

nated from a certain district in Bohemia, and following this action there occurred such a severe epidemic among the hares of this area that it was necessary to reintroduce foxes.

It is my personal conviction that if our hawks and owls now existed in something like their former numbers, bird malaria would be far less prevalent among the quail of California, and that the very existence of the eastern ruffed grouse would not now be threatened by a complex of diseases.

This being the case—that the sanitary brigade as represented by our predators is a very vital factor in the numerous representation of our game bird species—ornithologists should certainly be the last to condemn unqualifiedly the killing of an occasional individual, but rather presume that in the majority of instances every two out of three birds captured were on the sick list. The third may be cheerfully ceded, by sportsman as well as conservationist, as payment for the good office performed in removing a threatened source of infection, even without taking into account the injurious rodents that have been eaten between times. Naturally, however, when goshawks or other habitual game-getters invade territory in which birds are being raised or conserved in large numbers, that is a horse of another color.

And to those who may be reluctant to concede that more sick than healthy birds are usually captured by the hawks that frequently favor such fare, I would say that I, as an American citizen, am entitled to my just share of ducks, grouse and quail—perhaps not to the tune of fifteen per day during the open season, but to my fair proportionate share. During the last ten years I do not recall to have killed a duck or a quail, and only half a dozen grouse for specimens. This uncollected increment, together with the proportion to which I shall be entitled in the future, I hereby bequeath to the bald eagle, the duck hawk, the prairie falcon and their kith and kin, in partial payment for the service that our fine raptors have rendered us economically and aesthetically.—A. BRAZIER HOWELL, *Department of Anatomy, Johns Hopkins Medical School, Baltimore, Maryland, February 5, 1930.*

**Some Observations on Erythrocyte Count in Birds.**—Some years ago while engaged on a study of the body temperatures of nestling altricial birds, the results of which are awaiting publication, I was struck with the evidences of a high metabolic rate in birds, such as the high temperature, fast respiration, and rapid cardiac rate. Such metabolic activity necessitates the supplying to the tissues of large quantities of oxygen. The red blood cells bearing hemoglobin are the only specific tissues differentiated for this purpose and it therefore became of interest to study briefly the number of cells and the hemoglobin content of the blood in birds.

The counting of blood cells has become a standardized procedure, simple in preparation and fairly accurate in skilled hands. It consists of drawing a column of blood into an accurately gauged pipette and diluting with normal salt solution to a 1-200 dilution. A drop of this dilution is expelled onto a hemacytometer ruled to measure exactly one millimeter square and 1/10 mm. deep, or in other words the contents measure 1/10 cubic millimeter in quantity. By means of further rulings within the chamber mathematical fractions of this quantity are obtained and the cells in this portion counted. The estimation of the number of cells per cubic millimeter of blood consists therefore of multiplying the number of cells counted by the necessary factors and the dilution. The estimation of hemoglobin content is done by means of comparison with a color scale.

On various field trips Mr. R. C. McGregor and I combined forces and armed with microscope, guns, and collecting equipment sallied into the jungle surrounded by a most omnipresent and noisy group of native children. Killed birds were retrieved immediately, the chest and heart opened and the blood pipetted out. The results were exactly nothing, since it was found that the clotting time of blood which in man averages three minutes, in birds is almost immediate. Fluid blood could not be withdrawn even from the chambers of the heart. Eventually it was found that blood could be used only from living birds and even this clotted in the pipette while the diluent was being added.

To correct this troublesome tendency of the blood to agglutinate and to clot, one percent of potassium citrate was added to the diluting fluid and this served as an anti-coagulant. The interior of the pipettes had to be moistened to prevent the formation of small clots in the bore.

Blood can be secured quite readily from the brachial vein at the bend of the elbow of the wing. The vein comes to the surface here, being covered only by a thin integument and lying alongside the tendon of the biceps. A fine needle thrust into the vein will produce a drop of blood which must be drawn into the pipette and diluted with great rapidity. The counting preferably should be done at once. No injury is sustained by the bird in this procedure and the pain is negligible or absent. It can be utilized in the case of trapped birds without fear of harm.

