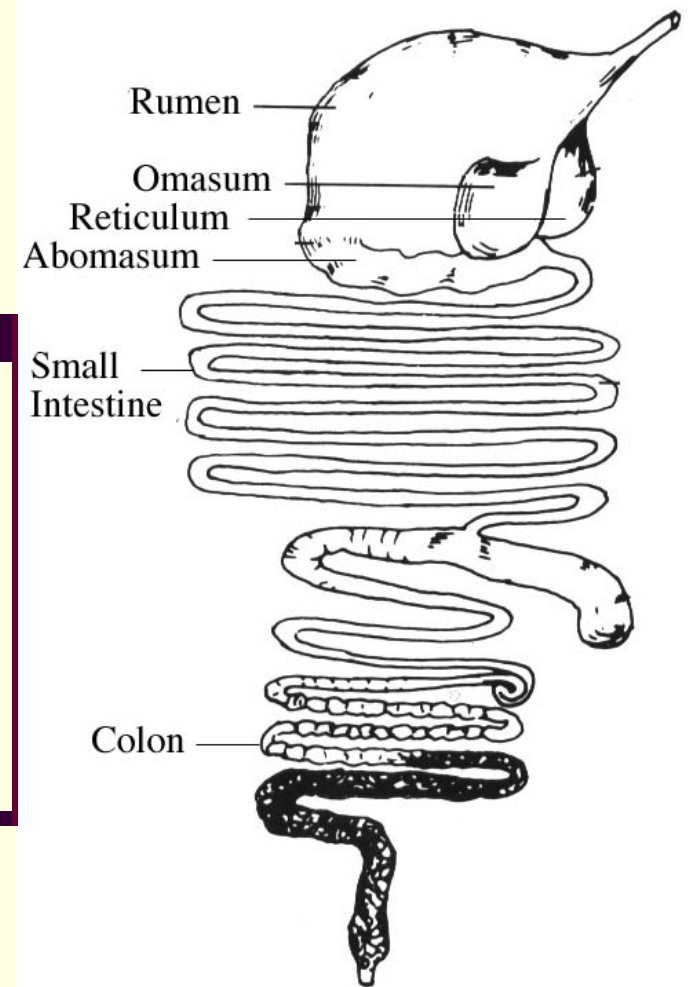
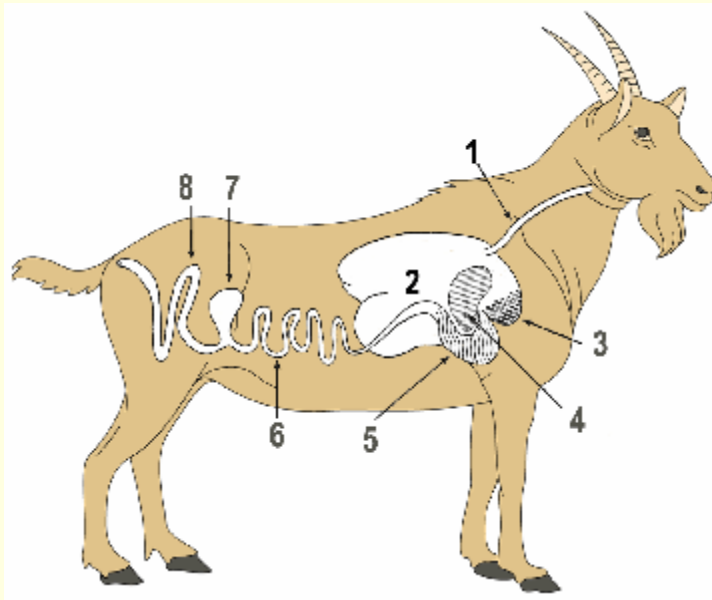


