

## GROSS ANATOMY

Prehensile and masticatory organs are limited to an upper and lower beak. (Pl. I-1).

The chicken possesses a hard palate which is separated from the pharynx by a row of papillae. (Pl. II-5). The nares (Pl. II-4) open through a longitudinal slit into the middle of the hard palate and the dorsal mid-portion of the pharynx.

The tongue (Pl. II-12) is attached to the caudal part of the floor of the mouth and conforms to the shape of the beak. On its posterior part is a row of papillae. (Pl. II-13). The tongue muscles include lingual and hyoid muscles [Owen (1866) and Shufeldt (1890)].

The pharynx (Pl. II-6) is a poorly defined area in the back of the mouth into which open the Eustachian tubes (Pl. II-8), esophagus (Pl. II-11), larynx, mouth, and the nasal openings as described above. The aditus laryngis (Pl. II-16) presents no epiglottis.

The esophagus (Pl. I-5) is a long dilatable tube leading from the pharynx to the proventriculus with an outpouching, the crop (Pl. I-6), at the entrance into the thoracic cavity.

The proventriculus (Pl. I-7) appears as a dilatation of the esophagus at its posterior extremity but upon palpation is found to be thicker-walled and spongy. It opens after a narrow constriction at its posterior extremity into the muscular stomach, the gizzard or ventriculus.

The ventriculus (Pl. I-8) is oval, flattened laterally, and particularly prominent because of its musculature. This muscular mass is comprised of two pairs of muscles: the two thin muscoli intermedii (Pl. I-10), one of which arises near the proventriculus and the other at the posterior end, are between the thick muscoli laterales, (Pl. I-9) which are part of the wall of the lumen. Both pairs have their insertion on a tendinous aponeurosis (Pl. I-11) on the lateral side of the ventriculus.

The duodenum (Pl. I-12), the fore part of the small intestine, forms a loop in which the main part of the pancreas lies. Three pancreatic and two bile ducts enter at a point approximating the junction of the duodenum with the remainder of the small intestine.

The jejunum and ileum (Pl. I-16), between which there is no line of differentiation, are arranged in coils supported by the mesentery.

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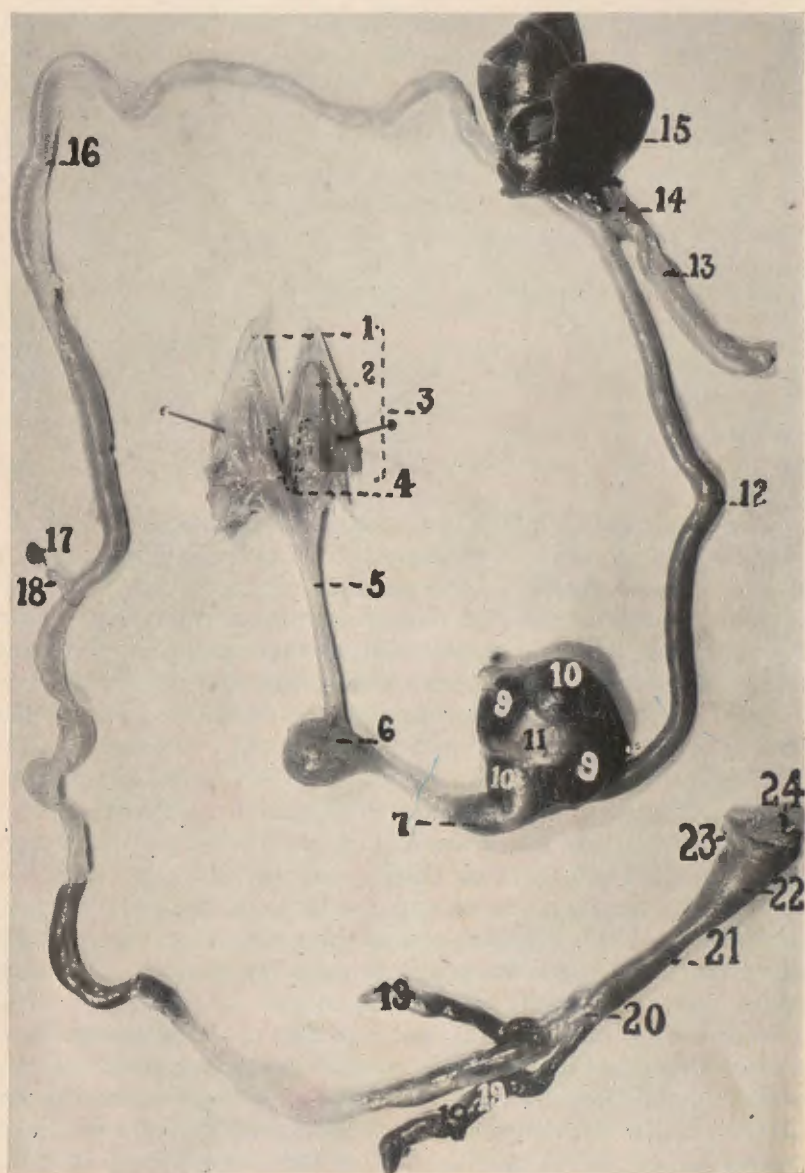
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At a point about midway in the small intestine may be found the attachment of the stalk of the yolk sac (Pl. I-17) or its remnant (Pl. I-18) depending on the age of the chicken.