Since killed birds were of no use in this work and bird trapping was impossible it was necessary to secure market and caged birds. For this purpose permission was secured from the Director of the small Zoological Garden in Manila to get blood from the caged birds there. McGregor and I usually went together taking "Andy", the old and faithful taxidermist at the Bureau of Science, as interpreter. I have a keen recollection of the time that Andy had with a large Sea Eagle (*Cuncuma*) on its back which promptly sank its talons into my ankle and its beak into Andy's hand while a good portion of the native population of Manila crowded around the cage to watch Andy, the eagle and myself battle it out with considerable casualty on all sides.

The results of this brief investigation were so nearly uniform as to warrant the conclusion that the erythrocyte count in birds is approximately two and one-half million red cells per cubic millimeter of blood. This is about one-half the number found in man. On the other hand the hemoglobin readings were about 90 percent or equal to that of man. In other words the cells while fewer in number than in man are larger and carry more hemoglobin per cell. This was not the result expected. Evidently the needs for abundant oxygen are met by an increased speed in the circulation of the blood rather than by increasing the number of oxygen carrying elements in the blood.

The birds studied in this connection were as follows:

Platalea minor, Lesser Spoonbill, averaging	3,600,000 per cu. mm.
Platalea minor, two weeks later	1,800,000; this bird was ill and died shortly thereafter.
Nycticorax nycticorax, Night Heron	2,400,000 per cu. mm.
Ardetta cinnamomea, Cinnamon Bittern	2,800,000 per cu. mm.
Sula leucogastra, Brown Booby	2,200,000 per cu. mm.
*Cathartes aura septentrionalis	2,600,000 per cu. mm.
*Bubo virginianus (pallascens?)	2,500,000 per cu. mm.
Cuncuma leucogaster, White-breasted Sea Eagle	2,600,000 per cu. mm.
Haliastur intermedius, Malayan Brahminy Kite	2,500,000 per cu. mm.
Passer montanus, Mountain Sparrow	2,500,000 per cu. mm.

\*Studied in the United States.

—LEON L. GARDNER, *Camp John Hay, Mountain Province, P. I., November 20, 1929.*

**Odd Bill Formation in a California Horned Lark.**—A boy in my neighborhood brought to me on February 8, 1930, a California Horned Lark (*Otocoris alpestris actia*) which interested me immediately because of the strange shape of the bill, the upper mandible curving to such an extent as to suggest the hooked bill of a raptor. The length of the upper mandible in this specimen, which I have preserved as a skin, is 13.5 mm., and it extends in a curve downward 4 mm. beyond the tip of the lower mandible, which latter appears to be normal. (See fig. 57.) Both mandibles are stout and smooth with no irregularities except for shape. A possible explanation is a fracture of the upper mandible at some time in the bird's life, possibly as a nestling, resulting in this extension beyond the normal length.

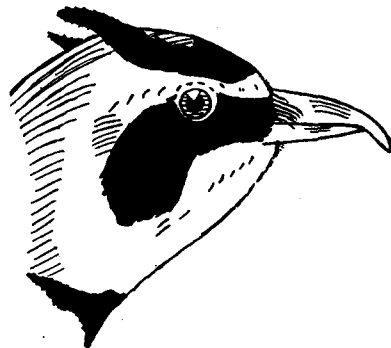


Fig. 57. HEAD OF CALIFORNIA HORNED LARK SHOWING ABNORMAL GROWTH OF ITS UPPER MANDIBLE.

It occurred to me before skinning it that the bird, which was a male, must have had difficulty in securing food. Skinning, however, showed the bird to be well developed, even having traces of fat. The stomach contents consisted entirely of fragments of small black beetles.—EMERSON A. STONER, *Benicia, California, February 12, 1930.*