The Goat's Digestive System

Roy Beckford
UF/IFAS
Lee County

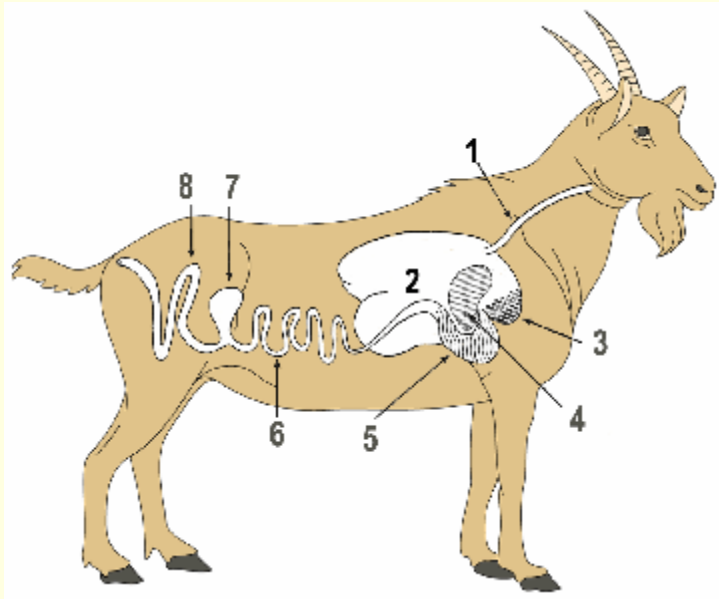


Ruminants



- The goat is a member of a class of animals called ruminants. These animals ruminate (chew their cud).
- Unlike us, they have special four-compartment stomachs especially designed to digest roughage (food high in fiber) such as grass, hay and silage.

Ruminants



- 1. Esophagus
- 2. Rumen (paunch)
- 3. Reticulum (honeycomb)
- 4. Omasum (Manyplies)
- 5. Abomasum (true stomach)
- 6. Small Intestine
- 7. Cecum
- 8. Large Intestine

Upper Gastrointestinal Tract

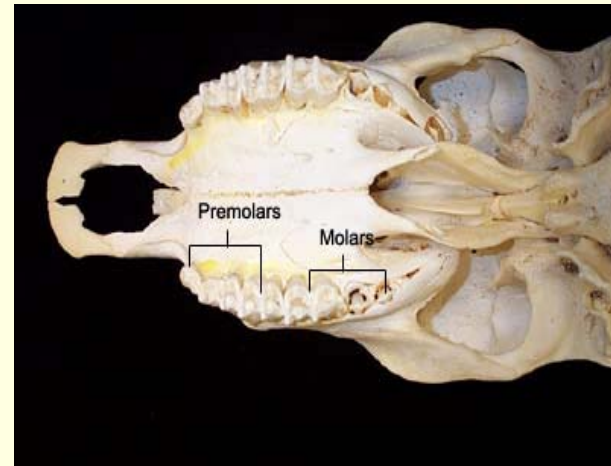
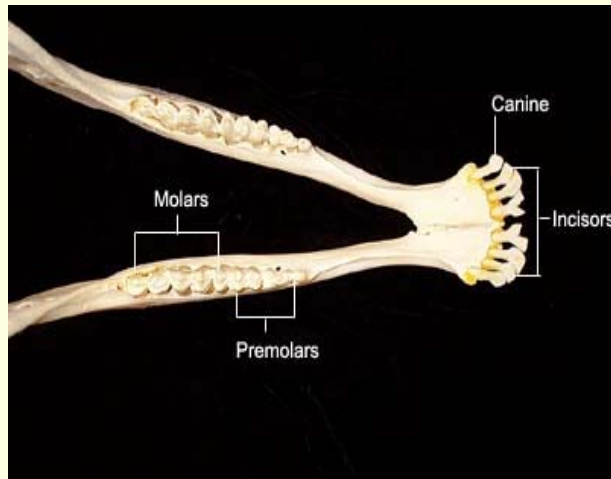
- Mouth (buccal cavity; includes salivary glands, mucosa, teeth and tongue)
- Pharynx
- Esophagus (gullet)
- Stomach.

Dentition (teeth)



- A prominent feature of ruminant dental anatomy is that they lack upper incisors, having instead a "**dental pad**", as shown in the image to the right of a goat.

Permanent teeth



- Permanent $\frac{0\ 0\ 3\ 3}{3\ 1\ 3\ 3} = 16\ (x\ 2)$

Chewing



- Chewing is the first step in processing the food.
- This is no small task as the goat makes 40,000 to 60,000 jaw movements per day as it chews and re-chews regurgitated feed.

Chewing and Swallowing

- When roughage is eaten by the adult goat, it is chewed on, soaked with saliva, and then swallowed.
- This bolus of food is called “the cud”.



