Unit B
Understanding Animal Body Systems

Lesson 1
Understanding Animal Digestion

Terms

- Absorption
- Amino acids
- Anus
- Avian
- Bile
- Cecum
- Chyme
- Crop
- Cud
- Digestion
- Digestive system
- Enzymes
- Eructated
- Feces
- Gizzard
- Intestinal juice

Terms

- Monogastric
- Omasum
- Organs
- Pancreatic amylase
- Pancreatic juice
- Pepsin
- Polygastric
- Pseudo-ruminant
- Reticulum
- Rumen
- Ruminant
- Rumination
- Salivary amylase
- Salivary maltase
- Stomach
- Trypsin

What are the various types of digestive systems found in animals?

Knowledge of the different types of digestive systems is critical in selecting the proper feeds for livestock. Understanding the chemical and physical changes that occur during the digestion process leads to more efficient livestock feeding.

- ***Digestion*** is the process of breaking down feed into simple substances that can be absorbed by the body.
- ***Absorption*** is taking the digested parts of the feed into the bloodstream.
- The ***digestive system*** consists of the parts of the body involved in chewing and digesting feed.
  - This system also moves the digested feed through the animal's body and absorbs the products of digestion.

- Different species of animals are better able to digest certain types of feeds better than others.
- This difference occurs due to the various types of digestive systems found in animals.
  - There are **four basic** types of digestive systems:
    1. Monogastric (simple)
    2. Avian
    3. ruminants (polygastric)
    4. pseudo-ruminants.

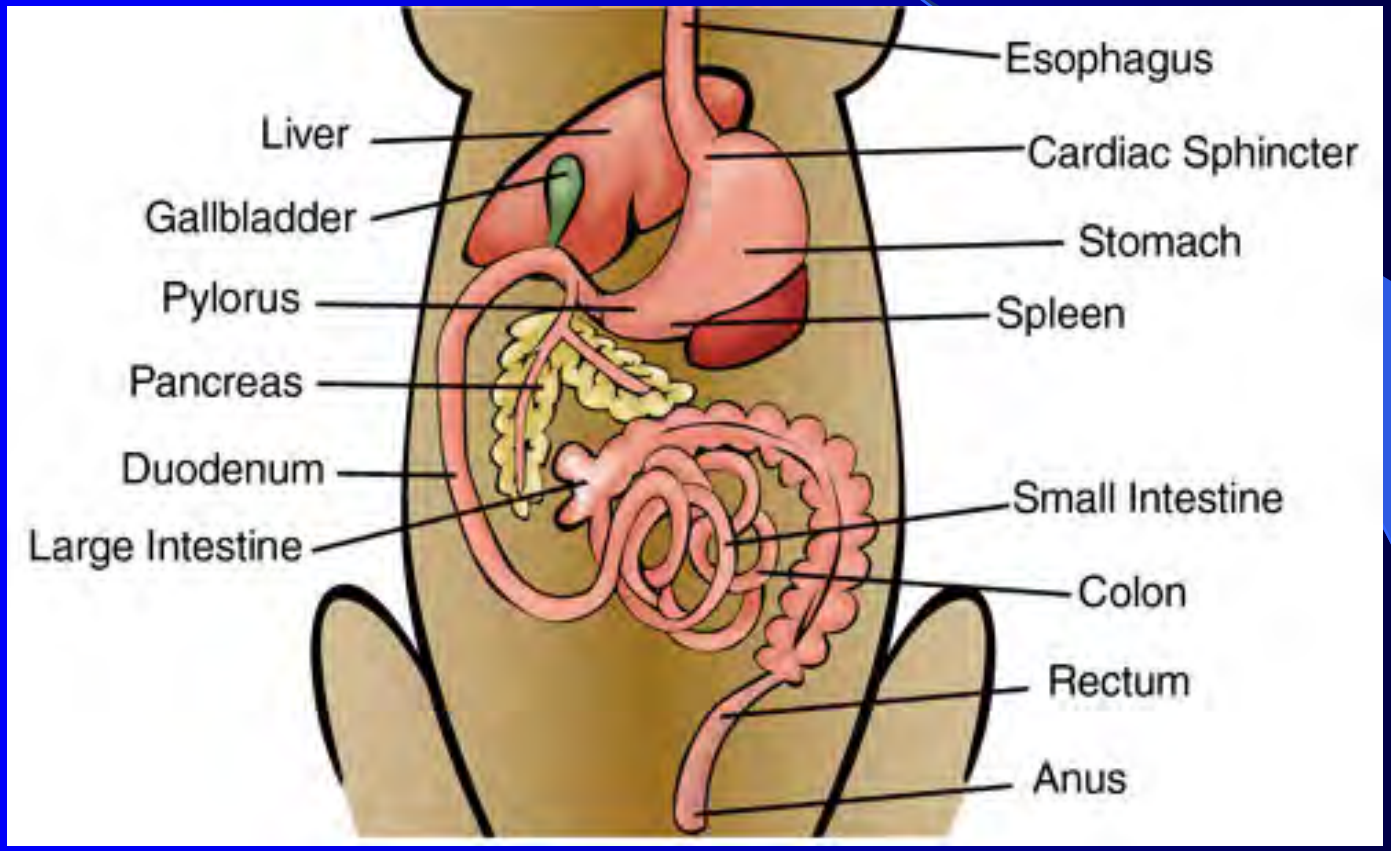
A. A ***monogastric*** digestive system has a simple stomach.

