Digestive Physiology of Farm Animals

Introduction

- Digestion- the process of breaking feed down into simple substances that can be absorbed by the body.
- Digestive System- the parts of the body involved in chewing and digesting feed.
- Absorption- the process of taking digested parts of feed into the bloodstream.

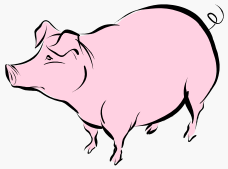
Introduction

- Three (3) basic types of digestive systems:
  - Monogastric – simple stomach.
  - Ruminant – multi-compartmented stomach.
  - Poultry – simple stomach, but very large and complex large intestine

Types of Digestive Systems

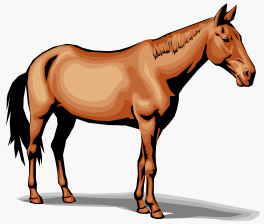
Monogastrics

Dogs



Pigs

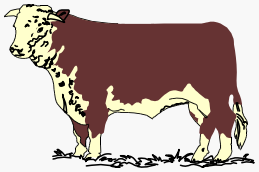
Cats



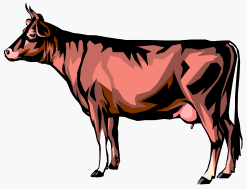
Horses

Human

Ruminants

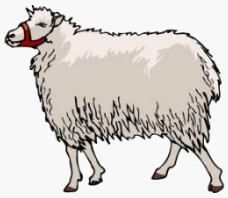


Beef Cattle



Dairy Cattle

Goats



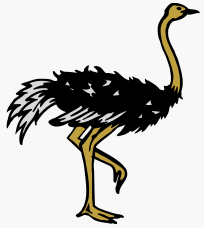
Sheep

Deer

Poultry

Chickens

Turkeys

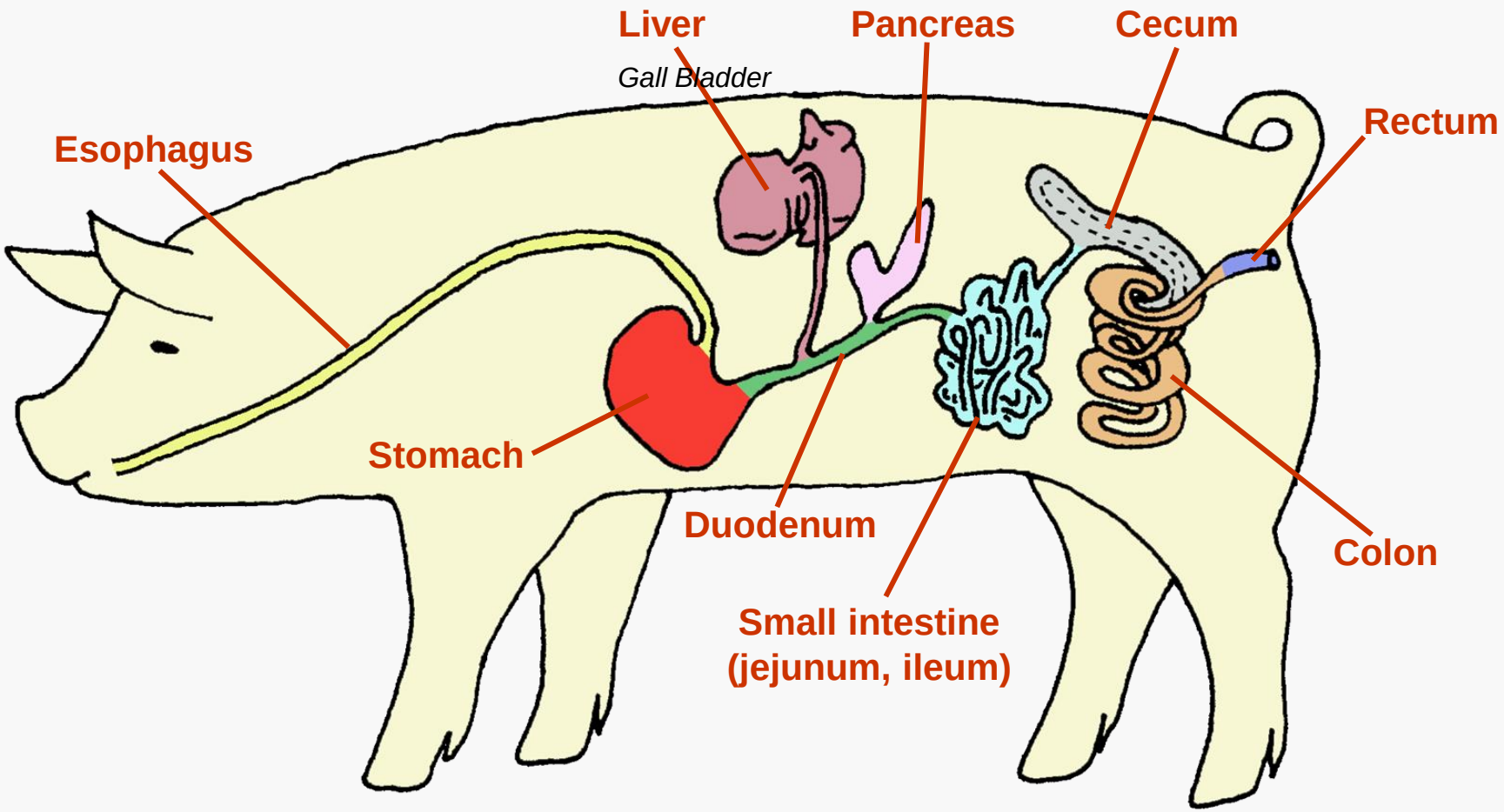


Ostrich

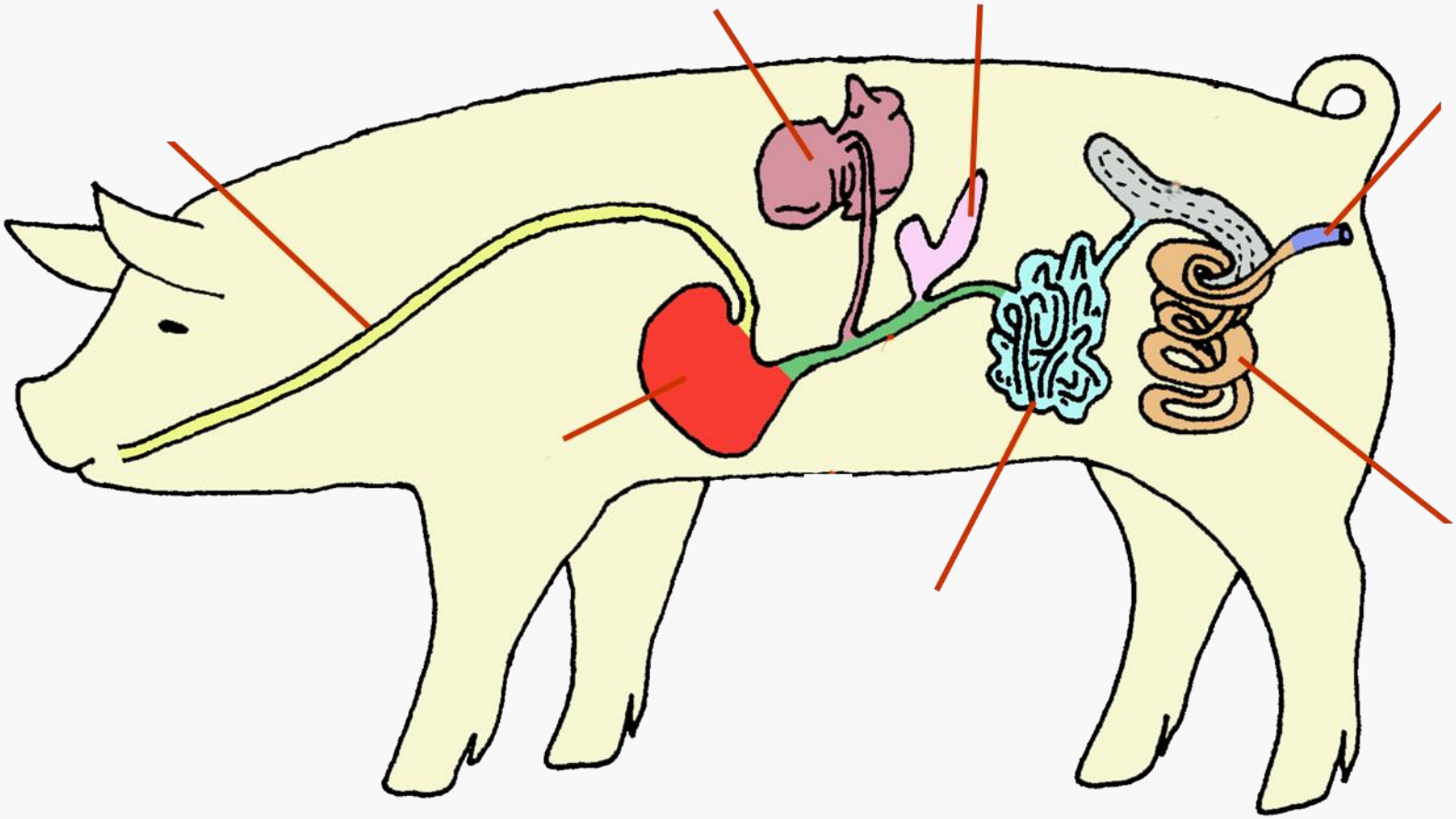
Basic Functional Anatomy of the Digestive System

– *Monogastrics* –

Digestive Tract - Pig

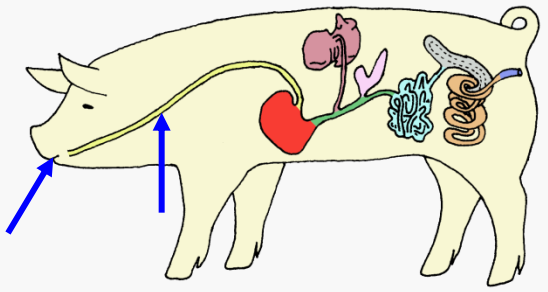


Digestive Tract - Pig



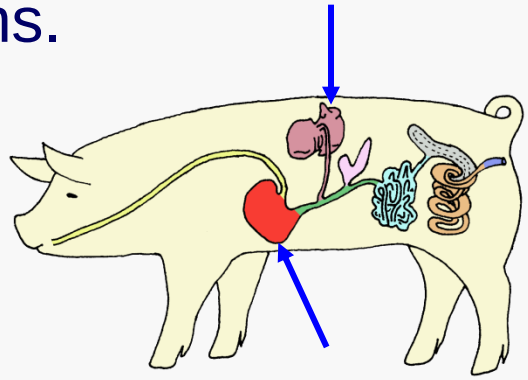
Organs of the Digestive System
– *Monogastrics* –

- Mouth