Cudding

- It goes down into the rumen to be attacked and broken down or digested by the micro-organisms.
- At regular intervals the cud is brought back up to the goat's mouth to be chewed on some more and then swallowed again.
- This entire process is called rumination.



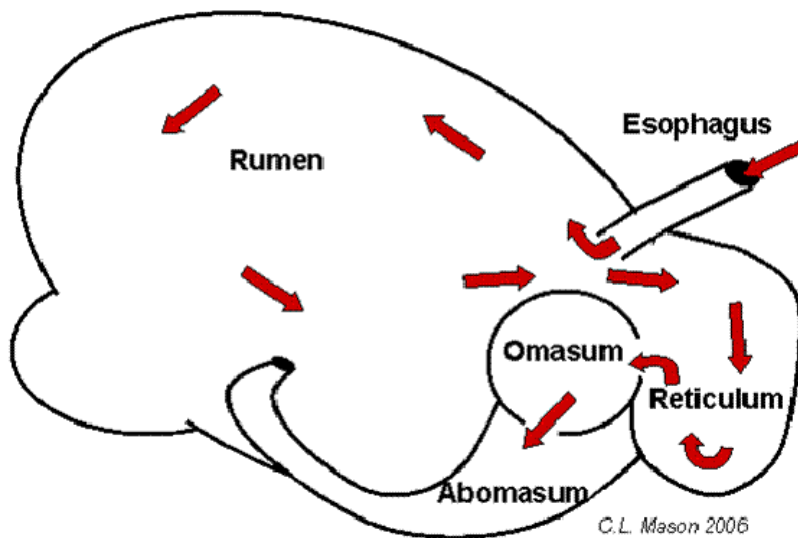
Cudding and Burping

- If you watch the goat's neck carefully, you can see him swallow and later regurgitate his cud.
- The goat will often burp to get rid of the gas produced by all the fermentation going on in his rumen.



The Goat's Stomach

Digestive flow of a ruminant stomach



- The goat's stomach has four chambers:
- 1) the rumen,
- 2) the honey-combed reticulum,
- 3) the omasum, and
- 4) the abomasum or true stomach.

The Immature Chambers



- The size relationship of the four chambers changes as the animal grows up.
- The abomasum gets proportionally smaller.
- To understand why this happens, let's consider the function of each compartment and then review the goat's diet.

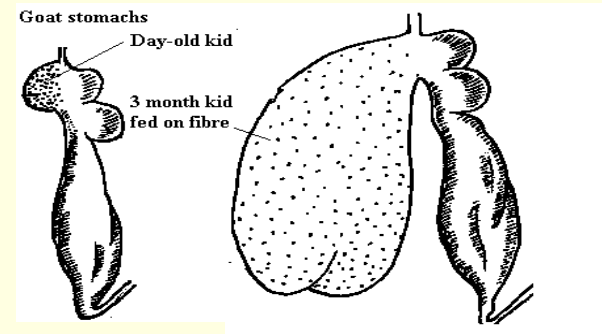
Digestion in kids

- When a goat kid is born, its rumen, reticulum and omasum are very tiny and not useful. The goat kid depends on a liquid, milk, not roughage for its feed source.
- When the kid swallows milk, the milk goes directly to the abomasum through the esophageal groove.



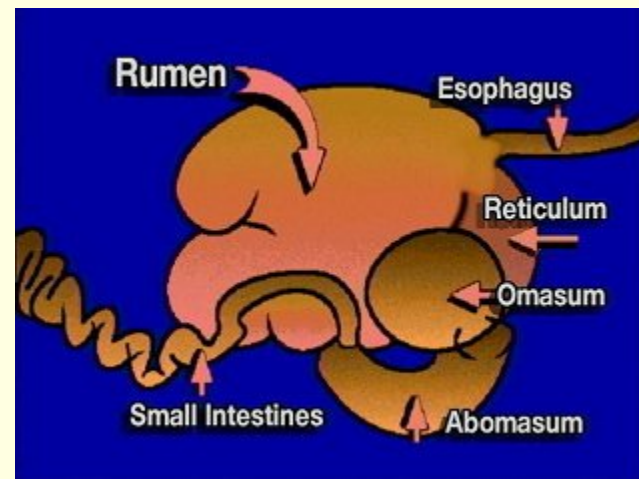
The Kid's Stomach

- Everytime the kid swallows, a flap of skin at the entrance to the rumen folds over to form a groove that bypasses the rumen and sends the milk straight to the abomasum to be digested by stomach acid.