- The ***stomach*** is a muscular organ that stores ingested feed and moves it into the small intestine.
- The stomach secretes acid.
  - The acid results in a low pH of 1.5 to 2.5. The low pH destroys most bacteria and begins to break down the feed materials.

Monogastric Digestive System

- Animals with this type of digestive system are better adapted to the use of concentrated feeds, such as grains, than the use of large quantities of roughages.
- Examples of monogastric animals are dogs, cats, and humans.

Monogastric Digestion



The digestive system of a dog

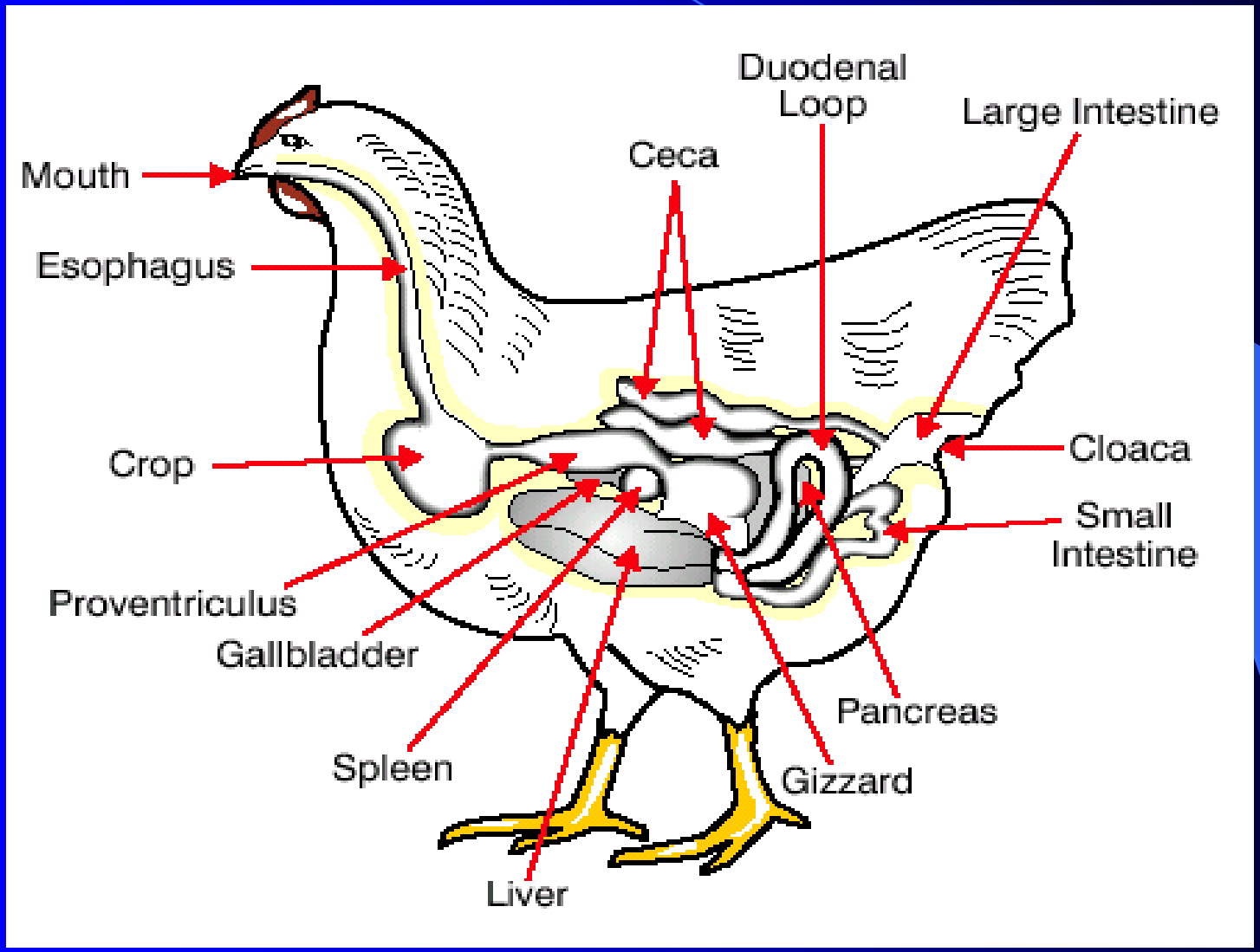
B. The ***avian*** digestive system is found in poultry.

- This system differs greatly from any other type.
- Since birds have no teeth, there is no chewing.
- The esophagus empties directly into the crop.
  - The ***crop*** is where the food is stored and soaked.
- From the crop the food makes it way to the gizzard.

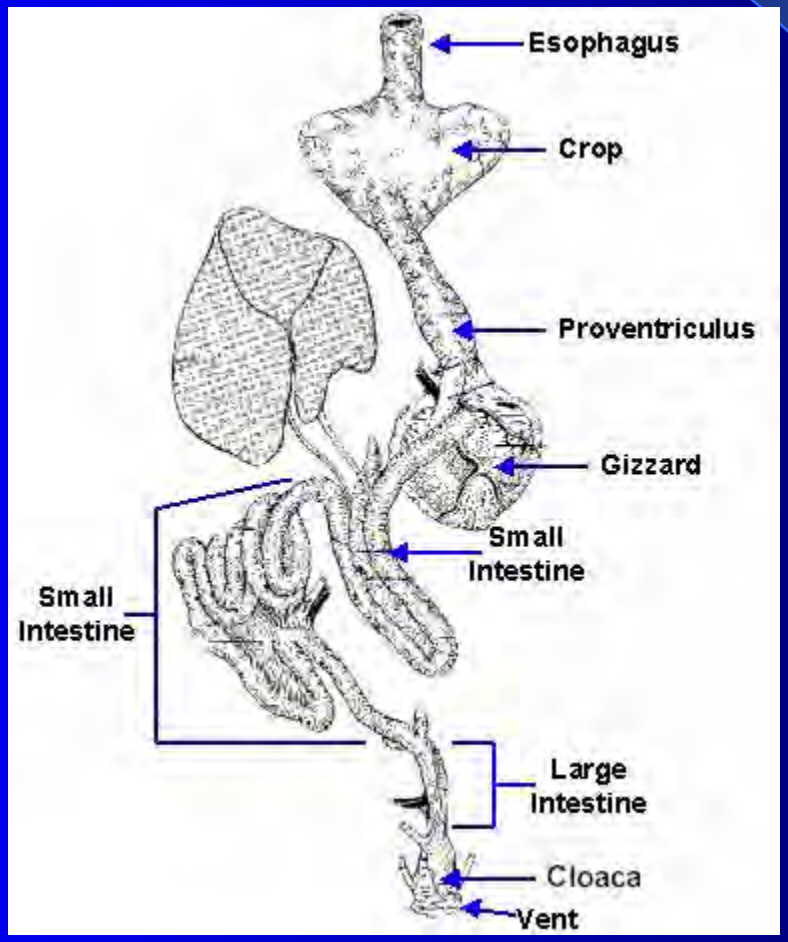
Avian Digestive System Continue:

