
<td></td>
<td>27.12</td>
<td>1808.3</td>
</tr>
</tbody>
</table>

From this table it appears that:

1. Both pituitary body (anterior lobe) substance and corpus luteum substance retarded the growth of the birds in this experiment. Throughout the experiment all of the birds were in a perfectly healthy and active condition. It was impossible to detect any differences in these respects between the three lots. There appears to be no means of accounting for the growth differences observed except as a result of the organ substances fed.

2. The retardation of growth in the case of the birds fed corpus luteum substance (lot B) is greater than that in the lot fed pituitary substance (lot A). The differences are very small and not separately significant until the September 11 and later weighings, from which time they are relatively large.

3. After 43 days of organ substance feeding of birds starting at the same body weight those birds fed pituitary substance average 4.01% less in body weight, and those fed corpus luteum substance average 9.31% less in body weight, than normal controls.
A parallel experiment to that reported above has been run with male birds, and gave essentially the same results. Since the numbers used were too small to give reliable figures, they are not published. Leaving now the matter of growth in body weight we may turn to a consideration of the attainment of sexual maturity in these three lots of birds. There was practically no difference between the three lots of birds in respect to time of beginning laying. The small differences exhibited cannot be regarded as significant, considering the nature of the character.

Several interesting points are brought out by this experiment. In the first place the results with pituitary body substance confirm all of our earlier work with this substance so far as concerns activation of the ovary. There is no evidence that the administration of pituitary substance hastened in any way the initial activation of the pullet ovary. The pituitary birds did not in fact begin to lay as soon as those receiving corpus luteum substance, though the two day difference between the lots cannot be regarded as significant. We have now tested the effect of pituitary (anterior lobe) substance on the ovary in three different physiological states, viz., (a) completely resting adult ovary during moult, (b) adult ovary in laying condition but with declining fecundity rate, and (c) the inactive, immature ovary of the young pullet. In none of these physiological states has there been the slightest evidence that the pituitary has activated or accelerated the activity of the ovary in any manner or degree.

In the second place it appears that both pituitary (anterior lobe) substance and corpus luteum substance retard growth in the chick, but without affecting the attainment of sexual maturity (egg laying). The pullets in lots A and B began to lay at the same time they would have had they not received organ substance, but their body weight at the onset of laying was from 4 to 9% smaller than it would normally have been. These results are of interest in connection with the experiments of Gudernatsch in feeding thyroid and thymus substance to growing tadpoles, though there is no evidence in the present experiments of differentiation being accelerated. It merely is not retarded, while body growth is retarded by pituitary and corpus luteum substance. It will be a matter of much interest to extend the period of feeding these substances, particularly corpus luteum, into earlier life. I propose to do this next year. For students of growth a means is afforded in corpus luteum feeding of notably retarding body growth without disturbing, so far as yet appears, the normal physiology or physiological development.
The complete paper describing these results and discussing them further will shortly be published elsewhere.

1 Pearl and Surface, J. Biol. Chem., 19, 263–278 (1914); and Ibid., 21, 95–101 (1915).

A PRELIMINARY REPORT ON FURTHER EXPERIMENTS IN INHERITANCE AND DETERMINATION OF SEX

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In two former papers the interesting 'gynandromorphism' produced by crossing the European and the Japanese races of the gipsy-moth (Lymantria dispar) was described and an experimental analysis of the phenomenon was attempted. From the data obtained important conclusions on the sex-problem in general were drawn. Although the main points seemed to be clear, a series of questions still remained open. One of them was, that the (apparently) same kind of crosses did not give the same results, if the material used had a different origin. It could be regarded as practically certain that the chief result, viz., the appearance of gynandromorphism in certain crosses found its right explanation in the hypothesis of a quantitatively different behavior or a different potency of the male sex-factors in the different races. Some of the experiments led me to suspect that this potency varied with the geographical distribution of the moth. Therefore it was one of my aims during a sojourn in Japan, to study the behavior of different local forms in that country in various crosses inter se and with different European forms. These experiments are in no way to be regarded as completed, but the results so far obtained are so interesting and seem to bring the definitive solution of the problem so near, that a preliminary report on a part of them may be made.

A few words are first needed about the terminology. In previous papers I have used the term of gynandromorphism to indicate the sexual abnormalities produced in the racial crosses of these moths. It seems, however, no longer advisable to use this term, as it is applied more or less generally to quite a different phenomenon, i.e., to individuals showing a mosaic of the characters of both sexes. In such a gynandromorph—see for example Boveri's late analysis of the Eugster bees—a given organ or complex of cells is either male or female. But this