

Rumen Physiology for the Rancher

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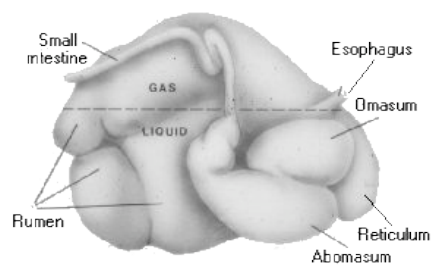
The Ruminant

- Chews cud and has 4 compartment stomach
- Converts forages to protein for consumers

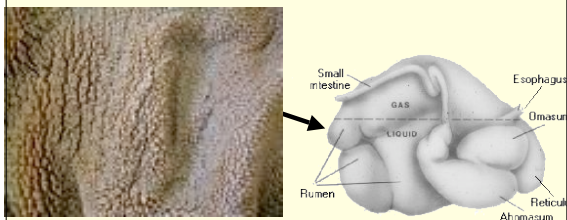
Why Study Basics?

- Understanding will aid in making better feeding and management decisions

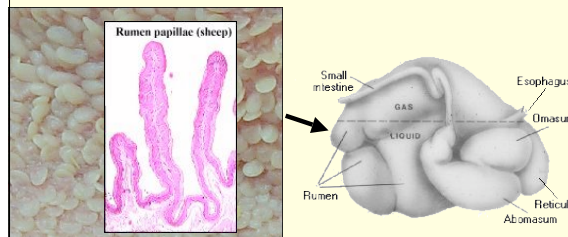
The Stomachs



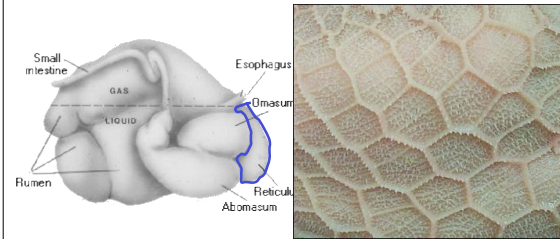
Rumen Papillae



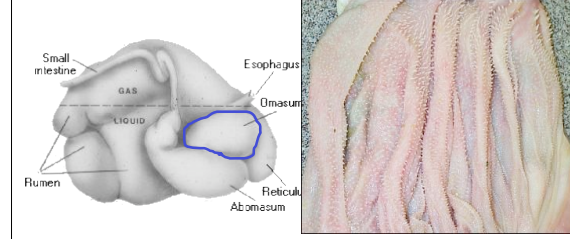
Rumen Papillae



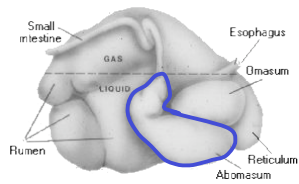
Reticulum



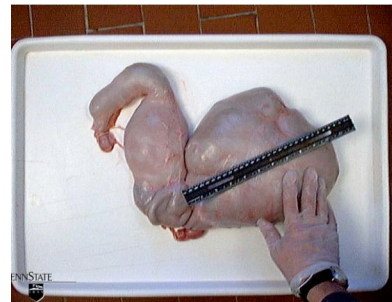
Omasum



Abomasum – true stomach



Stomach in Young Calf

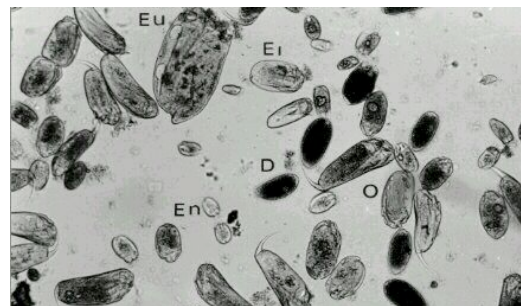


Calf Rumen, 4 Weeks of Age
Diet: Milk and Hay

Rumen Microorganisms

- Bacteria
 - By far the most numerous and productive
 - More than 1,000,000,000,000 in 1 oz of rumen fluid
- Protozoa
 - Much larger – can be viewed easily with low power scope
- Fungi
 - Very small fraction

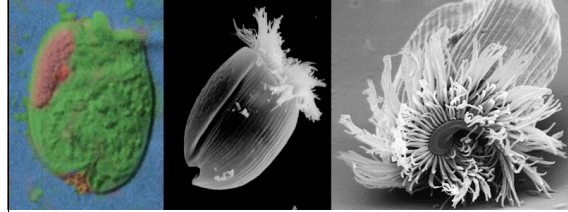
Protozoa



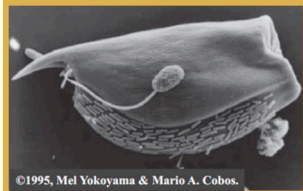
Protozoa



Protozoa



Protozoa



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The large microbe is a type of protozoan. The creature that looks like a tadpole attached to the side of the protozoan is a fungal spore. The smaller, rod-shaped beasts lining the underside of the protozoan are bacteria.