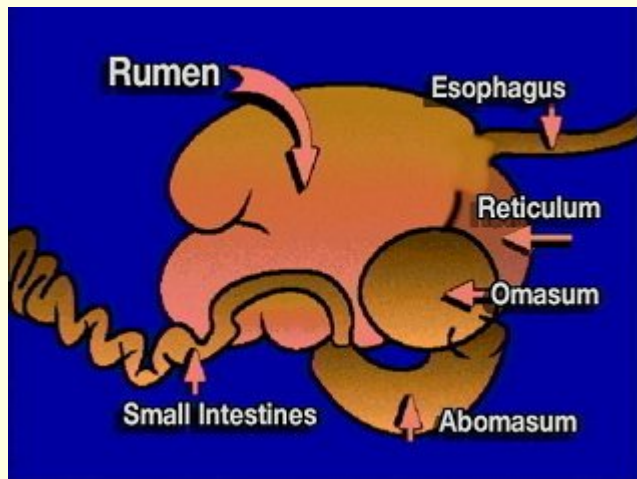


Rumen Development

- As the kid gets older, he starts trying to consume roughage.
- The rumen becomes active and starts to enlarge. Its population of micro-organisms increases.



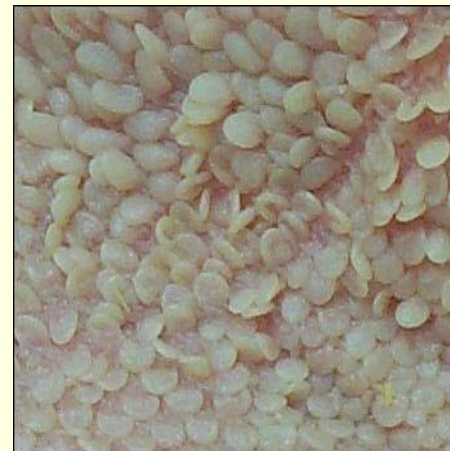
Rumen Enlargement



- The reticulum and omasum also respond to the changes in diet by getting bigger.
- By the time the kid is an adult goat, roughage is his main source of food and his rumen is far larger than his abomasum.

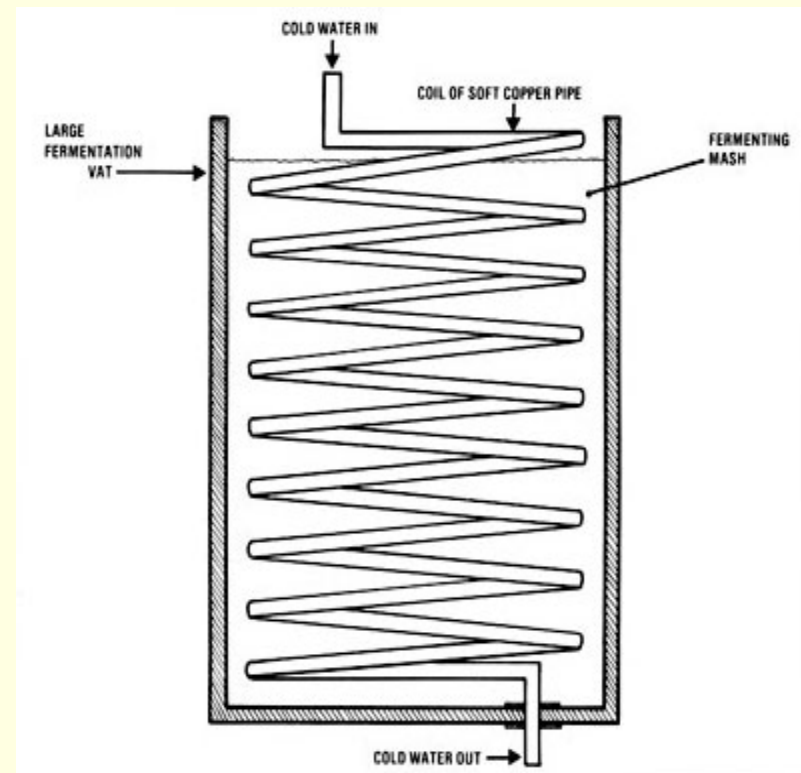
1. The Rumen

- The rumen acts as a big fermentation vat.
- Bacteria and protozoa in the rumen supply enzymes to break down the fiber in the goat's feed.