There is no line of demarcation between the colon and rectum, the two usually being considered as one, the rectum (Pl. I-21).

At the junction of the small intestine and rectum (Pl. I-20) the paired caecae (Pl. I-19) are given off anteriorly. Each terminates as a blind sac which is larger than the constricted part near its origin.

The rectum terminates in the anterior portion of the cloaca. There is no line of demarcation except a gradual widening.

The cloaca (Pl. I-22) is divided into three parts: the coprodaeum into which the rectum empties; the middle part, the urodaeum, into which the ureters and genital ducts enter; and the external part, proctodaeum, from which the bursa cloacae (Pl. I-23) extends antero-dorsally.

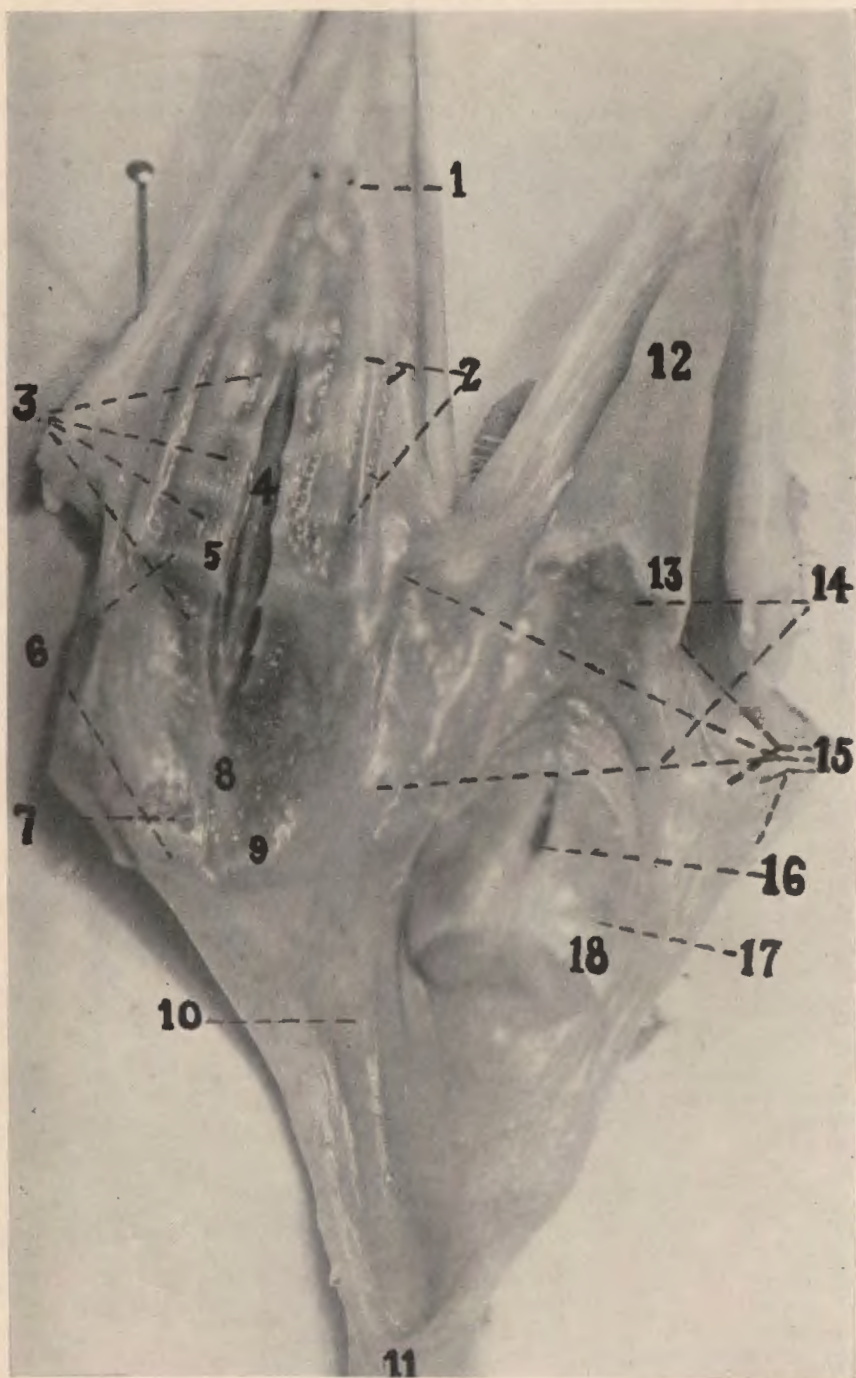
The anus (Pl. I-24) is comprised of a prominent dorsal and a ventral lip which meet at each side forming a lateral commissure. If these lips are extended dorsoventrally, the anal opening will be seen as a vertical slit.