- The ***gizzard*** is a very muscular organ, which normally contains stones or grit which functions like teeth to grind the food.
- Digestion in the avian system is very rapid.

Avian Digestive System



Avian Digestive System

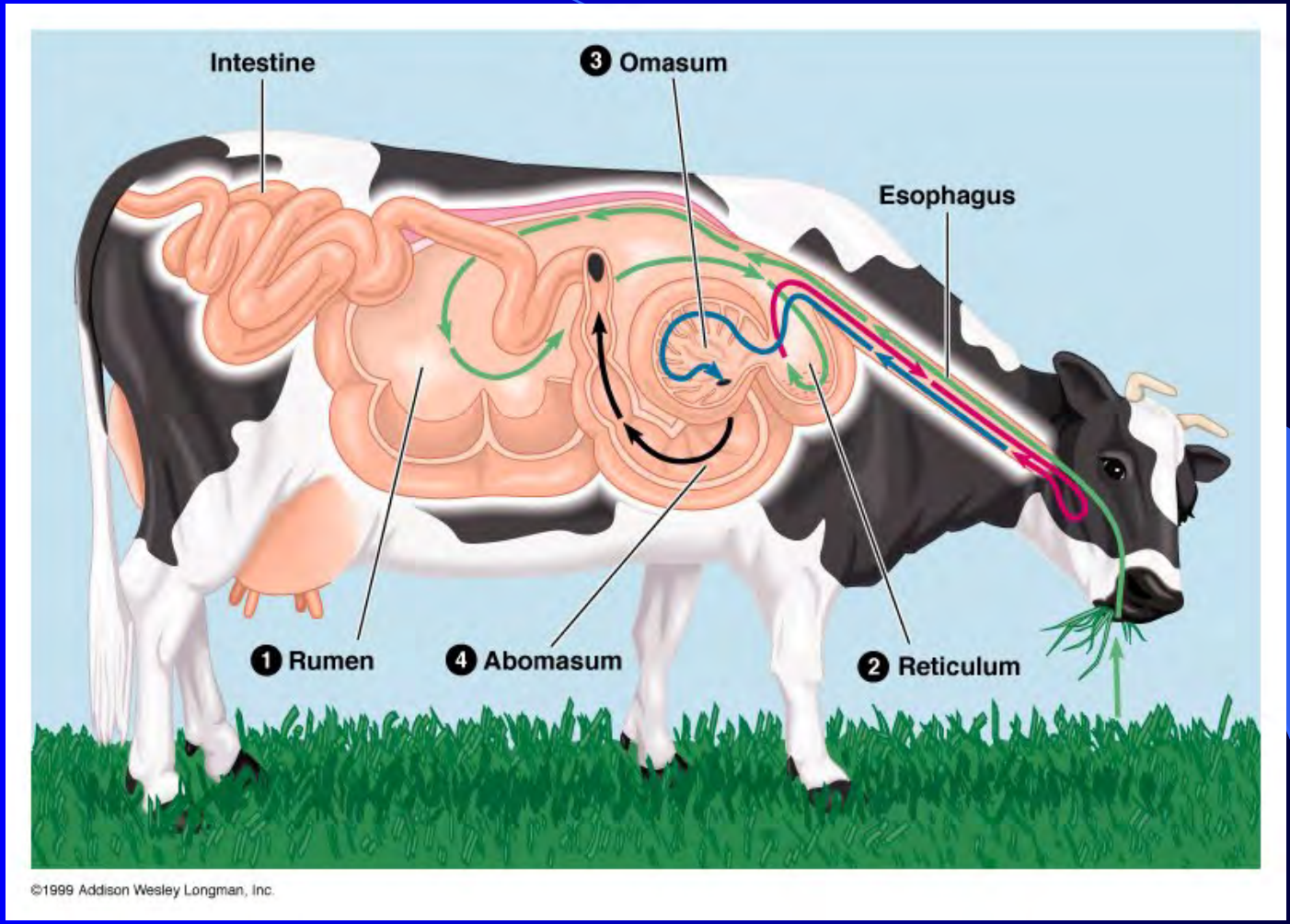


Ruminant Digestive System

C. The ***polygastric*** or ***ruminant*** digestive system has a large stomach divided into compartments.

- The ***rumen*** is the largest section of the stomach.
  - The rumen contains bacteria and other microbes that promote fermentation.
  - The rumen is the first compartment of the stomach that food enters.
- The polygastric system is designed for food to be ingested, ***eructated*** (belched up), chewed, and swallowed again..

Ruminant Digestive System



Locate the Rumen

Ruminant Digestive System

- The ***reticulum*** is the second segment of the stomach.
  - The reticulum is sometimes called the "honeycomb" due to the structure of its wall and location.

This is a picture of an actual reticulum. Notice the honeycomb texture.

Ruminant Digestive System

- The third portion of the ruminant digestive system is the ***Omasum***.
  - The Omasum is shaped like a small cabbage.
  - The omasum is a small compartment that acts as a filter of materials for the fourth compartment.
  - The omasum is also known as “manypiles”.

Ruminant Digestive System

This is a picture of an omasum. Notice the folds on the exterior.

Ruminant Digestive System

- The ***abomasum*** is the fourth and final compartment to the ruminant digestive system
  - The Abomasum is often considered the true stomach. It functions just like that of the simple-stomached animals.

Ruminant Digestive System

- The abomasum secretes gastric juices that kill the microbes that have passed with the food materials from the rumen.
- The abomasum also contains hydrocholoic acid and enzymes that break down feed materials into simple compounds.
- These simple compounds can be absorbed by the stomach wall and the intestines.

Ruminant Digestive System

- The polygastric system uses feed high in fiber.
- Thus, these animals make good use of roughage.
- Some examples of polygastric or ruminant animals are cattle, sheep and goats.