  - Mechanical breakdown of foodstuffs by chewing (reduces particle size, increases surface area for action of enzymes).
  - Saliva added as a lubricant and, in some species, contains amylase to begin starch digestion.
- Esophagus
  - Tube connecting the mouth to the stomach.



Organs of the Digestive System
– *Monogastrics* –

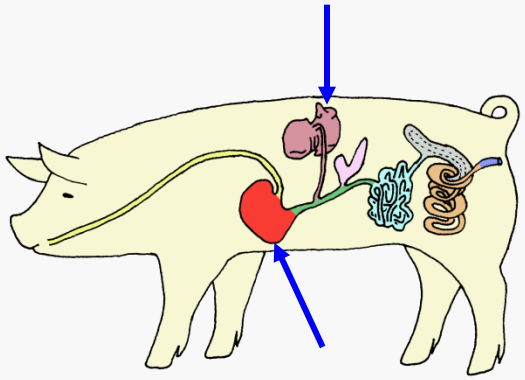
- Stomach
  - Enzymatic digestion of proteins begins.
  - Foodstuffs reduced to liquid form.



- Liver
  - Center of metabolic activity in the body.
  - Major role in digestive process is to provide bile salts to small intestine (needed for digestion and absorption of fats).

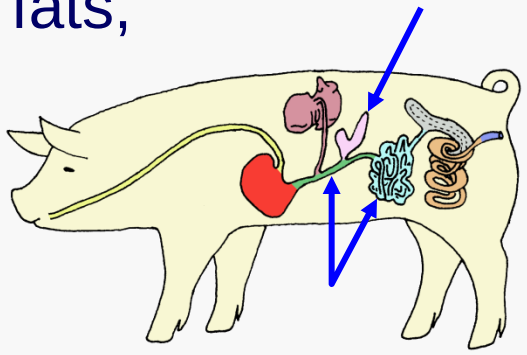
Organs of the Digestive System
– *Monogastrics* –

- Gall Bladder
  - Function: Produces bile that aids in digestive process.
  - Description: Sac like structure filled with greenish fluid. Located on the liver.



Organs of the Digestive System
– *Monogastrics* –

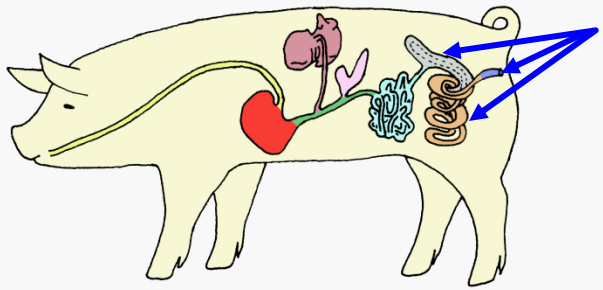
- Pancreas
  - Provides a potent mixture of digestive enzymes to the small intestine to help in digestion of fats, carbohydrates, and proteins.



- Small Intestine
  - 3 sections – duodenum, jejunum, ileum
  - Site of final stages of chemical enzymatic digestion.
  - Where almost all nutrients are absorbed.