The liver (Pl. I-15) is a two-lobed organ lying posterior to the rudimentary diaphragm. Its posterior edges are quite noticeably notched. The gall bladder (Pl. I-14) is located on its visceral surface, and from it the ductus cysticus carries the bile to the duodenum, while a second duct, the ductus hepaticus, comes directly from the left lobe and empties into the duodenum in close proximity to the first.

As mentioned the main part of the pancreas (Pl. III-10, 11)

Plate 1 — Entire digestive tract of a baby chick. The duodenum was separated from the pancreas and the loop opened. The pancreas and liver were joined to the intestine by the ducts.

- |  |   |
|--|---|
| 1. Beak  | 13. Pancreas                              |
| 2. Tongue  | 14. Gall bladder                          |
| 3. Mouth   | 15. Liver                                 |
| 4. Pharynx   | 16. Jejunum and ileum                     |
| 5. Esophagus   | 17. Yolk sac                              |
| 6. Crop  | 18. Yolk stalk                            |
| 7. Proventriculus  | 19. Caeca                                 |
| 9. Mm. laterales   | 20. Junction of caeca and small intestine |
| 10. Mm. intermedii                                       | 21. Rectum                                |
| 11. Tendinous aponeurosis of the ventriculus, or gizzard | 22. Cloaca                                |
| 12. Duodenum   | 23. Bursa cloacae                         |
|  | 24. Anus                                  |



is located in the loop of the duodenum. The pancreas is composed of three lobes, the dorsal and ventral lobes located as described and a third much smaller lobe extending dorsally to the spleen. (Pl. III-12).

Measurements of the digestive tract of five chickens were made and are included in Table 1, to show the relative lengths. By comparing the figures one may get an idea of the rate of growth.

TABLE 1  
GROWTH CHANGES IN THE DIGESTIVE TRACT

Measurements	36 hr. (M)	20 da.	5 mo. (F)	1.5 yr. (M)	2 yr. (F)
	(cm.)	(cm.)	(cm.)	(cm.)	(cm.)
Entire digestive tract.....	43	85	152	210	175
Angle of beak to crop.....	2.5	7.5	12.5	20	17.5
Angle of beak to proventriculus....	5	11.5	20	35	27.5
Duodenum (complete loop).....	6	12	20	20	25
Ileum and jejunum.....	24	49	85	120	92.5
Caeca.....	3.5	5	15	17.5	16
Rectum and cloaca.....	3	4	11.25	11.25	13.75

