

The gastrointestinal (GI) tract varies a great deal between species. Also known as the digestive tract or the alimentary canal, it consists of the mouth, esophagus, stomach, small intestine, large intestine, and anus.

## Mouth

The mouth, also known as the oral cavity, is where food is taken into the body.

### Anatomy

- Soft palate – tissue that separates the oropharynx and nasopharynx, prevents food from going into the nasal passageways when swallowing
- Hard palate – bony partition between the mouth and nose
- Oropharynx – the part of the pharynx between the tongue and the soft palate
- Salivary glands – secrete saliva (mandibular, submandibular, parotid)
- Teeth – used for biting/mastication

### Physiology

- Starts mechanical and chemical digestion of food. Mechanical digestion begins the process by increasing the surface area of the food by **chewing, also known as mastication**. Chemical digestion of food is accomplished by secretion of enzymes that help to break down sugars, fat and protein.
- A ball of food, or bolus, is created and then passed to the esophagus by swallowing.
- In addition to the start of the digestion process, the **mouth also plays a key role in the cooling of dogs via the evaporation of saliva**, thereby cooling blood in mucus membranes.

## Esophagus

The esophagus is the tubular organ that **connects the mouth to the stomach**.

### Anatomy

- 2 layers of lining: the **mucosa and submucosa**
- 2 layers of muscle: the longitudinal and the circular

## Physiology

- Moves food through peristalsis, which is the alternating contraction and relaxation of the the longitudinal muscle and the circular muscle
- The bolus is moved through the esophagus in this manner until it reaches the stomach.

## Stomach

The stomach is where the major part of digestion of food occurs and links the **esophagus to the small intestine**.

## Ruminant Anatomy

**Ruminants**, such as cows, goats and sheep, have a **4-compartment stomach** instead of a single stomach like a cat or dog. These compartments are:

- Reticulum
- Rumen
- Omasum
- Abomasum

## Monogastric Anatomy

**Monogastric animals**, such as the cat and dog, have a **single stomach that has 3 separate parts**:

- Fundus
- Body
- Antrum

## Physiology

- Further digest food by peristalsis
- Produce **hydrochloric acid (via parietal cells)** which aids in the breakdown of food. The pH of the stomach is tightly controlled by active transport
- Enzymes, most notably **pepsin**, break down proteins into amino acids.
- The stomach itself is not digested by its own secretions because it produces a layer of mucus containing mucin and bicarbonate to protect itself from acidity.

## Small Intestine

As with the other parts of the intestinal tract, peristalsis occurs in the small intestine. However, segmental contractions also take place here, moving contents more slowly through the system allowing for more contact time with the intestine and greater nutrient uptake.

## Anatomy

The small intestine consists of **3 parts**:

1. **Duodenum** (upper small intestine which is connected to the stomach and on which the pancreas is attached)
2. **Jejunum** – makes up the majority of the small intestine (middle segment)
3. **Ileum** (connects to the cecum)

## Physiology

- **Absorbs nutrients** due to the large surface area created by the folds in the intestinal wall and the millions of **villi** along its surface.
- The villi themselves contain **microvilli, which secrete digestive enzymes and absorb nutrients (the brush border)**.
- Water, vitamins, and electrolytes can be absorbed across the intestinal wall while fats, carbohydrates and proteins must be altered prior to absorption, through enzymes associated with the lumen or microvilli.
- Fats are digested by emulsification and micelle formation.
- **Carbohydrates are digested via the fermentation process in the ruminant.** In monogastric animals, amylase, lactose, sucrase, maltase, isomaltase, and lactase convert carbohydrates into monosaccharides that are then absorbed across the **brush border**.
- In addition to the enzymes made by the small intestine itself, the pancreas also secretes enzymes into the small intestine to help with chemical digestion. These enzymes, known as proteases, break down proteins into amino acid chains that are then absorbed across the brush border.

## Large Intestine

The large intestine is another part of the digestive tract that varies a great deal between the species (the most notable exception being the horse) and is responsible for recovery of fluid and electrolytes and to store feces prior to elimination.

## Large Intestine (Cont.)

Its main components are:

1. **Cecum**- a **blind sac** that is less developed in dogs and cats but is more advanced in the ruminant. Located where the small and large intestine meet.
  - a. In the **horse, the cecum and colon are referred to as the hindgut**. The hindgut is more developed than the small intestine in the horse and has a much greater capacity for absorbing nutrients
  - b. Most ruminants also perform some fermentation in the hindgut
2. **Colon**- In the dog and cat, the colon is a tubular organ that uses peristalsis and segmental contractions. The main functions and abilities of the colon are:
  - a. Absorb nutrients and water not already absorbed by the small intestine
  - b. Store feces (rectum)

## Anus

The anus is the sphincter muscle that controls defecation. Its main components are:

1. **Internal sphincter** (under involuntary control)
  - a. relaxes and allows for fecal material accumulation
  - b. fecal material comes into contact with the anal mucosa and this stimulates the mucosal receptors
2. **External sphincter** (under voluntary control)
  - a. mucosal receptors in the internal sphincter signal the need for defecation
  - b. the external sphincter allows for voluntary control of defecation