Ruminant Digestive System

Rumen – Largest, fermentation occurs here

Reticulum – honeycomb structure

Omasum – Filter, known as manypiles

Abomasum – True Stomach

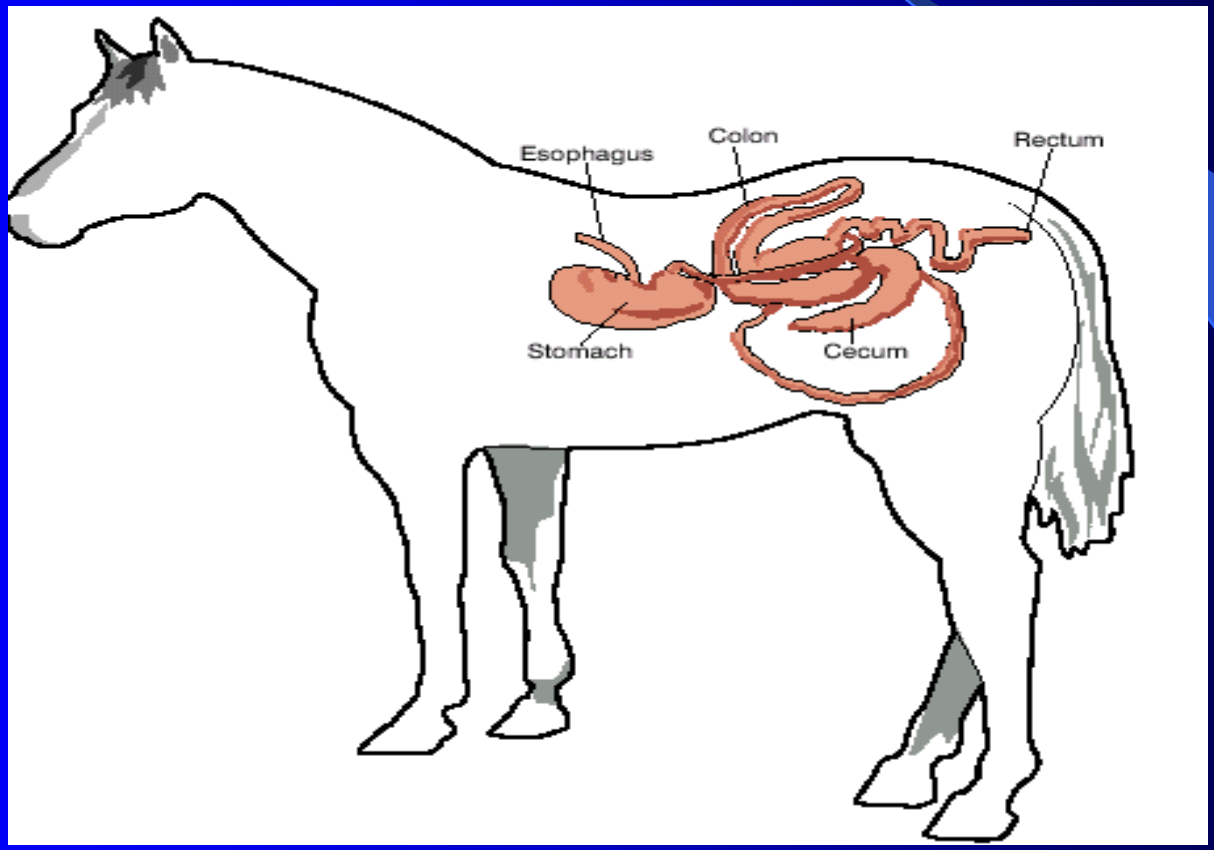
D. A ***pseudo-ruminant*** is an animal that eats large amounts of roughage but does not have a stomach with several compartments.

- The digestive system does some of the same functions as those of ruminants.
- They are able to utilize large amounts of roughages because of the greatly enlarged ***cecum*** and large intestine.

Pseudo-ruminant Digestive System Continued:

- These animals often eat forages as well as grains and other concentrated feeds.
- Examples of pseudo-ruminants are horses and rabbits.

Pseudo-ruminant Digestion



What are the major parts of the digestive system and their functions?

II. The digestive system is made up of a number of parts known as ***organs***.

- The system beings at the mouth, where food enters the body, and continues until anus, where undigested material exits the body.
- The digestive systems of most livestock are very similar in terms of the organs they contain.

A. Mouth and Esophagus

- The chewing action of the mouth and teeth breaks, cuts, and tears up the feed.
- This increases the surface area of the feed particles which aids in the chewing and swallowing process.
- Saliva stimulates the taste of the feed but also contains the enzymes, salivary amylase and salivary maltase.