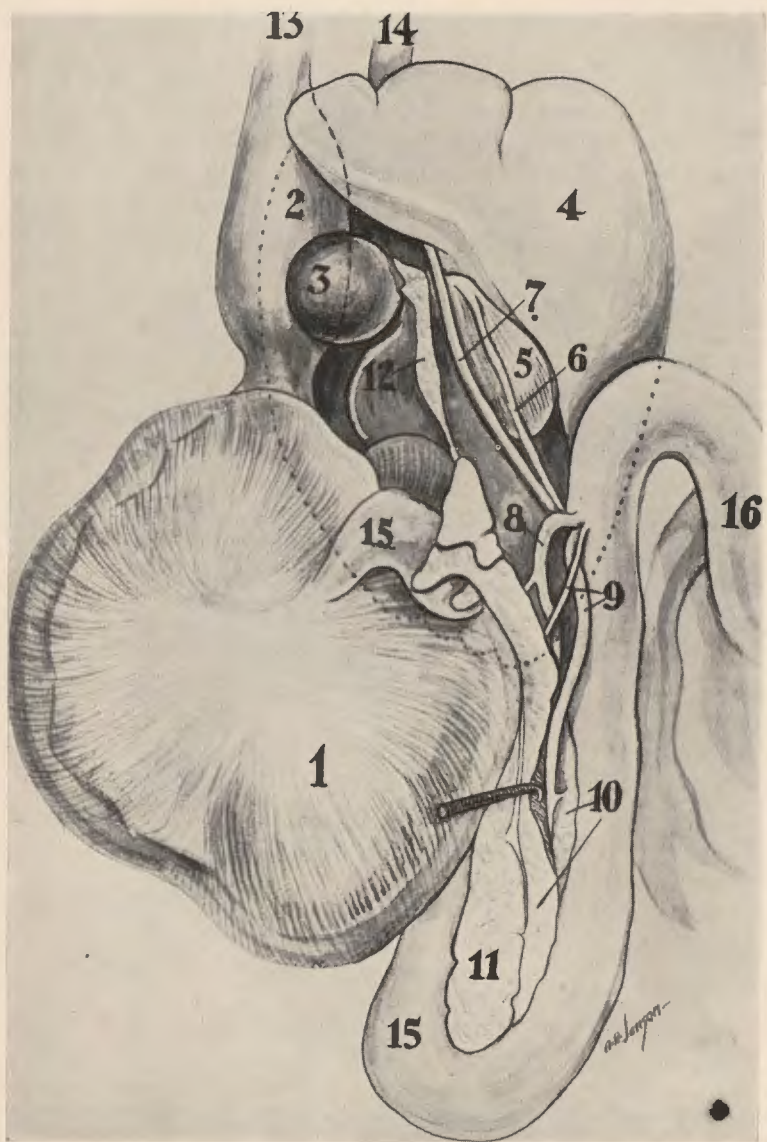
Marsden (1940) measured the intestines of 10 male and 10 female turkeys. The total length and the length of individual organs was longer in the male than in the female. The above data for the 1½-year-old male and the 2-year-old female followed the same pattern.

Orr (1931) took measurements and computed averages on the intestines of 35 birds. The birds ranged in weight from 1200 to 1800 gm., 85 per cent of which were within a 200 gm. range. His results follow: the duodenum (measurements including the entrance of the bile and pancreatic ducts), 25.3 cm.; the remainder of the small intestine, 104 cm.; entire small intestine, 132.5 cm.;

Plate II — Mouth parts of the chicken.

1. Opening of the maxillary gland
2. Openings of the lateral palatine gland
3. Openings of the medial palatine gland
4. Nasal opening
5. Papillae separating mouth from pharynx
6. Pharynx
7. Openings of the sphenopterygoid gland
8. Opening of the Eustachian tubes
9. Pharyngeal papillae
10. Aditus esophagus with mucous gland opening on its surface
11. Esophagus
12. Tongue
13. Lingual papillae
14. Openings of the posterior lingual gland
15. Openings from the three parts of the posterior submaxillary gland
16. Aditus laryngis
17. Openings of the cricoarytenoid gland
18. Laryngeal papillae





caeca, 14.4 cm.; and "colon" (measured from the entrance of the caeca to the point where the rectum began to widen), 6.36 cm.

Kersten (1912) made measurements on the intestine of 24 specimens ranging from 2 da. 3 hr. to 21 wk. 8 hr. (Table 2).