Organs of the Digestive System
– *Monogastrics* –

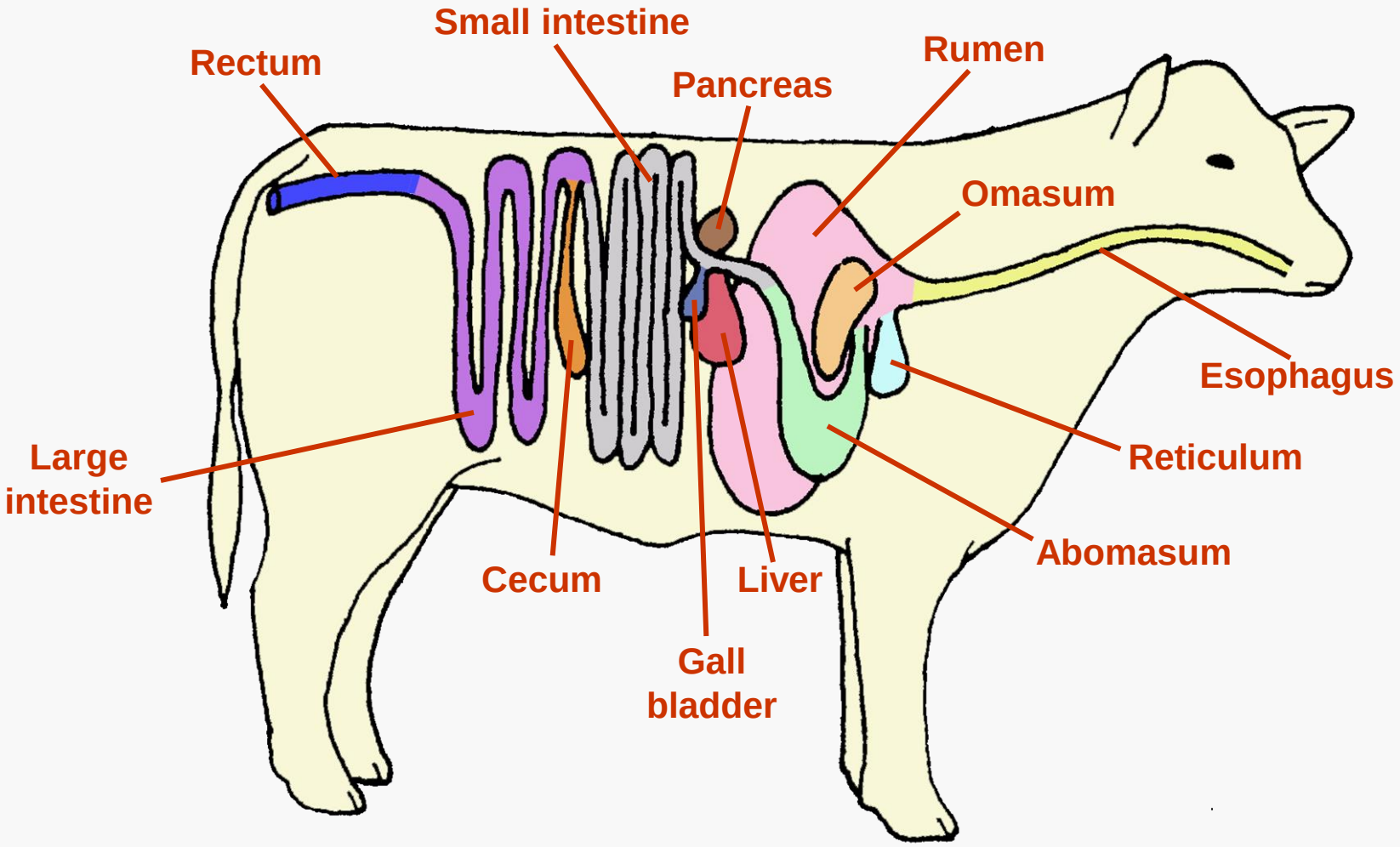
- Large Intestine
  - 3 sections – cecum, colon, rectum
  - Site of water absorption from G.I. tract.
  - Bacterial fermentation occurs (production and absorption of volatile fatty acids).
    - ✓ Somewhat limited in monogastrics
  - Feces formed.



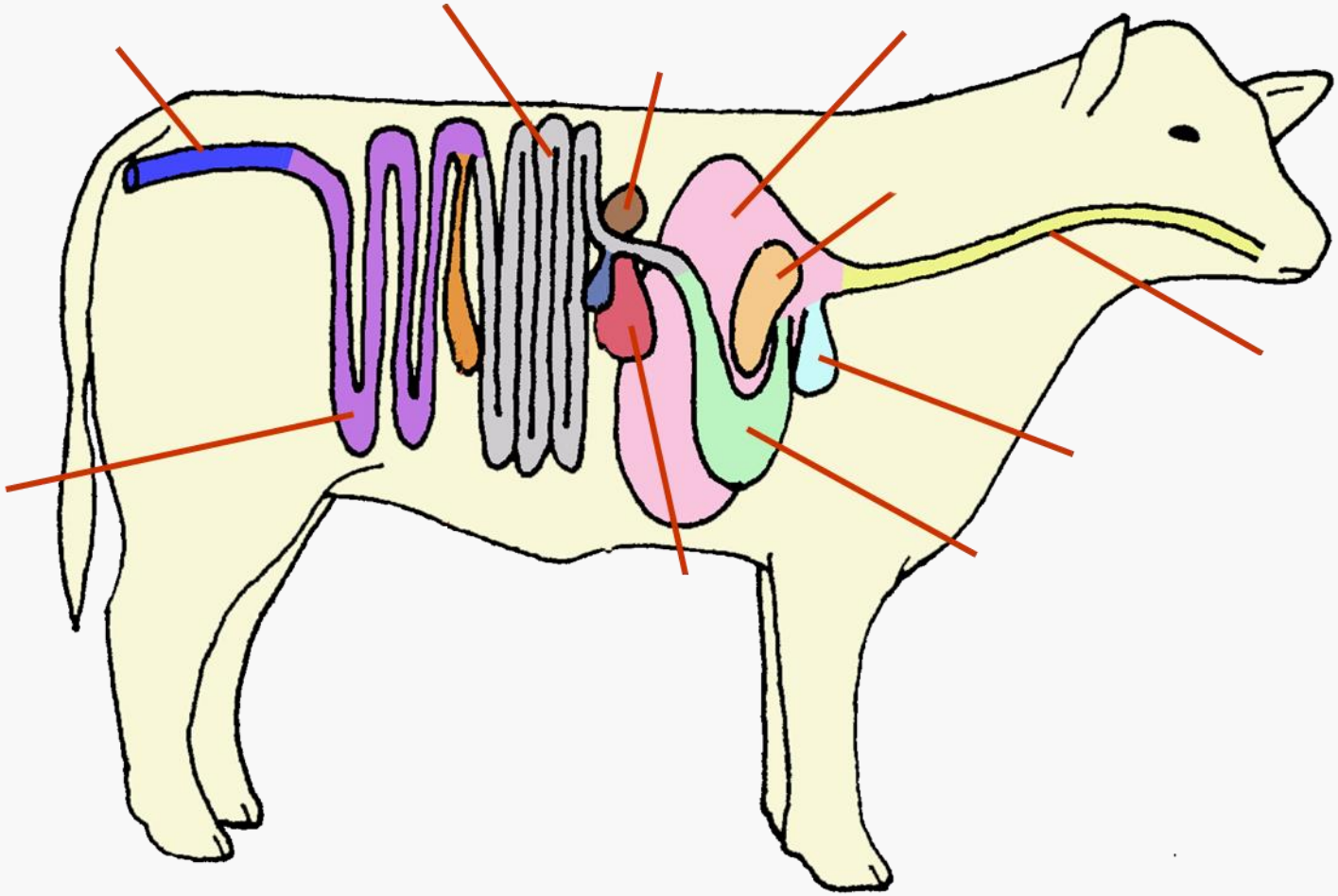
Basic Functional Anatomy of the Digestive System

– *Ruminants* –

Digestive Tract – Beef Cattle

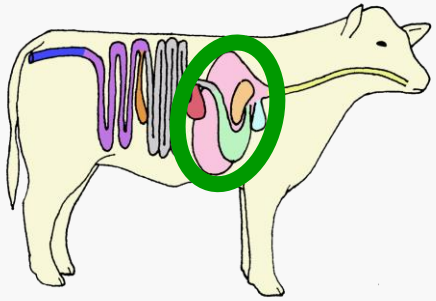


Digestive Tract – Beef Cattle



Organs of the Digestive System
– *Ruminants* –

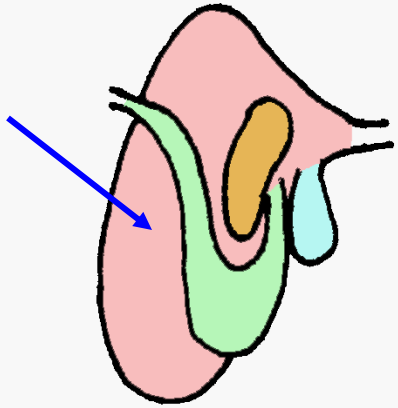
★ Mouth, esophagus, liver, pancreas, gall bladder, small intestine, and large intestine have functions similar to monogastrics.