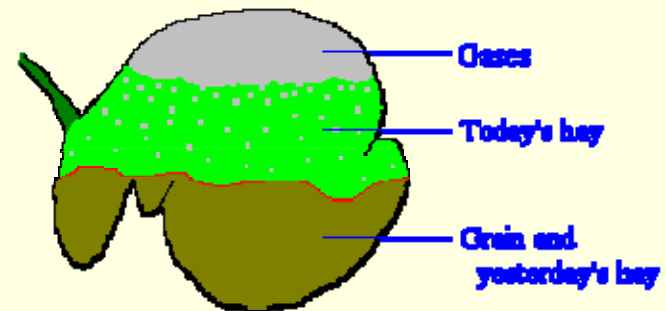
Rumen (fermentation)

- This is similar to how bacteria can ferment the sugars in grape juice to make wine in big wine barrels.



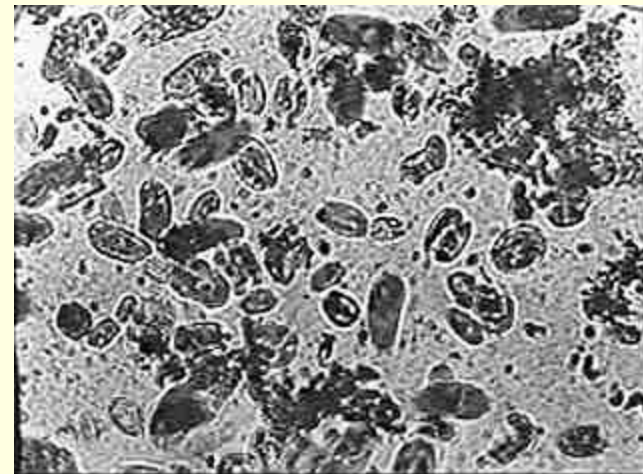
Rumen (fermentation)

- You can really smell the fermentation process on a goat's breath.
- If something causes the goat to stop being able to burp up the gases, the gas will build up and bloat or swell up his rumen and he may become very sick with "bloat".



Rumen (digestion)

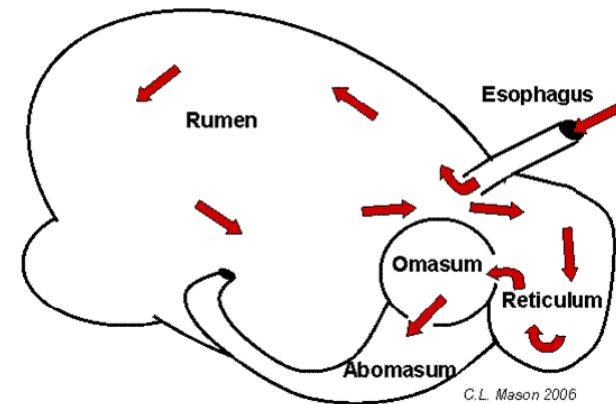
- The tiny organisms also help to build proteins from the feed and manufacture all of the B vitamins needed by the goat. Many nutrients that help provide the goat with energy are also absorbed here.
- Two primary types of rumen microbes - fiber digesting, and starch (grain) digesting



2. The Reticulum

- Once the food particles of cud become small enough, they pass to the second compartment or reticulum.
- Here any foreign objects that may have been accidentally swallowed with the feed settle out in the honeycomb structure of the reticulum's walls.
- Another name for the reticulum is the “hardware stomach”.