In a 3-week-old chick, Kersten found the length of the small intestine to be 72 cm., while the writer found it to be 61 cm. Likewise in a 5-month-old specimen, Kersten found the length of the small intestine to be 127.5 cm. and the writer found it 105 cm. The latter measurement by Kersten compares with Orr's figures (132.5 cm.) of the intestinal length. An average of the length of the two adult specimens of the intestine studied by the writer was 128.7 cm. Other figures are similar: the duodenal length of the adult according to Orr was 25.3 cm. and the writer found 22.5 cm.; the length of the small intestine without the duodenum was 106.5 cm. according to Orr, and 140 cm. according to the author's observation; the caecal length as Orr gave it was 14.4 cm. and the author found 16.5 cm. According to Kersten, the caecal length in a 5-month-old chicken was 16 cm. and the author found it to be 15 cm. In the 3-week-old specimen the figures for the caeca were similar, being 6.5 cm. as Kersten gave it and 5 cm. according to the author.

In the oldest specimen Kersten measured (21 weeks), the length of the "colon and rectum" was 9.5 cm. In the adult specimens, Orr found the "colon" to be 6.36 cm. in length.

Magnan (1911a) made the statement that the total surface of the body was 2.4 times the intestinal surface in granivorous birds (917 individuals, 12 species). In the same article M. Caullery criticized Magnan's work and said that the surface of the intestine from a physiological viewpoint should be its glandular surface and should take into consideration the villi and crypts.

Plate III — Photograph of a drawing to show the pancreas, the pancreatic ducts, and the bile ducts.

- |  |   |
|--|---|
| 1. Gizzard                                   | 9. Pancreatic ducts from the ventral pancreas |
| 2. Proventriculus                            | 10. Ventral lobe of the pancreas              |
| 3. Spleen                                    | 11. Dorsal lobe of the pancreas               |
| 4. Liver                                     | 12. Splenic lobe of the pancreas              |
| 5. Gall bladder                              | 13. Esophagus                                 |
| 6. Ductus cysticus                           | 14. Vena cava                                 |
| 7. Ductus hepaticus                          | 15. Duodenum                                  |
| 8. Pancreatic ducts from the dorsal pancreas | 16. Small intestine                           |



TABLE 2  
LENGTH OF THE INTESTINAL CANAL AFTER HATCHING

Week	Age		Length of Small Intestine up to Yolk Stalk	From Yolk Stalk to Opening of Caeca	Length of Colon and Rectum	Intestinal Length Without Caeca	Length of a Single Caecum	Relative Length of the Caeca
	Day	Hour						
1	2	3	26.5*	17.25	3.25	47.5	4.5	0.19
	4	22.5	34.0	18.5	3.5	56.0	4.5	0.16
		12	25.0	15.0	3.0	43.0	4.0	0.19
	4	13	42.0	24.5	3.5	70.0	5.5	0.16
2		7	.....	.....	3.0	.....	5.5	.....
2	3	16.5	27.0	18.0	3.0	58.0	4.5	0.15
3		4	43.0	29.0	4.0	76.0	6.5	0.17
3	3	15	37.0	25.0	3.5	65.5	4.0	0.12
4		4	41.5	24.0	3.5	69.0	6.5	0.19
4	3	15	54.0	37.0	4.0	95.0	4.75	0.10
5		2	31.0	21.0	3.5	55.5	5.5	0.20
5	4	13	40.0	23.0	4.0	67.0	5.0	0.15
6		7.5	43.0	20.5	4.5	68.0	5.5	0.16
6	3	13.5	49.0	29.5	4.5	83.0	6.0	0.14
7		21	52.0	59.5	5.5	117.0	11.5	0.20
7	4	16	52.5	30.75	4.25	87.5	7.0	0.16
8	3	5	65.0	49.5	5.5	120.0	12.0	0.20
9		6	70.0	54.0	6.0	130.0	10.5	0.16
10		10	60.0	36.5	4.5	101.0	9.5	0.19
11	1	7	55.0	45.5	5.0	105.0	6.5	0.12
12	2	6	57.0	35.75	5.25	98.0	9.0	0.18
13	3	3	71.5	56.0	5.5	133.0	11.5	0.17
15	5	8	75.0	43.75	6.25	125.0	14.0	0.22
21		8	77.0	50.5	9.5	107.0	16.0	0.23

\* All measurements in centimeters.