- Stomach
  - Structure and function of the stomach is the major difference between monogastrics and ruminants.
  - Multi-compartmented stomach – rumen, reticulum, omasum, abomasum.

Parts of the Ruminant Stomach

- Rumen:
  - Large, anaerobic fermentation vat.

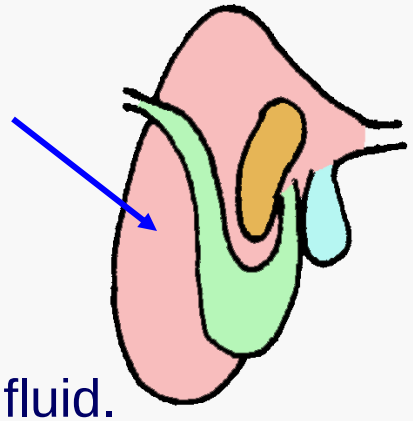


Rumen Capacity

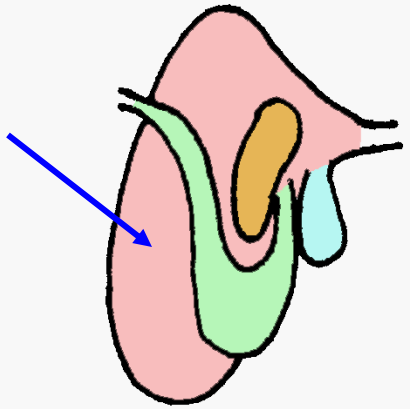
Species	Normal capacity	Maximum capacity
Cow (1000 lb)	25-30 gallons	55-60 gallons
Ewe (150 lb)	3-5 gallons	5-10 gallons

Parts of the Ruminant Stomach

- Rumen *(continued)*:
  - Houses microorganisms.
    - ✓ Protozoa – 100,000 per gram of rumen fluid.
    - ✓ Bacteria/fungi – 100 million per gram of rumen fluid.
  - Functions of microorganisms.
    - ✓ Digest roughages to make Amino Acids.
  - Amino Acids absorbed in rumen.

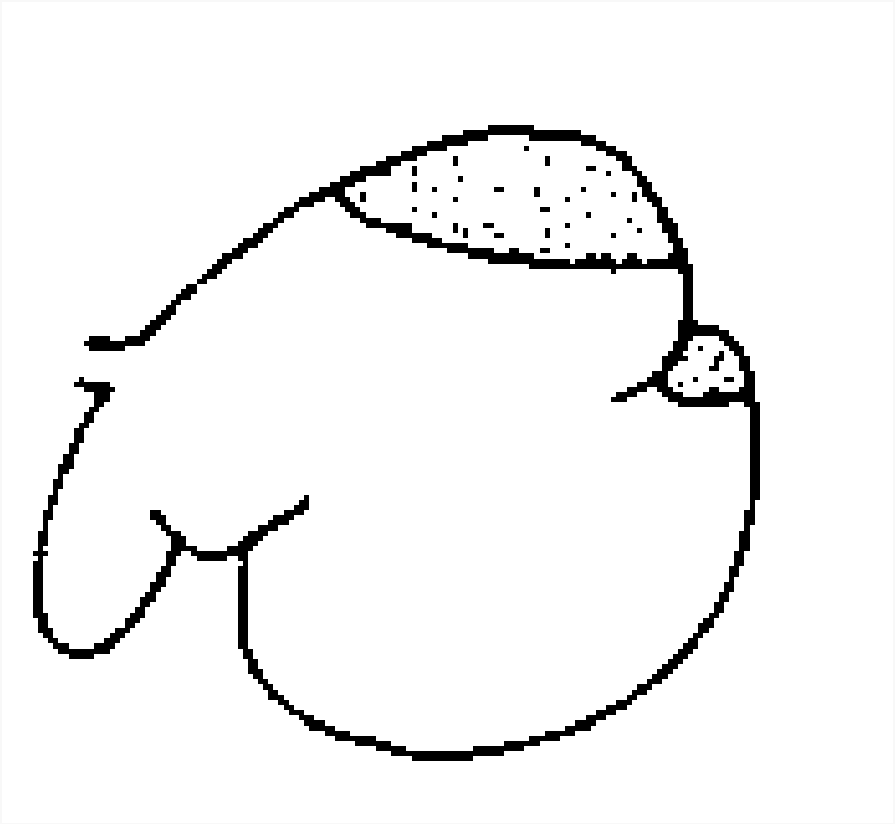


Parts of the Ruminant Stomach



- Rumen *(continued)*:
  - Lined with millions of papillae (short projections on wall of rumen) needed for absorption.
    - ✓ "Shag carpet" appearance

Parts of the Ruminant Stomach



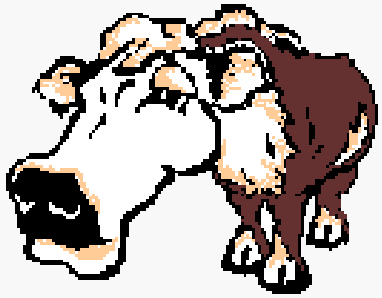
Rumen *(continued)*:

- Rumen saturated with gases and in constant motion.
- Contractions occur at a rate of 1-3 per minute.
  - ✓ Serve to mix contents, aid in mixing of gases, and move fluid and fermented feedstuffs into the omasum.

Taken from "Digestive Physiology of Herbivores"
http://arbl.cvmbs.colostate.edu/hbooks/pathphys/digestion/herbivores/

Parts of the Ruminant Stomach

- Rumination:
  - Ruminants are well known for “cud chewing”.
  - Rumination involves:
    - ✓ Bolus of previously eaten foodstuff carried back into the mouth.
    - ✓ Fluid in bolus is squeezed out with the tongue and reswallowed. May be up to 6-7 times per Bolus
    - ✓ Bolus is rechewed and reswallowed.
  - Rumination may occupy about 1/3 of a ruminant’s day



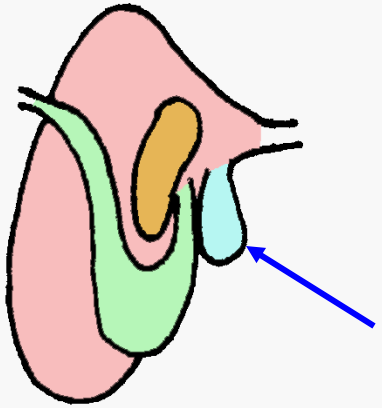
Parts of the Ruminant Stomach

- Fermentation of foodstuffs in the rumen generates enormous quantities of gas.
  - ✓ 30-50 liters per hour in adult cattle.
  - ✓ 5-7 liters per hour in adult sheep or goats.

