Viviparus bengalensis

1. The alimentary canal is divisible into a buccal mass, an oesophagus, a stomach, an intestine and a rectum. The salivary glands and the digestive gland are the appendages of the tract.

2. The mouth is a somewhat triangular opening, slightly ventral to the tip of the snout.

3. The labial palps are two short, fleshy, somewhat triangular projections.

4. The buccal mass is large, the anterior end of which narrows down suddenly and drawn forward slightly.
   a) The oesophagus emerges from the posterodorsal border of the buccal mass.
   b) The radular sac occupies a posteroventral position in the buccal mass.
   c) The radula is a long ribbon of uniform width.
   d) The supra and subradular epithelia are thick and made up of tall columnar, compactly arranged cells with distinct separating membranes.
   e) The number of teeth in a row is 1:1:1:1:1 and 116 such rows are present.
5. The oesophagus is attached to the concavity of the columellar muscle on its ventral surface with membranous connective tissue and dorsally with the epitaenia, a prominent wavy muscular fold.

6. The oesophagus is a narrow, thin walled cylindrical tube. The first 6 mm is slightly wider than the rest.
   a) The wall is bounded externally by an epithelium made up of flattened cells.
   b) The inner epithelium is thrown into a number of small folds being formed of tall, broad, columnar cells. The cytoplasm is highly granulated and the oval nucleus is restricted towards the base of the cell. Some mucous secreting cells are present.

7. The stomach is thin walled, elongateoval and gradually narrows down towards the ends.
   a) The openings of the oesophagus and the intestine in the stomach are terminal and opposite.
   b) The digestive duct opens on the ventral surface by a large elongateoval aperture at about one-fourth distance from the posterior end.
   c) The outer epithelium is made up of cells similar to those in the oesophagus but they are compactly arranged and in most cases separating cell membranes are not discernible.
d) The inner epithelium is of uniform thickness and made up of columnar cells, a part of which is thrown into a few prominent folds. The epithelium in the fold is nonciliated, but ciliated in the region devoid of folds. Mucocytes and gland cells are present.

8. The intestine is a narrow tube of uniform diameter.
   a) The wall is thin, similar to that of the stomach.
   b) The inner epithelium is thrown into numerous small and a few large folds being formed of nonciliated, tall columnar cells of varying height.

9. The intestinal glands are present.

10. The rectum is a more or less straight, thin walled tube, opening to the exterior by the anus. The anus is a round opening guarded by sphincter muscles.
   a) The inner epithelium is thrown into a number of small folds being formed of columnar cells, which bear cilia only in a limited zone on the ventral surface.

11. The rectal glands are present.

12. The buccal gland is a compact elongate-oval structure with large irregularly-shaped cells and small round nucleus.
13. The salivary glands are paired, whitish, much lobed structures.

a) Each lobe of the gland is made up of narrow columnar serous and broad columnar mucous cells, the latter is more numerous.

b) The salivary ducts independently in the lateral side of the buccal cavity towards the anterior limit.

14. The digestive gland is a spirally coiled, somewhat conical, dull grey mass.

a) The digestive gland consists of numerous narrow lobules made up of calcic, excretory, phagocytic and secretory cells.

b) The digestive duct is short but wide and thin walled.

**Acrocastomavariabile**

1. The alimentary canal is divisible into a buccal mass, an oesophagus, a stomach, a style sac, an intestine and a rectum. The salivary glands and the digestive gland are the appendages of the tract.

2. The mouth is a fairly large crescent-shaped transverse opening located at the anterior end of the snout.
3. The labial palps are thick, fleshy, somewhat semicircular in shape, extending from the lateral borders of the mouth.

4. The buccal mass is thick, dark brown and almost pear-shaped. The anterior end is narrower than the posterior one.
   a) The oesophagus emerges from the postero-dorsal border of the buccal mass.
   b) The radular sac runs posterocaudally from its point of origin in the buccal mass.
   c) The radula is a long ribbon of uniform breadth.
   d) The subradular epithelium is about four to five times in thickness to that of the supraradular one and made up of narrow columnar cells.
   e) The number of teeth in a row is 2:1:1:1:2 and 128 such rows are present.

