Veterinary Bioscience: Digestive System

LECTURE 1
INTRODUCTION TO THE DIGESTIVE SYSTEM AND ABDOMINAL CAVITY

INTENDED LEARNING OUTCOMES

At the end of this lecture, you should be able to:

- Describe the general design of the digestive system
- Identify the regions of the abdomen
- Describe the external and internal surface features of the oral and abdominal cavities
- Describe the structure and function of the peritoneum

OVERVIEW OF THE DIGESTIVE SYSTEM

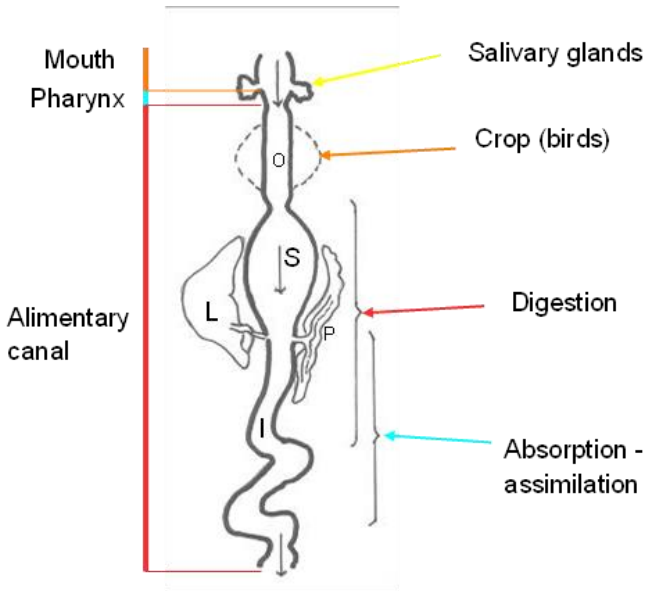
The digestive system includes the digestive tract and the accessory organs and glands. Its function is to turn food into fuel; more specifically, it fulfils the following functions:

- securing food;
- conducting and storing food;
- mechanical and chemical digestion;
- absorption of food;
- storage and disposal of wastes.

The design in different species is adapted to suit different diets, e.g. carnivore, herbivore, omnivore.

The digestive tract is a long tubular passage through the body from lips to anus, comprised of 3 main regions:

- the mouth
- the pharynx
- the alimentary canal



1. Mouth (= buccal cavity or oral cavity).

Obtains food and provides for its mechanical breakdown. The mouth is assisted by the accessory organs – teeth, tongue and salivary glands (provide fluid/enzymes for breakdown of food).

Main features of the mouth:

- Bones of the jaws: paired **maxillae and mandibles**. Teeth arise from individual sockets.
- **Cheeks (buccae) and lips (labia)**
  - The mouth is bounded by lips and cheeks externally.
- **Outer vestibule** formed between teeth and lips/cheeks when mouth closed.
- Mouth cavity proper: roofed by the palate **(hard and soft palates)**, bounded laterally by the teeth and gums, tongue on the floor of the cavity.

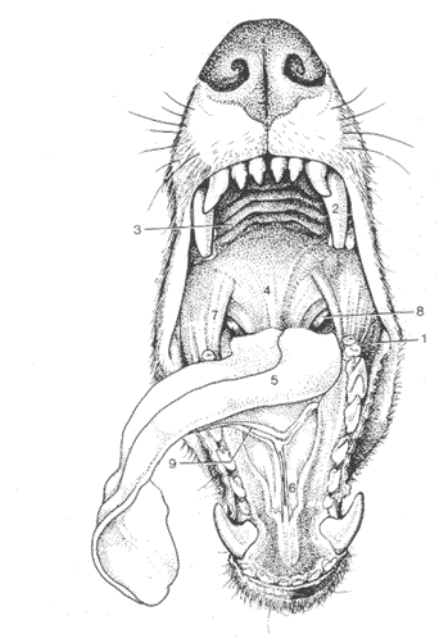


FIGURE 3–3. General view of the oral cavity of the dog.

Dyce, Sack and Wensing; Textbook of Veterinary Anatomy

2. Pharynx:

- A funnel-shaped chamber
- Crossover for the digestive and respiratory systems.

This Muscular tube connects the back of the nasal and oral cavities with the oesophagus and larynx/trachea, and conveys food from the mouth to the oesophagus by the process of deglutition (swallowing).

3. Alimentary Canal – is divided into 4 regions based on histological structure and specialised for specific functions:

A. Oesophagus – A muscular tube which conducts food from the pharynx to the stomach by peristalsis

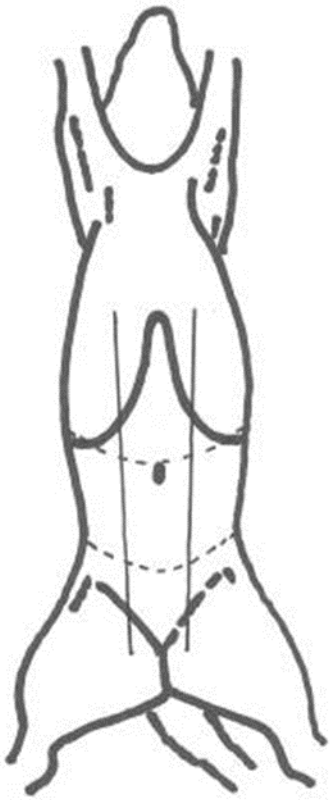
B. Stomach – A Musculo-glandular sac for storage and chemical digestion. It is subject to species variation:
- Dog, cat, horse and pig - have a simple stomach = monogastric. Cow, sheep and goat - have a complex or compound stomach where extensive fermentation of plant material takes place.

C. Small Intestine – A long thin tube with expanded luminal surface area.
- It is designed for further digestion but its main function is for the absorption of digested carbohydrates, protein and fat.