- Belching is how ruminants get rid of fermentation gases:
  - ✓ Anything that causes a hindrance to belching can be life threatening.
  - ✓ Bloating can result in death from asphyxiation.

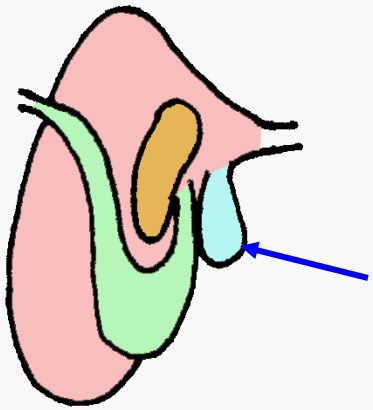
Parts of the Ruminant Stomach

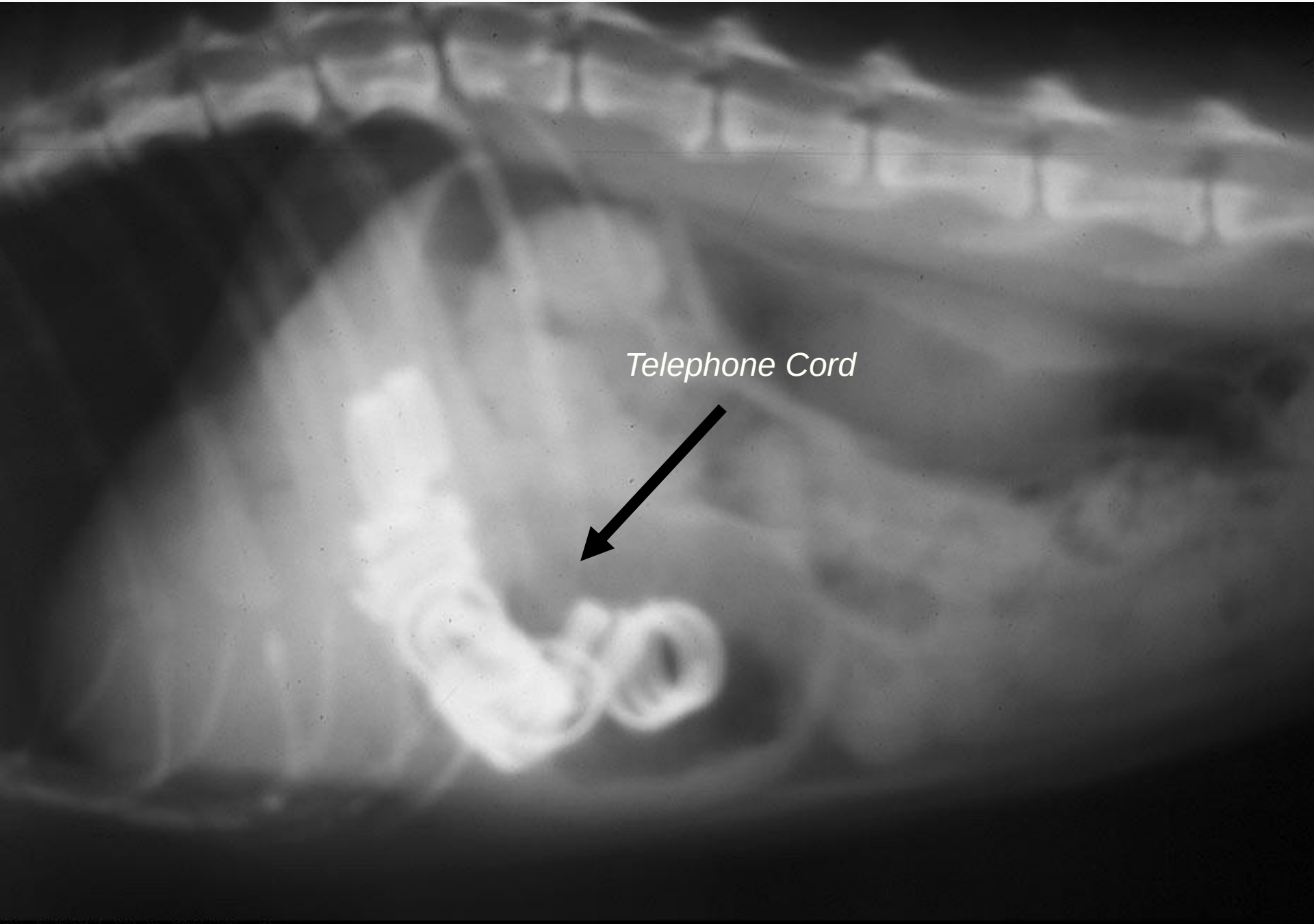
- Reticulum:
  - Contains microorganisms (like the rumen).
  - Provides additional area for fermentation.
  - As fermentation by microorganisms proceed and feedstuffs are digested, smaller and more dense material is pushed into the reticulum (from which it along with microbe-laden liquid is ejected into the omasum).

