A Comparative Study of the Hemoglobin and Red Blood Cells of Representative Diving and Dabbling Ducks[1]

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During the course of an investigation of the adaptations of certain aquatic birds for underwater progression, the blood of a considerable number of diving and dabbling ducks was analyzed, and an attempt was made to ascertain whether or not the characteristic swimming and feeding habits of these two groups of birds may be correlated with their hemoglobin concentration and red blood cell counts.

The 27 diving ducks (Redhead and Greater Scaup) used in this study were trapped on Cayuga Lake between February 20 and March 4, 1946, and the 18 dabbling ducks (Black, Mallard, and Black × Mallard hybrids), between March 5 and 21, 1948. In all cases examinations of the blood were made within 48 hrs after trapping.

Each blood sample of approximately 0.2 cc was drawn into an oxalated pipette from the large basilic vein on the ventral surface of the elbow. The sample was then placed in a vial containing a small amount of powdered heparin. The pipettes for the Hb and RBC determinations were filled from this vial at leisure without danger of clotting. Because of the rapidity with which avian blood coagulates, this method of taking a blood sample was found to be more satisfactory than the usual procedure of cutting a wing vein and drawing up into the counting pipettes the free-flowing blood.

Hemoglobin concentrations were measured as acid hematin with a Fisher Electro-Hemometer.[2] The red blood cell counts were made in duplicate with a Spencer Bright-Line Haemacytometer, and an error of 5% was allowed between counts. Color indices served as a check on the probable accuracy of these determinations and were calculated according to the formula:

$$\frac{\text{gm Hb/100 cc individual sample}}{\text{gm Hb/100 cc mean value for species}}$$

divided by

$$\frac{\text{individual RBC count}}{\text{mean RBC count for species}} \quad (2).$$

Statistical significances were derived by the methods of Snedecor (*3*).

Repeated Hb and RBC determinations, at intervals of 1–3 weeks, were made on the blood of 5 Mallard ducks over a 60-day period. These data, together with the total body-weight changes, are plotted in Fig. 1. During this period the birds were well fed and housed in an outdoor cage, and a careful record of their weight was kept. With one exception, no appreciable loss of weight occurred during this time, and the birds remained in good health.

TABLE 1

HEMOGLOBIN CONCENTRATIONS AND RED BLOOD CELL COUNTS IN DIVING AND DABBLING DUCKS

Species	No. examined	Mean Hb* (gm/100 cc)	Range	Mean RBC† (millions/mm³)	Range	Color index range
Redhead	10♂, 1♀	18.2±0.5	16.2–20.5	3.36±0.07	3.00–3.69	0.87–1.14
Greater Scaup	9♂, 7♀	17.8±0.6	13.0–20.2	3.08±0.10	2.42–3.74	0.78–1.14
Combined diving ducks	19♂, 8♀	18.0±0.4	13.0–20.5	3.21±0.07	2.42–3.74	0.80–1.18
Mallard	8♂, 5♀	18.0±0.6	13.1–23.5	3.59±0.12	2.90–4.60	0.90–1.12
Black	1♂ (?)	17.9	....	3.56	....	....
Hybrid (Black × Mallard)	3♂, 1♀	18.1±0.6	16.4–19.5	3.57±0.14	3.21–3.90	0.99–1.01
Combined dabbling ducks	12♂, 6♀	18.0±0.5	13.1–23.5	3.58±0.10	2.90–4.60	0.90–1.11

* Values of P are all greater than .5 for comparison of Hb between species.

† Values of P for comparison of RBC counts between species are as follows: Mallard-Greater Scaup—P less than .01; Mallard-Redhead—P between .1 and .2; Greater Scaup-Redhead—P between .05 and .02.

The analyses revealed no significant differences in hemoglobin concentration, either between species within a group or between the two groups (diving and dabbling ducks) investigated. Differences in red blood cell counts of the species studied were as follows: (a) Greater Scaup had fewer RBC than Mallard (difference significant); (b) Greater Scaup had fewer RBC than Redhead (difference probably significant); (c) Redhead had fewer RBC than Mallard (difference not significant).

Color indices for the species studied, with one or two possible exceptions, all fell within the range considered normal for human blood (*1*).