5. The oesophagus is a narrow thin walled tube. The first 4 mm is slightly narrower than the rest.
   a) The outer epithelium is made up of cuboidal cells.
b) The inner epithelium is thrown into three large and two small folds being formed of tall and broad columnar cells with distinct separating cell membranes. The cytoplasm is highly granulated and elongateoval nucleus is central in position. A good number of mucocytes are present.

6. The stomach is a thin walled, somewhat oval sac, the posterior end being a little narrower.

a) The gastric shield is a heavily cuticularized area in the stomach.

b) The food groove is semilunar in shape and originates at the oesophageal end and terminates at the intestinal opening.

c) The digestive duct opens into the stomach adjacent to the opening of the oesophagus.

d) The opening of the style sac into the stomach is very near the intestinal opening.

e) The outer epithelium is thin and made up of small cuboidal cells.

f) The inner epithelium is more or less folded, the folds being more conspicuous on one side. The lining epithelium in the narrow folds is formed of ciliated, tall columnar cells of varying height.
7. The style sac is a long pouch containing crystalline style.
   a) The sac is made up of an epithelium of broad columnar cells with highly granulated cytoplasm.
   b) The epithelium is supported by thick and distinct basement membrane and circular muscle fibre.

8. The intestine is a long, thin walled, coiled tube.
   a) The proximal part bears a large typhlosole dorsally.
   b) The distal part is devoid of a typhlosole and the wall is thrown into longitudinal folds.
   c) The inner epithelium is made up of tall columnar, ciliated cells. A good number of unicellular glands are present.

9. The rectum is a thin walled tube, opens to the exterior by an elongateoval anus. The anus is guarded by sphincter muscles.
   a) The inner epithelium is made up of ciliated, tall columnar cells. Unicellular glands are present.
10. Oesophageal glands are large, and number of mucous cells preponderate over the serous cells.

11. The salivary glands are two, large, elongated, compact, cream white masses. The gland is made up of a few lobes and lobules.

   a) The alveoli in a lobule are of two types viz., large mucous alveolus and small serous alveolus.

   b) The salivary duct is a small tube, proceeds forward and inward to enter the buccal mass.

12. The digestive gland is a large blackish grey mass consisting of numerous narrow lobules closely packed together.

   a) The lobule is made up of calcic, excretory, phagocytic and secretory cells.

   b) The digestive duct is short and thin walled.

**Telescopium telescopium**

1. The alimentary canal is divisible into a buccal mass, an oesophagus, a stomach, a style sac, an intestine and a rectum. The accessory glands, salivary glands and the digestive gland are the appendages of the tract.

2. The snout can extend considerably to form a proboscis-like structure.
3. The mouth is a small longitudinal slit situated slightly ventral to the anterior border of the snout.

4. The buccal mass is thick, muscular, almost globular in shape and narrows down at both the ends.

   a) The oesophagus emerges from the posterior border of the buccal mass.

   b) The radular sac runs from the posteroventral border of the buccal mass.

   c) The radula is a long ribbon of uniform width.

   d) The supraradular epithelium consists of cuboidal or short columnar cells.

   e) The subradular epithelium is about six times thicker than the supraradular one and made up of broad and narrow columnar cells.

   f) The number of teeth in a row is 1:2:1:2:1 and 79 such rows are present.

5. The oesophagus is a fairly long, narrow, thick walled tube, divisible into an anterior, a mid- and a posterior part.

   a) The anterior oesophagus runs straight backward along the midventral line of the snout.
b) A little wider mid-oesophagus proceeds backward along the left border of the columellar muscles following a zigzag course.

c) The posterior oesophagus is a coiled tube which is situated dorsal to the posterior border of the columellar muscle.

d) The outer epithelium is made up of flattened cells.

e) The inner epithelium is thrown into broad and narrow folds made up of tall columnar, ciliated cells. Large mucocytes are present.

f) The oesophagus opens in the stomach on its concave margin at about the middle of the length.

6. The stomach is a fairly large, elongated, curved, thin walled tube.

a) The gastric shield is a heavily cuticularized area in the stomach.

b) Two guiding ridges of varying height and of unequal length and thickness are present in the stomach.

c) The ridges help in sorting and guiding the food following a long route from oesophageal end to the intestinal opening of the stomach.
d) The wide but short digestive duct opens between the outer and inner guiding ridges on the concave surface of the stomach very near the oesophageal opening.

e) The opening of the style sac is located very near the intestinal opening.

f) The outer epithelium is made up of thin, flattened cells. The inner epithelium of the roof is thrown into a number of thick folds while the rest is devoid of folds and made up of tall columnar cells.

g) On the basis of the nature of the cells the stomach in a transverse section is divisible into ciliary, ciliary cum secretory, secretory and non-ciliary zones.