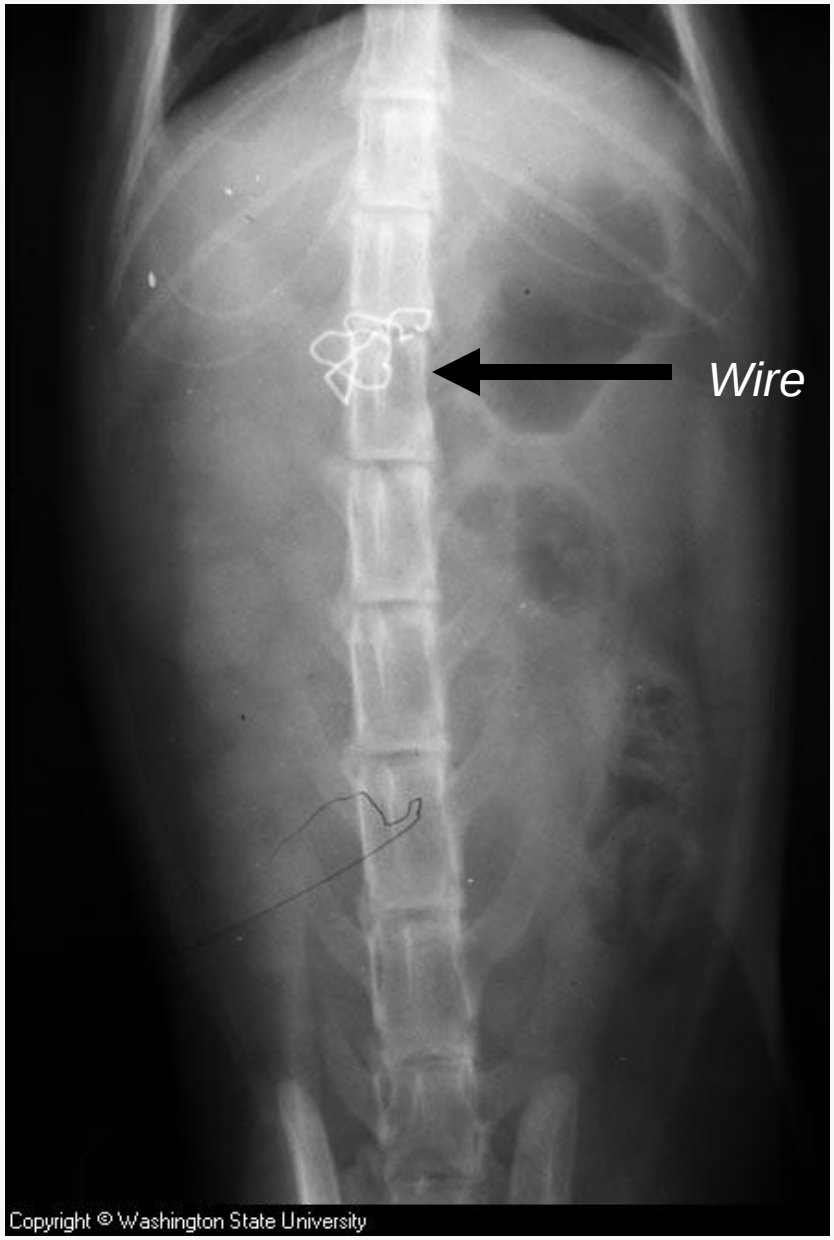


Parts of the Ruminant Stomach

- Reticulum *(continued)*:
  - Lining has a honeycomb structure.
    - ✓ Catches and holds hardware consumed by animal.
    - ✓ Hardware can be controlled with a rumen magnet.



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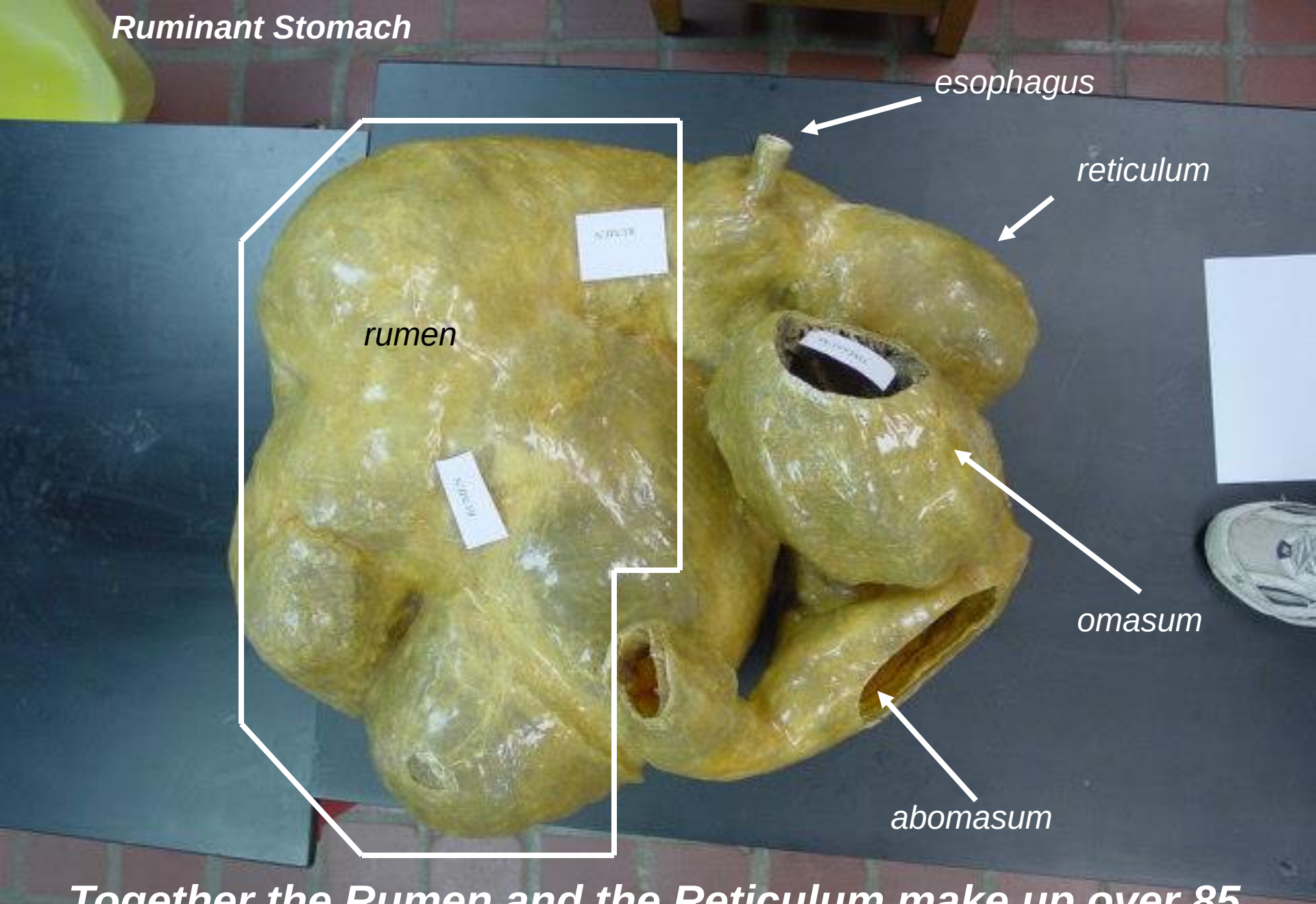
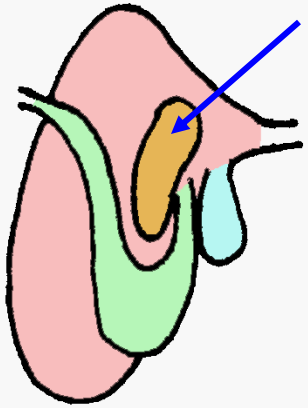


Together the Rumen and the Reticulum make up over 85 percent of the Rumen Stomach

Parts of the Ruminant Stomach

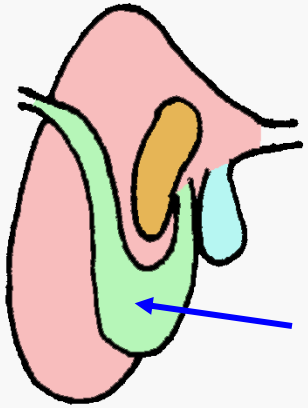
- Omasum:
  - A heavy, hard organ with a lining that has many folds (leaves).



  - Function: Contains papillae responsible for grinding roughage.
  - Description: Round, muscular part of stomach with many layers of tissue that squeezes feed and removes some liquid.