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[2] In a few birds Hb concentrations were also measured by the oxyhemoglobin method, using a Sheard-Sanford photoelectrometer, and the values agreed closely with those measured as acid hematin.

Repeated Hb and RBC determinations on the blood of 5 Mallard ducks, which at first sampling exhibited a considerable range, revealed that those ducks having Hb and RBC values at the extreme ends of the range tended to approach, over a 60-day period, the mean for the group (see Fig. 1).

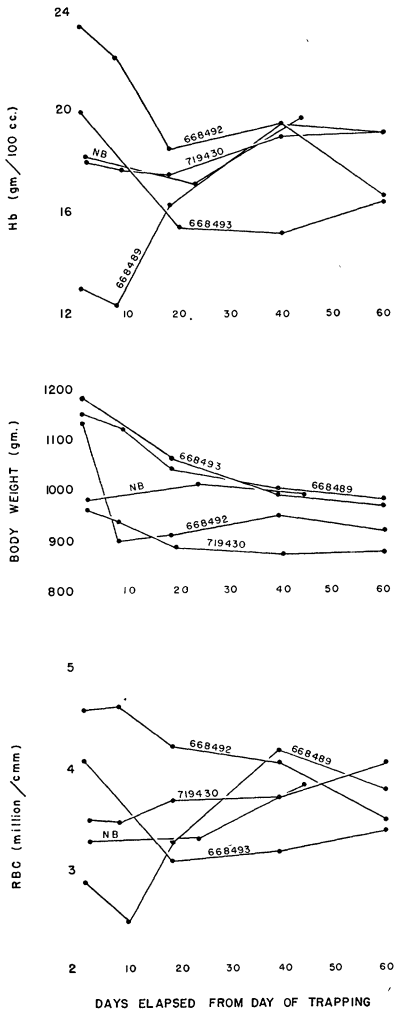

FIG. 1. Changes in Hb, body weight, and RBC count, in 5 Mallard ducks over a 60-day period.

It would therefore appear that, while no significant differences exist in the Hb of the ducks studied, considerable variation, even within a group, obtains in the RBC count. Thus, the Greater Scaup has about the same Hb concentration as the Mallard, yet possesses significantly fewer red blood cells. On the other hand, the Redhead not only possesses a Hb concentration similar to that of the Mallard, but its RBC count corresponds closely also to that of the dabbling ducks.

The writers started with the initial premise that an increased oxygen-carrying capacity of the blood would be of adaptive value to the diving ducks, which characteristically swim long distances under water, and that this increased oxygen capacity might be reflected in a higher Hb concentration and RBC count. Our findings reveal, however, that neither the Hb concentration nor the RBC count can be correlated with the locomotor habits of these two groups of birds.

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Liver Damage by Desoxycorticosterone[1]

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In work on experimental production of gall-bladder disease we found that all dogs treated with desoxycorticosterone acetate[3] showed pathological changes in the liver.

Seven normal mongrel dogs (4 males and 3 females) of an average weight of 10–12 kg each received a daily intramuscular injection of desoxycorticosterone acetate, 5 mg in oil, for 5 days. After a 5-day interval, 25 mg of the drug in oil was given intramuscularly to each dog. Seven to 10 days later the animals were sacrificed and autopsied immediately. Six of the dogs had 1% salt water to drink, and one had tap water.

There were 9 control dogs. Five were untreated, and the other four (2 males and 2 females) were given the peanut oil solvent of the desoxycorticosterone intramuscularly, in the same schedule and quantity as the 7 dogs receiving the desoxycorticosterone in oil. These 4 dogs also received 1% saline to drink. Seven to 10 days after the last injection of peanut oil these dogs were sacrificed and autopsied immediately. The 9 control dogs (untreated or injected with peanut oil) appeared healthy and normal. At autopsy, all organs were normal grossly, and the animals appeared to be in good nutritional condition. The histologic examination of the organs of all animals reported in this paper was performed by our pathologist, Dr. O. Saphir. The organs of the untreated control dogs, including the liver, were found to be histologically normal. In the control animals injected with peanut oil and with only salt water to drink the organs

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