XVI. LINKAGE RELATIONS IN ANIMALS

Abstract

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Castle[1] has reported a group of three linked characters in rats, albinism (c), red-eye (r), and pink-eye (p); albinism (c),

[1]Castle, W. E., Genetics and Eugenics, 3d ed. 1923, Harvard University Press.

and pink-eye (p) in mice; English coat pattern and Angora coat in rabbits; also Dutch coat pattern and Angora coat in rabbits. In poultry barring (B), silver (S), and an inhibitor of pigmentation (I) were suggested to be linked by Goodale.[2] Haldane[3] found linkage between barring and silver in crosses of the Barred Rock and Brown Leghorn. The barred plumage pattern in poultry has been repeatedly demonstrated as a sex-linked character also. Shank color in poultry is another example of sex-linked inheritance. An unusual case of sex-linked inheritance has been reported in a species of fresh water fish (Apolcheilus lactipes Temmick and Schlegel) by Aida[4]. The gene for color was found to be sex-linked. Aida concluded from his results that the 'y' chromosome of the male was carrying a dominant gene; and that crossing-over between the 'X' and 'Y' chromosomes occurred.

Darlow[5], suggests linkage or correlation between folds of the skin and fineness of fleece in sheep. If this can be clearly proven it will probably aid the wool producer in his problems of selection.

A greater number of linked characters have been found in Drosophila than in any other speices. Four groups of linked characters have been found corresponding to the four homologous pairs of chromosomes. I have recently made crosses with Drosophila (melanagaster) involving three characters, namely; eye-color, body-color, and wing-character. All three are sex-linked. Crosses were made between a female with white eyes, gray body and minature wings and a male with red-eyes, yellow-body and long wings.

The percentage crossing-over between eye-color and body-color (w and y) in this cross was 1.39 per cent. In the reciprocal cross, red yellow long female (W Wy y M M) and white gray minature male (w Y m —), the crossing-over between eye-color and body-color (w and y) was 2.4 per cent. Crossing-over between eye-color and wing-character (w and m) was 34.5 per cent. The difference between the cross-over values for eye-

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[2]Goodale, H. D., Crossing-over in the Sex-chromosome of the Male Fowl. Science 46:213. 1917.

[3]Haldane, J. B. S., Linkage in Poultry. Science, 54:663.

[4]Aida, Tatuo, The Inheritance of Color in a Fresh Water Fish. Genetics, 6:554-573, 1921.

[5]Darlow, A. E., Inheritance of characters in sheep. Unpublished data (to be published by Oklahoma A. & M. College, Exp. Sta.).

color and body-color (w and y) is probably due to small numbers. The cross-over values found in my experiments exceed the values obtained by Dr. Morgan and his students. This is undoubtedly due to the fact that my experiments did not include a large number of individuals. A total of 719 individuals were observed in the first cross and 683 in the second.

It is highly probable that linkage exists between various characters in our domestic animals. However, inheritance studies with the larger domestic animals have thrown but very little light on linkage relations. In livestock great improvement of types and function has resulted from selection. Considerable emphasis has been given to points of fancy in selection. There is perhaps an opportunity for scientific study in the hope of determining the correlation that may exist between points of fancy and function. In some cases it is possible that a negative relation may exist between some of these while in others it may be positive. If the inheritance of characteristics such as fleshing tendencies, milk production, egg production, and disease resistance should be found to show linkage with external characteristics it is apparent that a knowledge of this would greatly enhance selection in further improvement of our breeds on farm animals.