Parts of the Ruminant Stomach

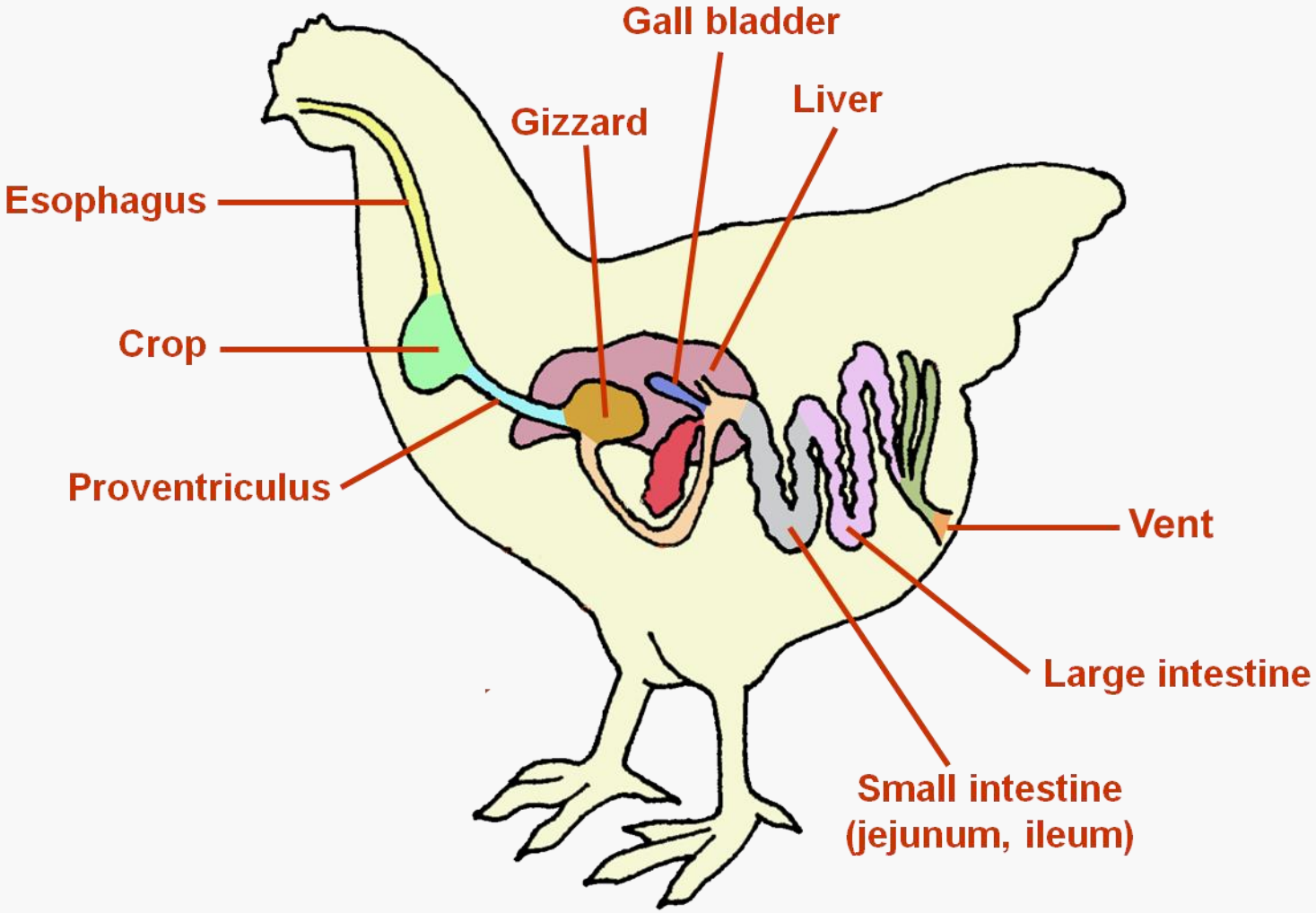
- Abomasum:
  - The true, glandular stomach.
    - ✓ Secretes acids and functions very similarly to monogastric stomach.
  - Unique feature is that it secretes lysozyme.
    - ✓ Enzyme that efficiently breaks down bacterial cell walls.
    - ✓ Needed to break down the large quantities of bacteria that pass from the rumen.



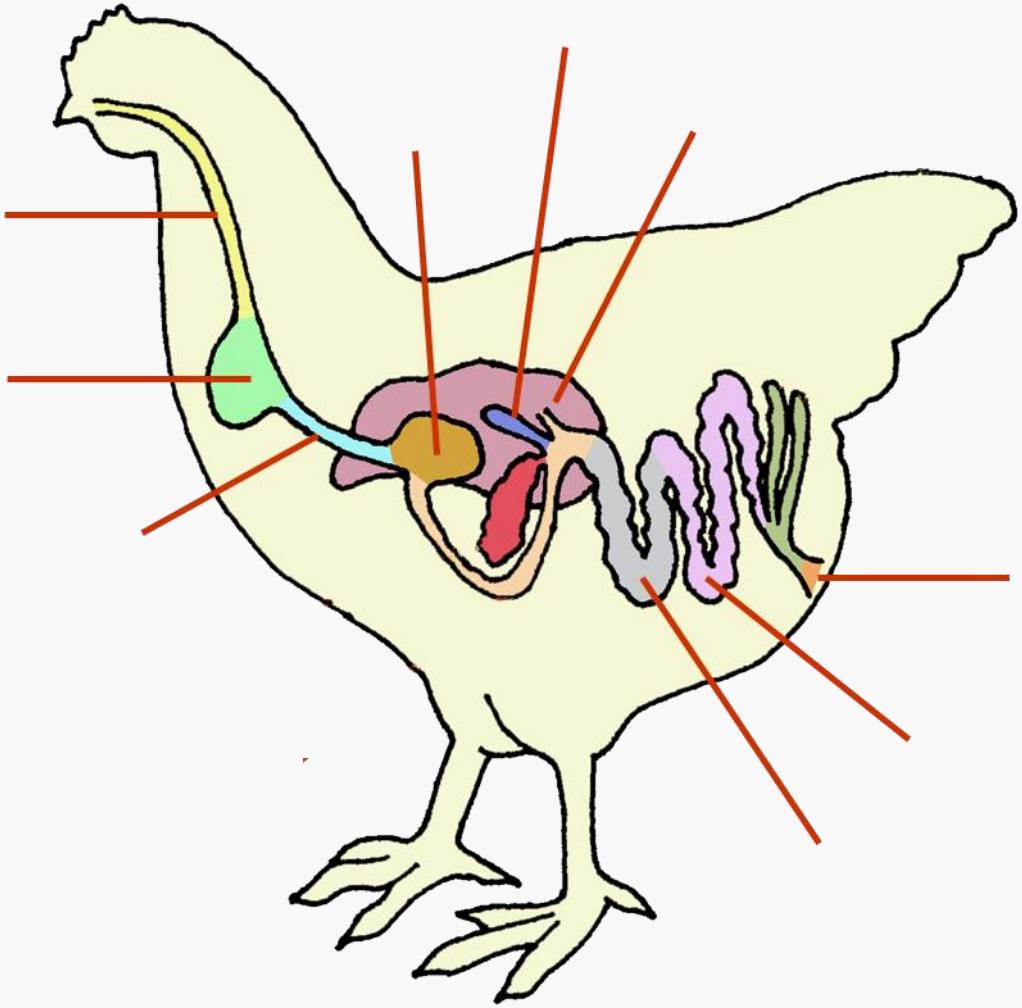
Basic Functional Anatomy of the Digestive System

– *Poultry* –

Digestive Tract - Poultry

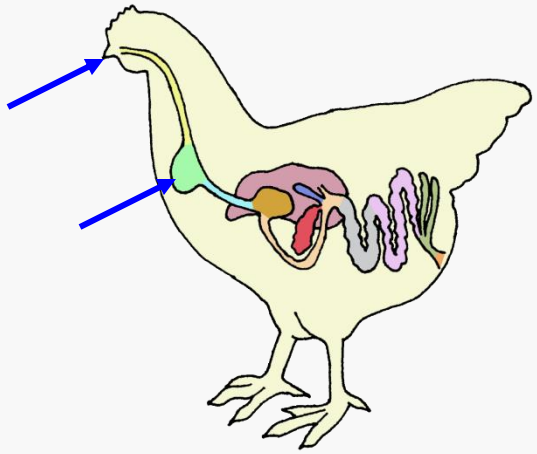


Digestive Tract - Poultry



Organs of the Digestive System
– *Poultry* –

Specialized Organs in Poultry

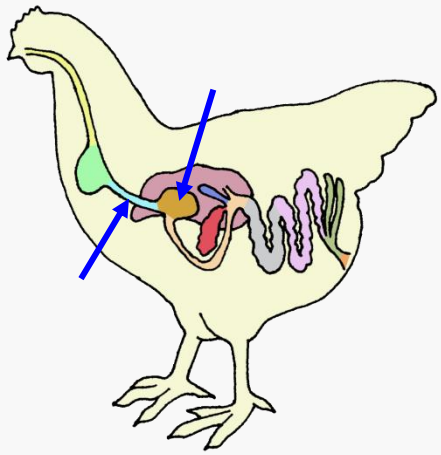


- Beak
  - No lips, no teeth, and no chewing.
- Crop
  - Out-pocketing of the esophagus that provides storage for consumed food.
  - Foodstuffs moistened and softened (little if any digestion).