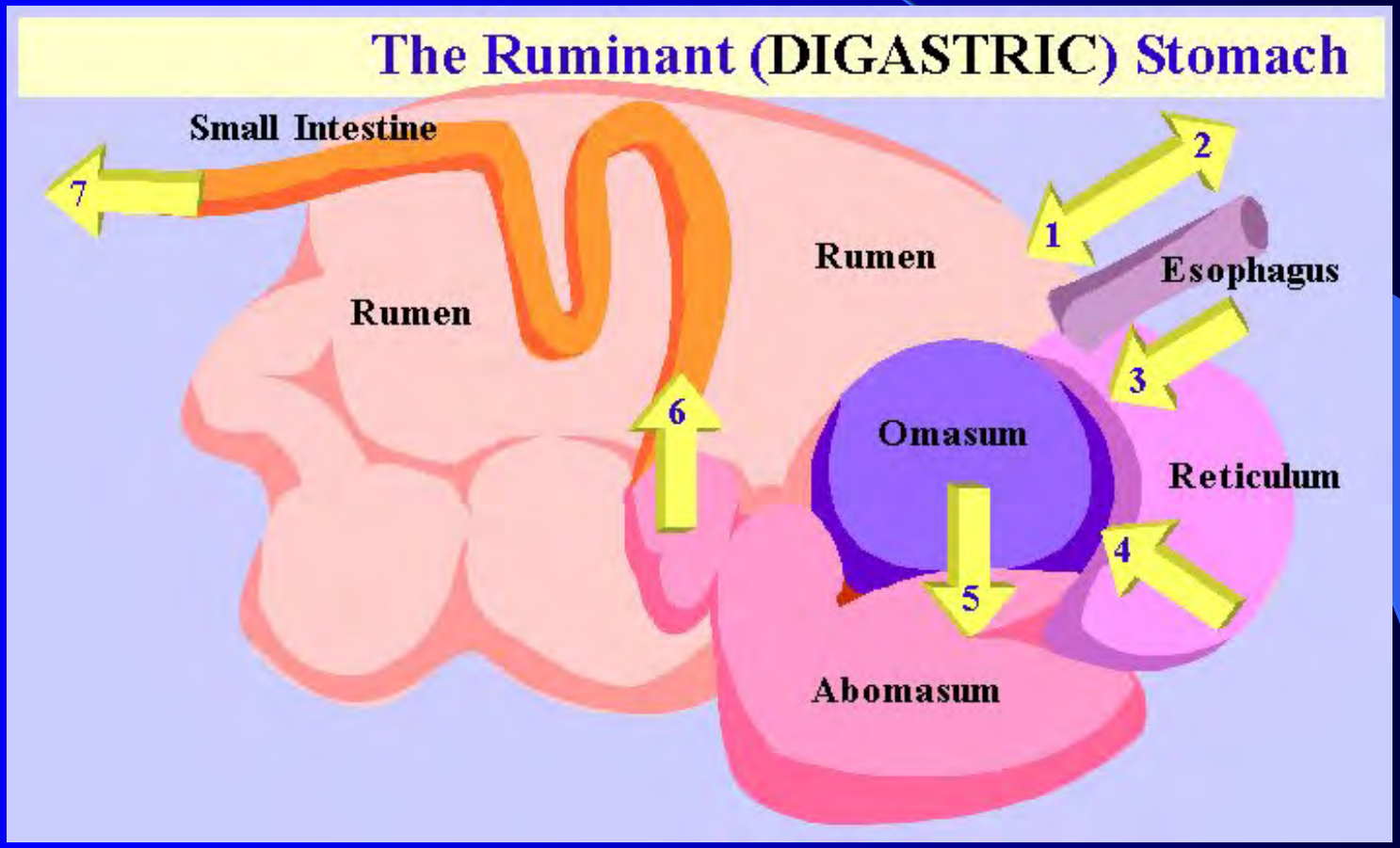
Mouth and Esophagus Continued:

- ***Enzymes*** are substance called organic catalysts that speed up the digestive process.
- ***Salivary amylase*** changes starch to maltose or malt sugar.
- ***Salivary maltase*** changes maltose to glucose.

B. Ruminant Stomach

- The four parts of the ruminant stomach are rumen, reticulum, omasum, and abomasum.
- They do not chew much of their food before swallowing.
- The solid part of food goes into the rumen. The liquid part goes into reticulum, then the omasum and on into the abomasum.
- In the rumen, the solid feed is mixed and partially broken down by bacteria.
- When the rumen is full, the animal lies down. The feed is then forced back into the mouth rumination occurs.

