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HISTOLOGICAL STUDY OF THE DIGESTIVE SYSTEM OF THE ENGLISH SPARROW

BY L. J. GIER AND OTTIS GROUNDS

Plate 9

THE available literature shows that little histological work has been done on the digestive systems of birds. The most extensive single piece of literature is that of Calhoun (Calhoun, M. Lois. The microscopic anatomy of the digestive tract of *Gallus domesticus*. Iowa St. Col. Jour. Sci., 7: 261–382, 1933). This paper gives a good review of the previous work.

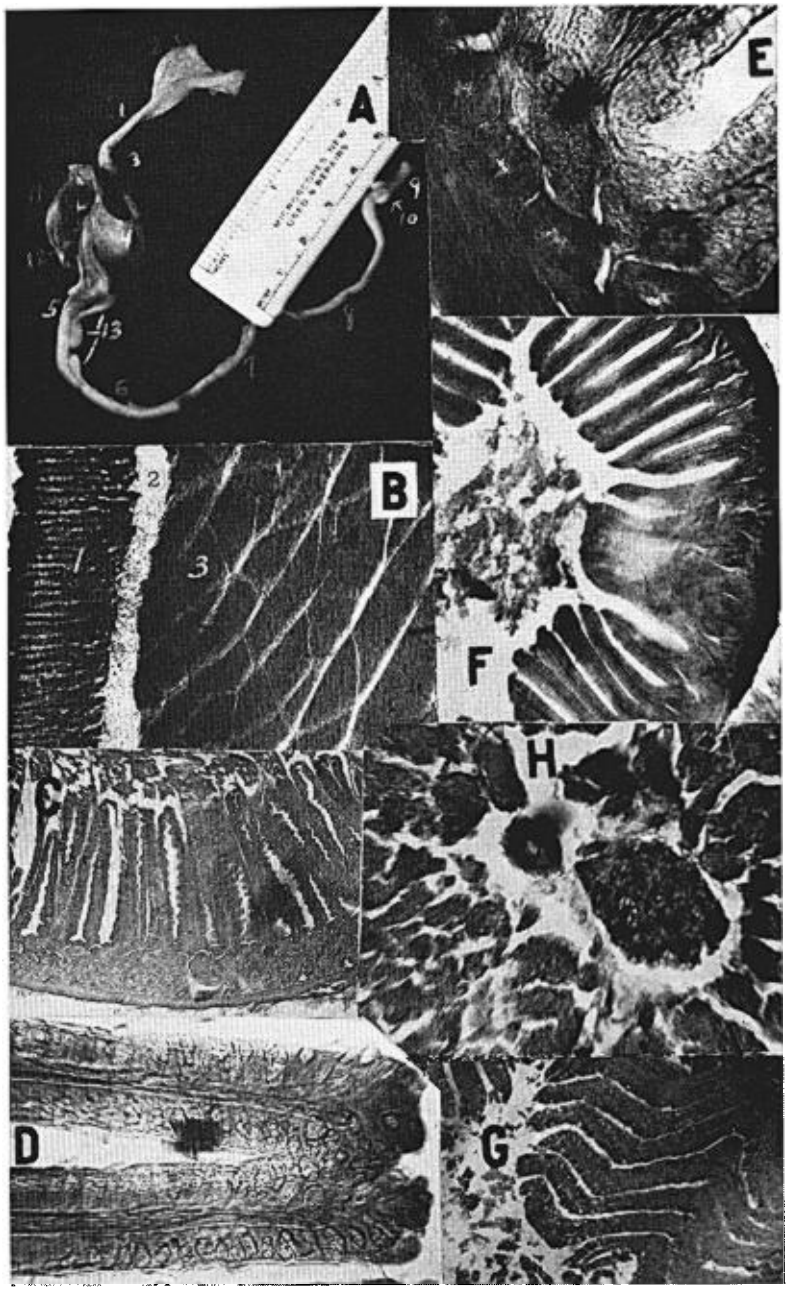
In the study described below, digestive tracts of ten English Spar-

rows (*Passer domesticus domesticus*) were examined. Representative areas of the ventriculus, five regions of the intestines (Plate 9, fig. A, 5–9), liver, and pancreas were sectioned in paraffin and stained with Delafield's hematoxylin and eosin. Photomicrographs were made on Plus X 35 mm. film using exposures of one and sixteen seconds for low and high power, respectively, and with a lens aperture of f. 4.5.