Organs of the Digestive System
– *Poultry* –

Specialized Organs in Poultry *(continued)*

- Proventriculus
  - Glandular stomach where the first significant amount of digestive juices are added.
- Gizzard
  - A muscular organ used to grind and break up food.
  - May contain grit (small stones) eaten by animal.



Organs of the Digestive System
– Poultry –

- Grit that is commonly added to chicken feed to aid in digestion.

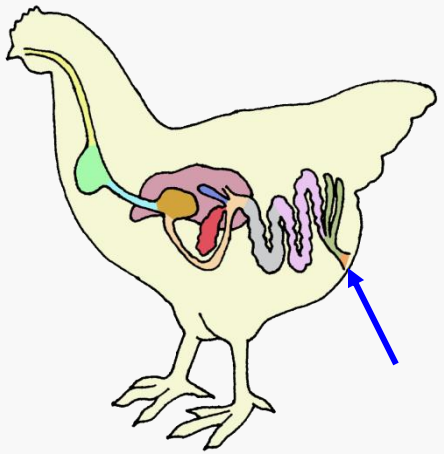
Organs of the Digestive System
– Poultry –

- Feed has to be very high in nutrients due to the rapid movement through the digestive system.

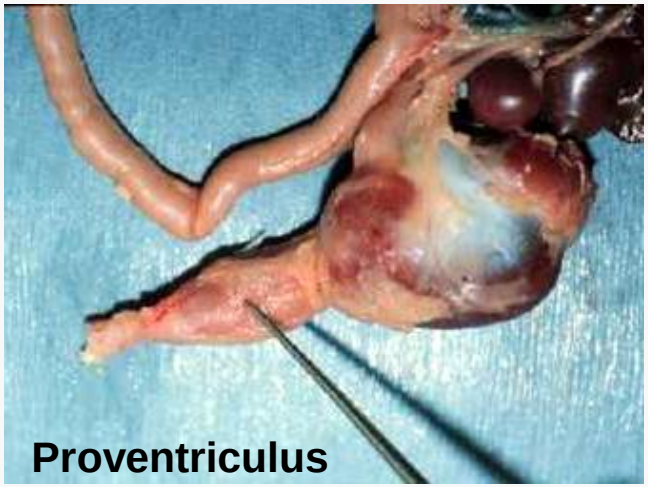
Organs of the Digestive System
– *Poultry* –

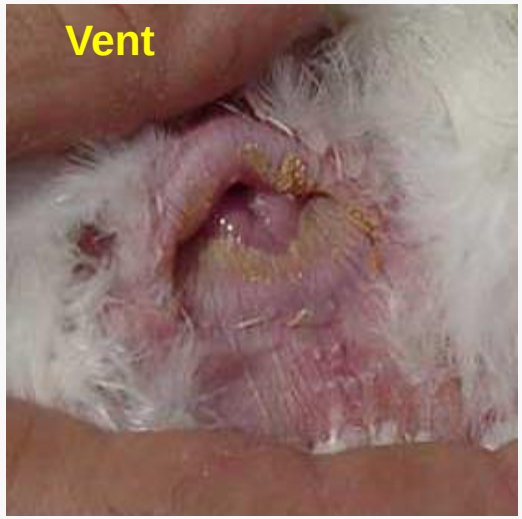
Specialized Organs in Poultry *(continued)*

- Vent
  - Common chamber into which the digestive, urinary, and reproductive tracts open.
    - ✓ When fecal material is excreted, the vent folds back allowing the rectal opening of the large intestine to push out, closing the reproductive tract opening.



Specialized Poultry Organs





Summary

Summary

- There are three (3) basic types of digestive systems in farm animal species.
  - Monogastric
  - Ruminant
  - Poultry
- The type of digestive system influences the dietary foodstuffs the animal can effectively utilize.

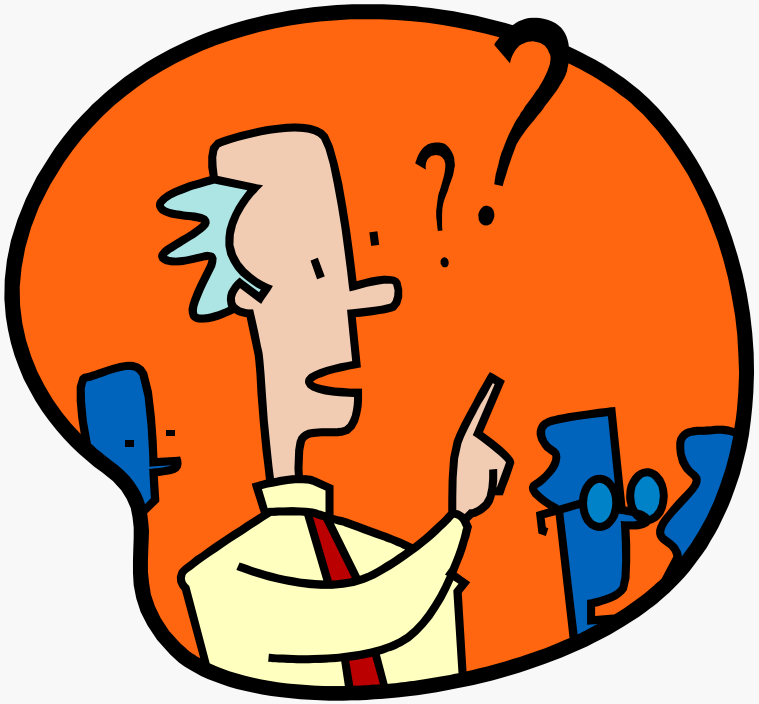
- Horse Digestion
- Inside Poultry Digestion
- How animals get food

Digestive Tract Capacities

	Sheep/Goats	Cattle	Swine	Horses
Rumen	5-10 gal	55-60 gal	----	----
Reticulum	1.5 qt	3-4 gal	----	----
Omasum	1 pt	1-2 gal	----	----
Abomasum	1.5 qt	3-4 gal	----	----
Stomach	----	----	2 gal	2-3 gal
Small intestine	2.5 gal	17-18 gal	2.5 gal	12-15 gal
Small intestine length	*85-90 ft*	*130 ft*	*60 ft*	*70 ft*
Large intestine	1.5 gal	10 gal	3 gal	30-35 gal

THE END

Any questions?




Play-Doh

Digestive System Paper

Introduction

Similarities: Ruminant and non-ruminant

Differences: Ruminant vs. non-ruminants

Differences : Poultry vs. Ruminant and Non-ruminants

Conclusion