D. Large Intestine – Wider and shorter than the small intestine.
- Designed mainly for the absorption of water, but in certain animals such as the horse the caecum is the site where extensive fermentation of plant material takes place.
- The caudal large intestine straightens into the Rectum and Anus: The rectum is designed to store the waste until it is expelled via the anus.

THE ABDOMEN

Portion of the trunk that extends from the diaphragm to the pelvis.



Regions of the abdomen

Basically 2 transverse and 2 sagittal planes divide the abdomen into **9 regions**:

Cranial:

- **Xiphoid** (or epigastric) region
- Left and right **hypochondrial** regions

Middle:

- **Umbilical** region
- Left and right **lateral** (or flank) regions
- The **sublumbar fossa** is contained in the dorsal aspect of the flanks

Caudal:

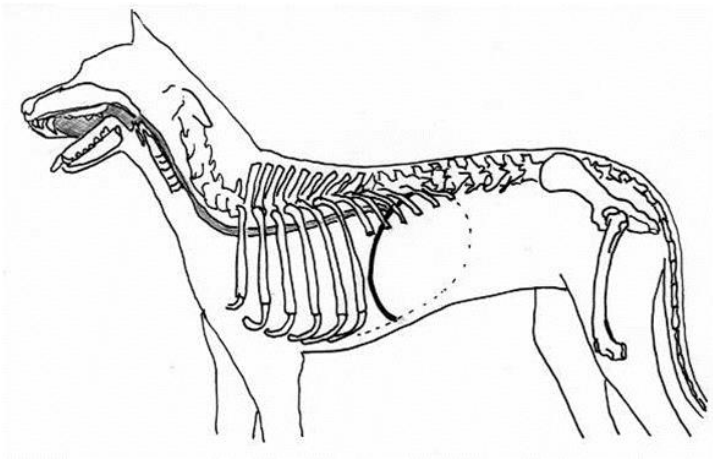
- **Pubic** region
- Left and right **inguinal** regions

Abdominal cavity

Boundaries:

- **Cranial boundary:**
  - The diaphragm

- **Dorsal boundary:**
  - The lumbar vertebrae
  - The sublumbar muscles
  - The arms (crura) of the diaphragm



- **Lateral boundary:**
  - The diaphragm
  - The three muscles of the lateral abdominal wall:
    - external abdominal oblique muscle
    - internal abdominal oblique muscle
    - transverse abdominal muscle
  - Part of the pelvis (wing of the ilium)

- **Ventral boundary:**
  - The left and right rectus abdominis muscles (strap-like; either side of midline)

- **Caudal boundary:**
  - The pelvic inlet

The **pelvic cavity** is a continuation of the abdominal cavity beyond the pelvic inlet.

Peritoneal cavity

The **peritoneum** is a smooth shiny serous membrane which lines the abdominal cavity and part of the pelvic cavity.

It is composed of a surface layer of simple flat (squamous) mesothelium which lies on a layer of connective tissue containing blood vessels, nerves and lymphatics. It is semi-permeable to the movement of water and small molecules, and its function is to secrete the watery peritoneal fluid that acts as a lubricant to decrease friction between apposing surfaces.

The peritoneal cavity is the cavity enclosed by peritoneum, and it is divided into the peritoneal portion and the pelvic portion.

It contains little space because of the great bulk of viscera (internal organs) which obliterate it. However, because of many folds and apposing surfaces, the surface area of the peritoneum is greater than that of skin.

A small volume of **peritoneal fluid** is normally produced which is just enough to keep the peritoneal cavity moist.

Parietal peritoneum is peritoneum attached onto the wall of the abdominal cavity. **Visceral peritoneum** is peritoneum lining the external surfaces of the viscera (soft internal organs).

There is also **connecting peritoneum** – composed of **double** membranes:

- **Mesentery** – peritoneum from the intestine to the dorsal wall of the abdominal cavity.
    - The **common or great mesentery** – connects most of the small intestine to the abdominal roof at the level of the first and second lumbar vertebrae.
    - **Mesocolon** – attaches the colon (large intestine) to the abdominal roof and continues into the pelvic cavity as the **mesorectum**.

- **Greater omentum** – passes from greater curvature of stomach to the spleen to the dorsal lumbar wall. It encloses a potential cavity – the **omental bursa**. The **lesser omentum** passes from the lesser curvature of the stomach to the liver.

- **Ligament** – reflections of peritoneum between the viscera, or between viscera and the abdominal wall-usually not conducting vessels and nerves.

Relations of abdominal organs

Dog stomach:

Empty – does not contact the abdominal wall.

Moderately filled – lies against the xiphoid and left hypochondrial region.

Completely full – lies primarily in contact with the xiphoid and umbilical regions ventrally, and the right and left lateral regions and can reach caudally to a transverse plane just caudal to the umbilicus.

Stomach, uterus, urinary bladder and spleen vary more than the other organs because of their ability to undergo marked changes in size and shape. The **gravid (pregnant) uterus** alters the position of all other moveable abdominal organs greater than any other does. The gravid uterus always occupies the most ventral position in the abdomen because it contains no gas and is therefore the heaviest freely moveable abdominal organ - near term it occupies nearly all the ventral half of the abdominal cavity.

FURTHER READING

Singh: *Dyce, Sack & Wensing's Textbook of Veterinary Anatomy*, 5th Ed. Elsevier, 2018.

Boyd: *Color Atlas of Clinical Anatomy of the Dog and Cat*, 2nd Ed. Mosby, 2001.

Hermanson: *Miller and Evans' Anatomy of the Dog,* 5th Ed. Elsevier1964.

Smallwood: *A Guided Tour of Veterinary Anatomy*, Saunders, 1992.