7. The style sac is a long, tubular pouch, the terminal part is round in shape which contains a crystalline style.

a) The histology is almost similar to that of Acrostoma.

8. The intestine is a long, thin walled tube arising from the posterior end of the stomach.

a) It bears a large typhlosole dorsally, and a prominent groove-like structure ventrally.
b) The inner epithelium is made up of tall columnar cells. The cells are densely ciliated in the ventral groove region. Unicellular glands are present.

9. The rectum is a wide, thin walled tube terminating at the anus.

a) The cells of the inner epithelium are tall columnar and ciliated. Unicellular glands are present.

10. The accessory glands are compact, tubular, and run parallel to the salivary glands.

a) The glands are made up of a few large lobules firmly held together by connective tissue.

b) Each lobule of the gland is made up of tall columnar cells.

11. The salivary glands are paired acinus glands almost tubular in shape.

a) The gland consists of a few lobes and lobules made up of mucus alveoli. Serous cells are absent.

b) The salivary duct is short and narrow and opens in the buccal cavity on the ventrolateral border slightly anterior to the middle of it.

12. The digestive gland is a large, spirally coiled compact mass consisting of numerous fairly large lobules.
a) The lobule is made up of calcic, excretory, secretory and vesicular cells.
b) The digestive duct is wide but short.

**Indoplanorbis exustus**

1. The alimentary canal is divisible into a buccal mass, an oesophagus, a crop, a stomach, an intestine and a rectum. The salivary glands and digestive glands are the appendages of the tract.

2. The mouth is a fairly large, almost triangular opening situated slightly ventral to the anterior end of the snout. The semicircular dorsal border of the mouth is provided with a number of small folds of the skin while the lateral borders are smooth.

3. The labial palps are large, fleshy and leaf-like and overhang the mouth.

4. The buccal mass is a slightly anteroventrally directed massive, pear-shaped structure narrower at the anterior end.

   a) The semicircular chitinous jaw is situated slightly posterior to the dorsal border of the mouth.

   b) The oesophagus emerges from the posterodorsal border of the buccal mass.
c) The radular sac runs from the posterobventral border of the buccal mass.

d) The radula is broad, elongateoval, the anterior end of which is round and narrow while the posterior end is drawn into a tongue-like shape.

e) The supra and subradular epithelia are made up of columnar cells.

f) The number of teeth in a row is 3:29:1:29:3 and 118 such rows are present.

5. The oesophagus is a slender, thick walled, round tube, followed by a closely crop.

a) The outer epithelium is made up of a single layer of flattened cells.

b) The inner epithelium is made up of columnar cells and thrown into a number of folds.

c) Unicellular glands are present.

d) The crop is thin walled and with a large lumen.

e) The epithelium is thrown into folds and the cells are narrow columnar.

6. The stomach is slightly curved, thick walled and roughly barrel-shaped.
a) The openings of the oesophagus and the intestine are terminal and opposite.

b) The digestive duct opens on the ventral surface very near the origin of the intestine.

c) The muscular layer is thick and constituted chiefly by circular fibres occasionally interspersed with isolated longitudinal and oblique fibres.

d) The inner epithelium is made up of slender, tall columnar cells.

e) The gastric glands, made up of large wedge-shaped cells, are restricted to the connective tissue.

7. The intestine is a thin walled tube, divisible into an anterior and a posterior zone.

a) The inner epithelium is practically devoid of folds and made up of tall columnar cells.

b) Mucous secreting cells are few in number.

8. The caecum is a small sac arising from the anterodorsal border of the intestine at its origin.

a) The inner epithelium is composed of long columnar ciliated cells.

b) A good number of glandular cells are present.
9. The rectum is a thin walled tube, opening to the exterior by the anus guarded by sphincter muscles.
   a) The cells of the epithelium are broad columnar and of unequal length. Mucous cells are scanty.

