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On individual differences of the blood of chickens and ducks.

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It was originally demonstrated[1] in the case of human blood that there exist differences between members of the same species detectable by the isohemagglutinin reaction. Similar results have been found in several species of animals, *e. g.*, cattle, horses, sheep, dogs. With the blood of other animals, however, clear-cut reactions have not been obtained, although biochemical individual differences must for other reasons be assumed to exist. Adequate study of the question of isoagglutination has been hampered to a certain degree by the failure to obtain satisfactory results in common laboratory animals such as rabbits, rats, and mice.[2] It was our purpose to find suitable laboratory animals for further investigation, especially for breeding experiments (cf. von Dungern and Hirschfeld, Epstein and Ottenberg, and others) and for the study of racial differences.

Our observations were made on chickens and ducks. In most of the studies hitherto reported, isoagglutination (or heteroagglutination) by normal sera and isolysin reactions by immune sera have been employed. In our experiments we made use of immune sera obtained from a distant species. This method, which offers some advantages, can be used if by previous treatment with cells of individual bloods those agglutinins are removed which act indiscriminately upon all bloods of the species.[3]

Hadda and Rosenthal[4] make brief mention of finding isolysins in chicken blood without presenting detailed information. Bailey[5] failed to detect isoagglutinins in chickens.

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[1] *Cent. f. Bakt.*, 1900, xxvii, 357. *Wien. klin. Woch.*, 1901, p. 1132. The experiments of Ehrlich and Morgenroth on goats.

[2] See Snyder, L. H., *J. Immun.*, 1924, ix, 45.

[3] Landsteiner, K., *Wien. klin. Rundschau*, 1902, xl. Hooker, S. B., and Anderson, L., *J. Immunol.*, 1921, vi, 419. Landsteiner, K., and van der Scheer, J., *J. Immunol.*, 1924, ix, 213, 221. Guthrie and Huck.

[4] Hadda, S., and Rosenthal, S., *Zeitschr. f. Immun.*, 1913, xvi, 536.

[5] Bailey, C. E., *Am. J. Hyg.*, 1923, iii, 370.

Our tests were made with anti-chicken and anti-duck sera obtained from rabbits injected with washed blood of Plymouth Rock chickens and domestic Mallard ducks, respectively. The following experiment is given as an example. The anti-chicken immune serum agglutinated chicken cells in a dilution of 1:1,200 (0.5 cc. diluted serum + 1 drop 5 percent washed blood cells). To each portion of 4 cc. of the serum, diluted 1:15, were added 2 cc. of washed blood sediment of each chicken to be tested.

TABLE I.
Reading after 2 hours at room temperature.

Absorbed sera	Blood cells.									
	1	2	3	4	5	6	7	8	9	10
1	0	0	±	0	+±	0	0	0	0	+
3	0	0	0	0	0	0	0	0	0	0
4	+	+	+±	0	+±	++	+±	+	+±	++
5	0	0	0	0	0	0	0	0	0	0
6	0	tr?	+	0	+	0	0	0	0	tr.
7	+	+±	++	0	+±	+±	0	0	±	++
8	±	+±	+±	0	+±	+	0	0	±	++
9	0	0	+	0	+	tr?	0	0	0	tr.
10	+	+±	++	+±	++	+	++	+	++	0

TABLE II.
Reading after night in ice-box and then one hour at room temperature.

Absorbed sera	Blood cells.									
	1	2	3	4	5	6	7	8	9	10
1	0	±	++	tr?	++	+	±	f. tr.	±	++
3	0	0	0	0	0	0	0	0	0	0
4	+±	++	+±	0	+±	++	+±	+	+±	++
5	tr.	tr.	0	0	0	0	0	0	0	0
6	tr.	+	+±	+	+±	0	+	±	+	+
7	+±	++	++	±	++	++	0	0	+±	++
8	+±	++	++	±	++	++	tr?	0	+±	++
9	+	+	+±	f. tr.	+±	+	f. tr.	0	0	+
10	++	++	++	++	++	++	++	++	++	0

Chickens
1 and 2. White Leghorn.
3, 4, and 5. Plymouth Rock
6. Brahma female.
7 and 8. Malay male and female.
9 and 10. Cochin male and female
} Purchased from poultry breeder as pure-bred chickens.

++ Large clumps seen macroscopically.
+ Small clumps seen macroscopically.
± Clumps seen microscopically.
tr. Trace.
f. tr. Faint trace.

These quantities proved adequate to remove all agglutinins acting on the blood used for absorption. After standing for one hour at room temperature, and over night in the ice-box, the separated liquid was tested for agglutinins against the various blood samples (0.3 cc. of the fluid + 1 drop 5 percent blood suspension).

The tests show the existence of marked differences between the blood corpuscles of the various chickens. In no case did agglutination take place with that blood with which the absorption was made. The reactions display a great variety since, according to the first reading (Table I.), only four pairs of bloods reacted identically or nearly so; and only two pairs, each belonging to the same race (or family?) reacted identically according to the second reading (Table II.). This would correspond to eight different types among the ten specimens examined. The fact that the examination of additional chickens revealed more differences suggests the existence of a still greater multiplicity. These observations agree well with the views on biochemical individuality resulting from the work on grafting of skin and other tissues, both normal and neoplastic (cf. L. Loeb[6]) and recall the findings of Todd and White[7] on isolysins in cattle.

In conformity with the results of von Dungern and Hirschfeld, L. and H. Hirszfeld, and their co-workers, the reactions are not dependent on the race of the animal in such a way that a certain race is associated with a certain serological type. It is quite possible, however, that certain types of chicken blood or certain of the factors underlying the reactions show an unequal racial distribution, as pointed out by the workers just mentioned.

Isoagglutinin tests with chicken blood gave positive reactions of moderate intensity in some instances.

Tests on a small number of duck bloods yielded results similar to those on chickens.

Some tests made on white, hooded, and wild rats with heteroagglutinins seem to indicate differences similar to those found in chickens, especially when different varieties were compared, but the results require confirmation.

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[6] Loeb, L., *The Amer. Naturalist*, 1920, liv, 45, 55.

[7] Todd and White, *J. Hygiene*, 1910, x, 185.