Lecture 1

The Nature of ruminant Stomach

The stomach of ruminants has four compartments:

The rumen

The reticulum

The omasum

The abomasum

Collectively, these organs (i.e stomach) occupy almost 3/4ths of the abdominal cavity. It fills virtually all of the left side and extending significantly into the right.

The rumen

The rumen is the largest of the fore stomaches. It is sacculated by muscular pillars into what are called the dorsal, ventral, caudo-dorsal and caudo-ventral sacs.

The Function of the Rumen

The rumen is the largest portion of "stomach“. It is a fermentation vat filled with microbial populations which collaborate to digest cellulose and other polysaccharides, producing carbon dioxide, methane and organic acids.

The rumen is an **anaerobic** environment; i.e. no oxygen. Ingested food first enters the rumen (pH 6.5, temperature of 30^0C) where it is microbially digested for ~ 9 hours. **T**he gaseous products of the microbial degradation are expelled from the animal (eructation). **T**he material from the rumen, called the cud, is regurgitated.

This regurgitated mixture of microorganisms and partially digested materials then travels through the abomasum, the omasum (pH ~ 2), and the rest of the digestive tract, for further digestion.

Microbes are also capable of producing protein from simple nitrogenous compounds.

Microbes produce B-complex vitamins. Microbes eventually die and are digested and absorbed for nutrients in the Small Intestine. Microbes are very useful for the digestion of forages but inefficient in the use of starches and proteins digestion.

The abundant volatile fatty acids produced by fermentation in the rumen are readily absorbed across the rumen epithelium.

The Reticulum

The reticulum lies against the diaphragm and is joined to the rumen by a fold of tissue.

In many respects, **the reticulum** can be considered a "cranioventral sac" of the rumen; for example, ingesta flow freely between these two organs.

The reticulum is connected to the spherical **omasum** by a short tunnel.

Function in the Reticulum

Honeycomb appearance which interacts with rumen to mix and stir feed. It provides additional area for fermentation.

The Omasum

The omasum is sometimes referred to as the "manyplies" because of its many layers of muscular tissue.

In the omasum, the particle size of digesta is reduced, and any excess water is removed before the digesta enters the abomasum. The omasum can contain up to 16 litres of digesta.

It may function to absorb residual volatile fatty acids and bicarbonate. The tendency is for fluid to pass rapidly through the omasal canal, but for particulate matter to be retained between the omasal leaves.

Periodic contractions of the omasum knocks flakes of material out of the leaves for passage into the abomasum.

The Abomasum

The fourth compartment is the abomasum or "true stomach."

This is where acids and enzymes are secreted to further digest the digesta. It is the first true glandular portion of the gastrointestinal tract where the stomach walls secrete enzymes.

It functions very similarly to the stomach of many simple stomached animals such as the pig.

This stomach compartment can hold approximately 20 litres of material in cattle. The time that digesta remains in the abomasum is very short compared to the retention time of feeds in the rumen.

The presence of food in the abomasum stimulates hydrochloric acid production.

Hydrochloric acid converts pepsinogen to pepsin, which breaks down protein to shorter molecular chain compounds such as peptides and amino acids for further digestion and absorption in the small intestine.

The true stomach has a low pH of 2 to 4, due largely to this acid production.

Some fat digestion also occurs in the true stomach.

Digesta flowing from the abomasum to the small intestines is composed of small particles suspended in liquid digesta.

One fascinating specialization of this organ relates to its need to process large masses of bacteria.

In contrast to the stomach of non-ruminants, the abomasum secrets lysosome, an enzyme that efficiently breaks down bacterial cell walls.