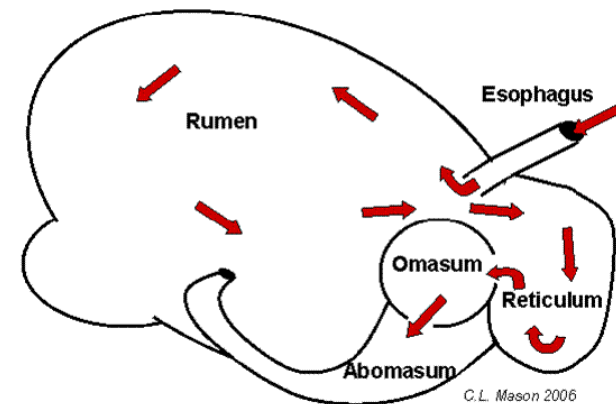
Digestive flow of a ruminant stomach



3. Omasum

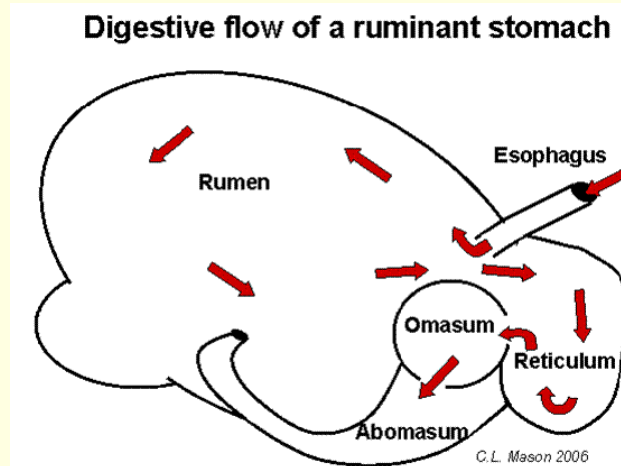
- The fermenting particles then pass on to the omasum.
- The omasum removes the water from them and also absorbs more nutrients called volatile fatty acids that help supply the goat with energy.

Digestive flow of a ruminant stomach



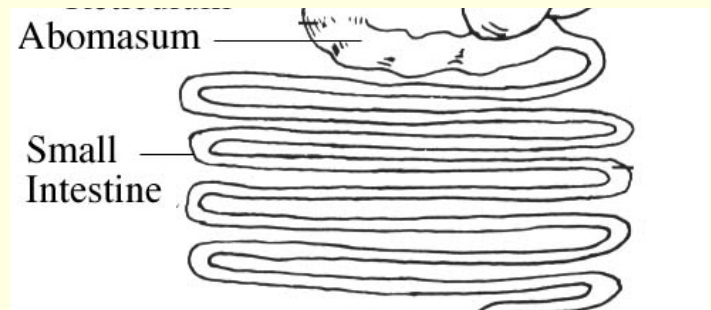
4. Abomasum

- The particles are then forced into the abomasum or true stomach.
- Here, the particles are digested by the stomach acid, hydrochloric acid (HCl). This form of digestion is the same as what occurs in our stomachs.



The Small Intestines

- The remaining particles are then passed on to the small intestine where most of the nutrients are absorbed by the body and made available to the goat.
- The small intestine is a 100 foot-long, 1 inch-wide tube.