There were no observed sex differences in the tissues studied. The gross anatomy of a typical system is shown in fig. A. The esophagus (1) has a single outpouching to form the crop (2). The proventriculus (3) is covered with a serous layer and lined with glandular tissue. The ventriculus (4) is a laterally flattened disc composed of heavy muscles. It is lined with a horny layer and contains a quantity of fine gravel. The plagiocoelous intestines (5–9) gradually decrease in diameter from the duodenum to the rectal region. The two bile ducts and three pancreatic ducts enter the duodenum. No remains of the attachment of the stalk of the yolk sac were found. There is no marked difference between the duodenum, jejunum, and ileum. At the juncture of the small intestine and the rectum (9), the paired elliptical caeca (10) may be found. The two-lobed liver (11) lies mostly on the right side of the ventriculus. The gall bladder (12) is on the dorsal side of the right lobe. The long ribbon-like pancreas (13) is in the curve of the duodenum.

The tunica propria of the ventriculus is simple cuboidal epithelium forming crypts (fig. B, 1). These rest on a submucosa of connective tissue. The mucosa (3) is formed of a thick layer of muscles. The structure of the small intestine, with the exception of the duodenum, is similar throughout. The inner layer is lined with simple columnar epithelium with many large goblet cells. These latter increase in number posteriorly (fig. C and D) and are probably mucus-secreting cells. The submucosa of the duodenum is composed of three layers of Glands of Lieberkühn while but a single layer may be found in the rectal region (fig. E). These glands are much more numerous than Calhoun found for the domestic fowl. The mucosa varies but slightly in the five regions studied. The villi are longest in the duodenum and are successively shorter in the other regions studied. Only a few "leaf-like" villi were found. In the rectal region, the villi were frequently grouped as shown in fig. F. These villi also clearly show the presence of lacteals and blood vessels (figs. D and E). The villi in about half of the sections from the posterior end of the jejunum-ileum show definite irregularity (fig. G).

In general, the liver and pancreas show no variations from those



HISTOLOGY OF THE ENGLISH SPARROW

of the domestic fowl, except that the Islets of Langerhans (in the pancreas) are separated from the remainder of the pancreas by connective tissue (fig. H).

EXPLANATION OF PLATE 9

Figure A Typical digestive system of English Sparrow (intestines have been loosened from mesenteries)

1 Oesophagus
2 Crop
3 Proventriculus
4 Ventriculus
5 Duodenum
6–8 Jejunum and ileum
9 Rectum
10 Caeca
11 Liver
12 Gall bladder
13 Pancreas

B Section of ventriculus 110 ×
1 Tunica propria
2 Submucosa
3 Muscles of mucosa

C Section of duodenum 110 ×
1 Villi showing goblet cells
2 Submucosa with Glands of Lieberkühn

D Villi of rectum showing goblet cells, lacteals, and blood vessels 440 ×
E Submucosa of rectum with Glands of Lieberkühn 440 ×
F Section of rectum showing grouping of villi 110 ×
G Irregular villa 110 ×
H Section of pancreas with blood vessel and Islet of Langerhans 440 ×

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THE BROKEN-WING BEHAVIOR OF THE KILLDEER

BY C. DOUGLAS DEANE

Plates 10, 11

THE most interesting behavior of the Killdeer (*Oxyechus vociferus*) is its polished performance of the broken-wing action—a device useful to many ground-nesting birds in luring enemies from the nesting area.

The display of the broken-wing trick is, in the opinion of many observers, a reflex action that automatically functions when an enemy enters the breeding territory. It is not dependent upon the presence or absence of eggs or young. In the case of the Killdeer, I cannot help thinking that it is too polished a performance to be merely a reflex action. There must be a considerable amount of training and intelligence combined in this trick, as the bird has evolved procedures that