10. The salivary glands are paired, fairly large, whitish, much lobed, shield-shaped masses.
   a) The gland consists of two lobes which are further divisible into many lobules.
   b) Lobules are mostly composed of mucous alveoli having two types of cells — serous and mucous.
   c) The salivary ducts are short and open dorso-laterally into the buccal cavity.
   d) The wall of the duct is made up of a single layer of columnar cells of uniform height.

11. The digestive gland is a fairly large, spirally coiled dull grayish mass consisting of a large number of lobules of varying size.
   a) The cells of the lobule are calcic, excretory, phagocytic and vesicular.

Macrochlamys indica

1. The alimentary canal is divisible into a buccal mass, an oesophagus, a crop, a stomach, an intestine and a rectum.
2. The mouth is a fairly large crescent-shaped opening, situated on the ventral side of the narrow anterior end of the snout. The semicircular dorsal border of the mouth is bounded by the skin of the snout bearing small folds while the ventral border is constituted by sphincter muscles of the buccal mass.

3. The semicircular labial palps extend medially from the dorsolateral corners of the mouth.

4. A small chamber, the vestibule, is present between the mouth and the buccal mass.

5. The buccal mass is thick, muscular and slightly narrower anteriorly. It is bounded dorsally by a semicircular cartilagenous jaw and ventrally by the sphincter muscles.

   a) The oesophagus emerges from the middorsal portion of the posterior end of the buccal mass.

   b) The radular sac lies on the posteroverentral border of the buccal mass.

   c) The radula is almost similar to that of the *Indoplanorbis exustus*, except being larger in size and in having a thicker ribbon.

   d) The number of teeth in a row is 37:17:1:17:37 and 95 such rows are present.
e) The supra and subradular epithelia are made up of columnar cells. The cells are of unequal height in the former.

6. The oesophagus is a narrow, thick walled tube.
   a) The outer epithelium is made up of extremely flattened cells.
   b) The inner epithelium is thrown into a few very large and a few small longitudinal folds formed of narrow columnar ciliated cells of unequal height. Mucous cells are present.

7. The crop is a large, elongated, thin walled sac richly supplied with blood vessels.
   a) The outer epithelium is made up of small cuboidal cells.
   b) The inner epithelium is thrown into numerous short folds. The cells are long, narrow, non-ciliated and of unequal height. Many unicellular glands are present.

8. The stomach is small, thick walled, almost globular in shape.
   a) The digestive duct opens on the ventral surface of the stomach, very near the origin of the intestine.
   b) The crop opens into the right side of the anterior end of the stomach.
c) The opening of the intestine is very close to the opening of the crop.

d) The histology of the stomach is almost similar to that of the crop except in having a ciliated epithelium. Majority of the cells of the epithelium are glandular in nature.

9. The intestine is a long thin walled tube.

a) The inner epithelium is thrown into a number of folds of varying size and is made up of long columnar, ciliated cells of varying height. Mucous cells are present.

10. The rectum is a long, thin walled tube opening at the pneumostome by a round anal aperture guarded by sphincter muscles.

a) The cells of the inner epithelium are short columnar, nonciliated on the outer and the lateral sides, while ciliated in the rest. Glandular cells are very few in number.

11. The salivary glands are paired, whitish, racemose, compact and lobulated masses, variable in shape and size.

a) The gland consists of many lobules. The lobules are made up of alveoli having both mucous and serous cells.
b) The salivary ducts are fairly stout, and open independently into the buccal mass.

12. The digestive gland is a large, thick, multilobular, greyish spirally twisted mass.

a) The lobule is made up of calcic, excretory, phagocytic, vesicular and secretory cells.

b) The digestive gland duct is thin-walled, wide but short.

Experimental results

1. The digestive organs are slightly to moderately alkaline in T. telescopium while in others these are slightly acidic.

2. A higher amylolytic activity was recorded in the oesophagus of I. exustus, A. variabile and M. indica and in the stomach of T. telescopium.

3. The amylolytic activity was quite low in the digestive gland of all the species studied except in V. bengalesis.

4. The amylolytic activity was moderate in the style sac and crystalline style of A. variabile, and low in T. telescopium.
5. A higher proteolytic activity was recorded from the oesophagus of *A. variabile* and *M. indica*, the stomach of the other three species, and the digestive glands of all the five species.

6. A higher esterolytic activity was recorded in the oesophagus of *A. variabile*, *I. exustus*, *M. indica* and *V. bengalensis*, the stomach of *T. telescopium* and the digestive gland of all the species studied.