Ruminant Stomach



Ruminant Stomach Continued:

- ***Rumination*** is the process of chewing the cud.
- ***Cud*** is a ball-like mass of feed that is brought up from the stomach to be rechewed.
  - On average, cattle chew their cud about six to eight times per day.
  - A total of five to seven hours each day are spent in rumination.

Ruminant Stomach Continued:

- The rumen and reticulum contain millions of bacteria and protozoa. It is the bacterial action in the rumen that allows ruminants to use large amounts of roughage.
- These bacteria can change low-quality protein into the amino acids needed by the animal.
  - ***Amino acids*** are compounds that contain carbon, hydrogen, oxygen, and nitrogen.
  - Amino Acids are essential for growth and maintenance of cells.
- Bacteria also produce many of the vitamins needed by the animal.

C. Monogastric Stomach

- When feed enters the stomach of monogastrics or the abomasum of ruminants, gastric juices begin to flow.
- The fluid comes from glands in the wall of the stomach.
- The juices contain from 0.2 to 0.5 percent hydrochloric acid.
- This acid stops the action of the amylase from the mouth.
- These gastric juices also contain the enzymes pepsin, rennin, and gastric lipase.

Monogastric Stomach Continued:

- ***Pepsin*** breaks the proteins in the feed into proteoses and peptones.
- The muscular walls of the stomach churn and squeeze the feed.
- Liquids are pushed on into the small intestine.
- The gastric juice then act on the solids that remain in the stomach.

D. Small intestine

- The partly digested feed that leaves the stomach enters the small intestine.
  - It is an acid, semi-fluid, gray, pulpy mass.
  - This material is called ***chyme.***
- In the small intestine, the chyme is mixed with three digestive juices: pancreatic juices, bile, and intestinal juice.

Pancreatic Juice Continued:

- ***Trypsin*** breaks down proteins not broken down by pepsin.
- Some of the proteoses and peptones are broken down by trypsin to peptides.
- Proteoses, peptones, and peptides are combinations of amino acids.
  - Proteoses are the most complex compounds and peptides are the simplest.
- Lipase works on fats in the feed. It changes them into fatty acids and glycerol.

Pancreatic Juice Continued:

- ***Pancreatic amylase*** changes starch in the feed to maltose.
- Sugar and maltose are then broken down even further by maltase.
- They are then changed into a simple sugar called glucose.

Bile

2. Bile is a yellowish-green, alkaline, bitter liquid produced in the liver.
   - Bile is stored in the gall bladder in all animals except horses.
   - Bile aids in the digestion of fats and fatty acids.
   - It also aids in the action of the enzyme lipase.

Intestinal Juice

3. Glands in the walls of the small intestine produce ***intestinal juic***e.
   - This fluid contains peptidase, sucrase, maltase, and lactase, all enzymes used in digestion.
   - Proteoses and peptones are broken down by peptidase into amino acids.
   - Starches and sugars are broken down by sucrase, maltase, and lactase into the simple sugars, glucose, fructose, and galactose.

E. Cecum

- The ***cecum*** or “blind gut” is found where the small intestine joins the large intestine.
- It is a small organ and has little function in most animals, except pseudoruminants.
- In these animals, roughage feeds are digested by bacterial action in the cecum.

F. Large intestine

- The main function of this organ is to absorb water.
- Material not digested and absorbed in the small intestine passes into the large intestine.

Large Intestine Continued:

- Feed materials that are not digested or absorbed are called ***feces.***
- This material is moved through the large intestine by muscles in the intestinal walls.
- The undigested part of feed is passed out the body through the ***anus,*** the opening at the end of the large intestine.

Review / Summary

1. What are the various types of digestive systems found in animals?
2. What are the major parts of the digestive system and their functions?