Lower Gastrointestinal Tract

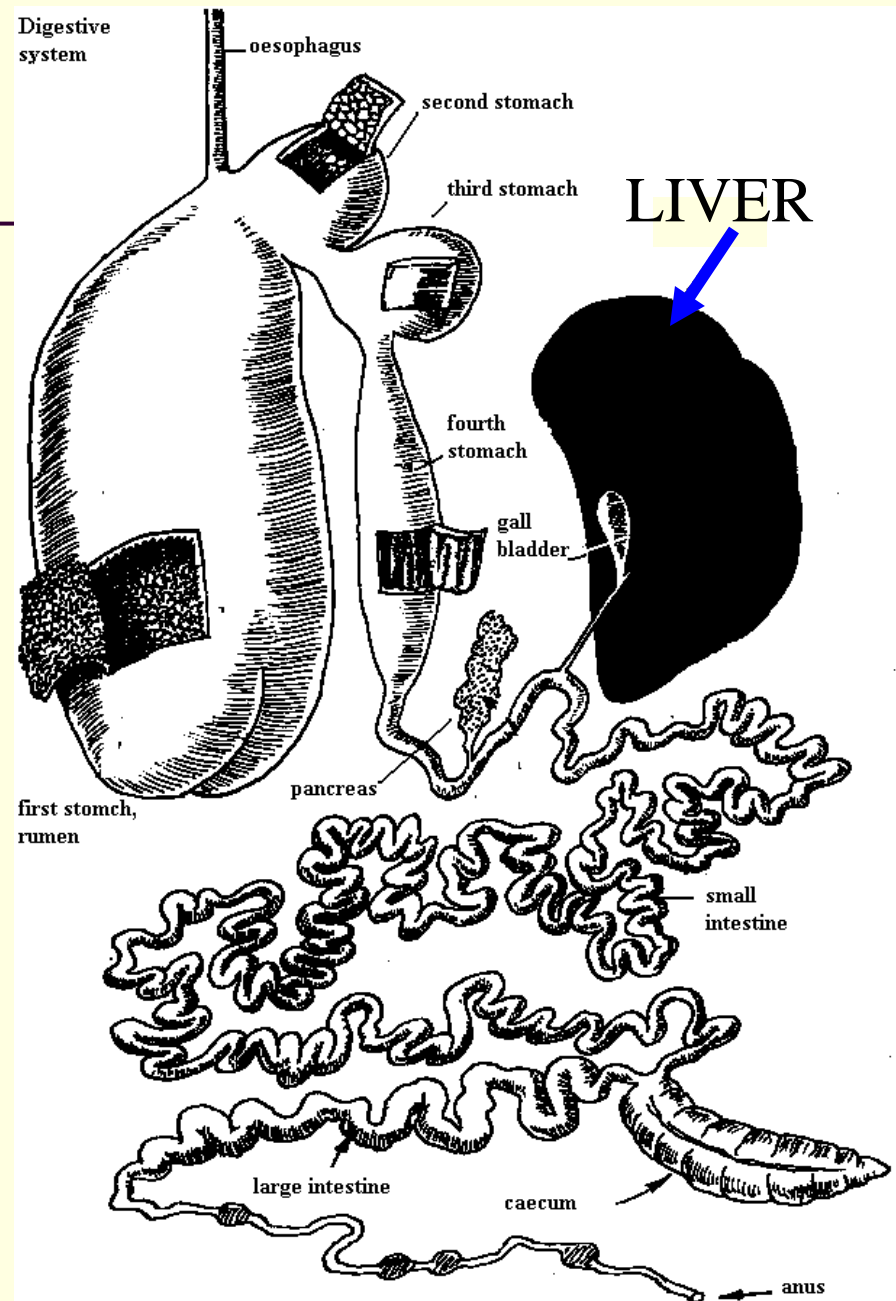
- *Bowel or intestine:*
 - small intestine has three parts:
 - duodenum
 - jejunum
 - ileum

The Small Intestines

- As the feed enters the small intestine, it mixes with secretions from the pancreas and liver
- Enzymes reduce any remaining proteins to amino acids, starch to glucose, and complex fats into fatty acids.

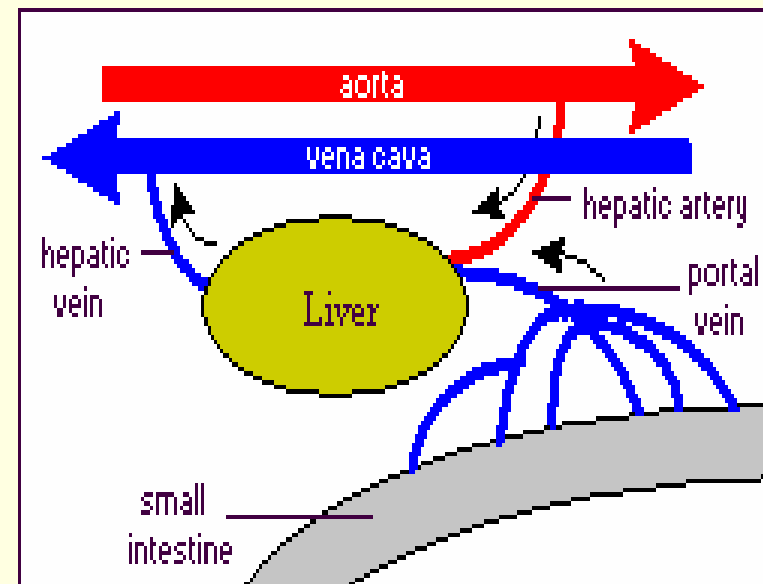
The Liver

- All of the venous blood returning from the small intestine, stomach, pancreas and spleen converges into the portal vein.



The Liver

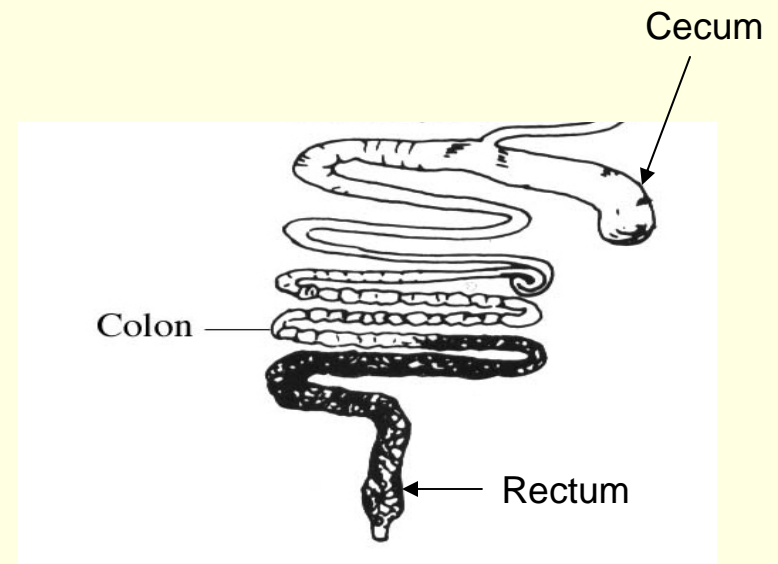
- One consequence of this is that the liver gets "first pickings" of everything absorbed in the small intestine, which is where virtually all nutrients are absorbed.



The Large Intestines

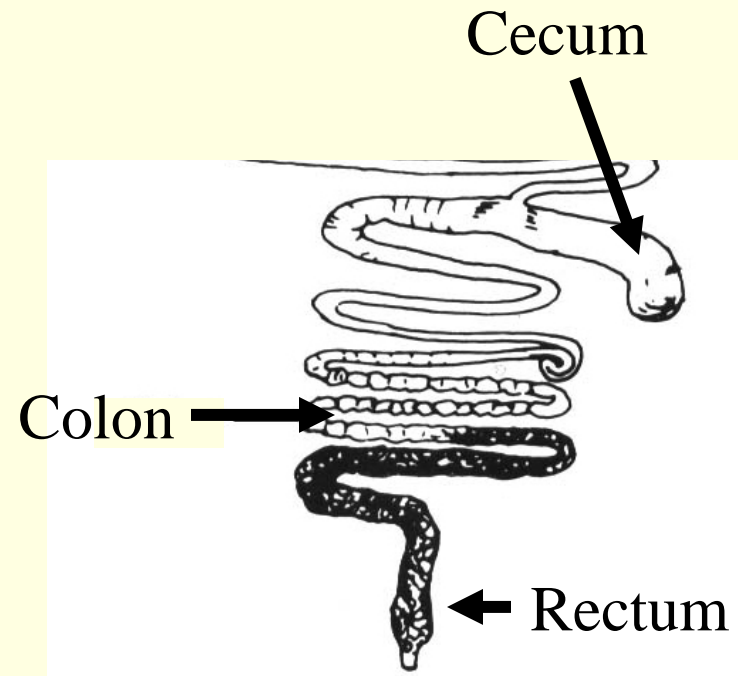
The Large intestine has three parts:

- Cecum
- Colon
- Rectum



Large Intestines

- The cecum, colon, and rectum make up the rest of the digestive tract.
- They are collectively referred to as the large intestine.
- Its primary purpose is to absorb water from the digesta thus making it more solid.



Large Intestines

- Bacteria living in the large intestine work at digesting any feedstuffs which escaped digestion earlier.
- This contributes less than 15% of the total digestion.

Uses of gut

- The use of animal gut strings by musicians can be traced back to the third dynasty of Egypt.
- Sheep gut was the original source for natural gut string used in tennis rackets.
- "Natural" sausage hulls (or casings) are made of animal gut.
- 'Catgut' is the name given to sheep intestines which was used to make absorbable sutures

Defecation



- End of the tract



...Or end of this presentation