Paul Weimer, Rumen Microbiologist, USDA-ARS Madison, WI –Fact Sheet 2007

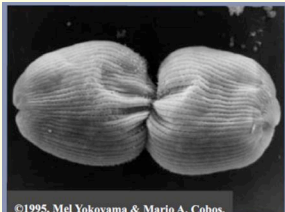


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This rumen protozoan is covered with chains of bacteria. Some protozoal and bacterial cells actually have a symbiotic relationship, each giving the other something that it needs to survive. Protozoa can consume 1000+ bacteria/hr

Paul Weimer, Rumen Microbiologist, USDA-ARS Madison, WI –Fact Sheet 2007

Reproduction of Microbes



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Most rumen microbes, like this protozoan, grow by increasing their cell size, then splitting in half to make two cells. Under ideal conditions, most species of rumen bacteria can double their populations in a few hours.

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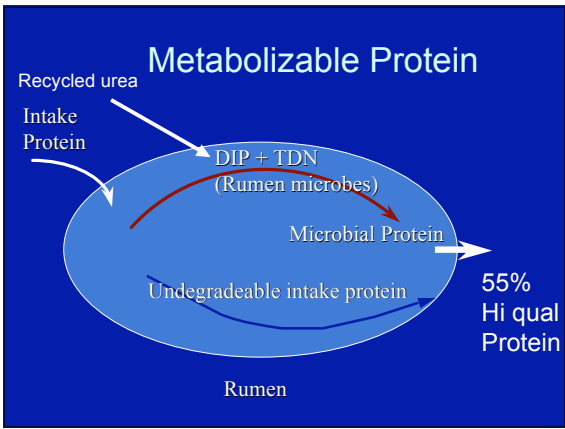
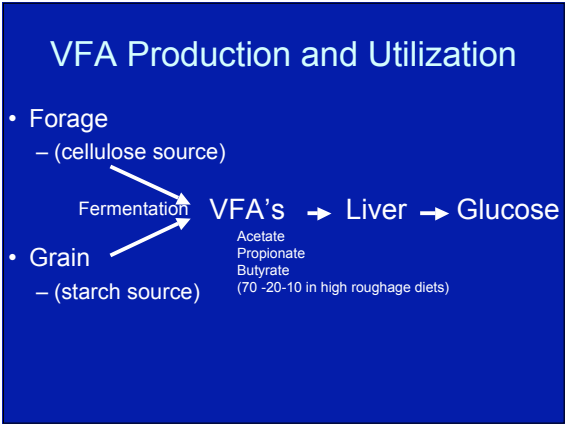
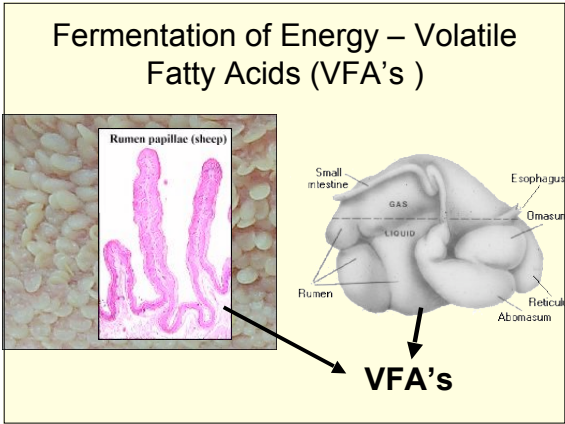
Fiber Digestion



Photo by Lydia Joubert.

Bacteria attacking a strand of fiber that was taken from a cow's rumen.

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Can This Be Applied ?

- Starch's effect forage digestion
- When starch (grain) is fed, acid level will increase (pH drops) and a shift in micros occurs and digestibility of forages will decrease
- Feeding energy is often desired
 - If protein is adequate energy fed will increase performance

Protein Supplementation of Low Quality/Protein Forages

- Protein will increase microbial levels and forage digestion will increase
- Microbes need a source of degradable protein – some recycled
- By product feeds will add energy and protein with complimentary effects on forage digestibility

Ionophores

- Increases the level of propionate decreasing the level of acetate
- Propionate is more efficiently converted to glucose
- Methane production is decreased
- Serve as coccidiostat

Feed additives

- Direct Fed Microbial (DFM)
 - Originally fed to overwhelm the pathogens in the gut – probiotics
 - Late 80's feed industry agreed with FDA to define as DFM – live natural occurring microorganisms
 - Currently fed to alter rumen fermentation
- Greater interest in “all natural claim cattle”

DFM – *Lactobacillus acidophilus*

- Perhaps most researched
 - Majority of trials with young calves, lactating dairy cows and stressed calves at receiving has shown positive results
 - Results more variable, but positive, in finishing cattle (2-5% in gain and 2% in FE)
 - Some indications to possibly reduce acidosis and shedding of *E coli* 0157
 - Limited controlled data on beef cows

DFM - *Propionibacteria*

- More recent research
 - Is a lactate utilizer and produces propionate

Enzymes

- *Aspergillus Oryzae* is perhaps is the most popular – Amaferm is an example
- Aid in fiber digestion
- Has shown improvement in milk production in dairy cattle
- One recent study increased weaning weight of beef calves

Good News

- More research is being conducted which will most certainly improve the efficacy DFM's and other feed additives

Summary

- As we understand basics better feeding decisions can be made
- We care and feed the microbes which provides digested nutrients for the cow
- Starch can decrease forage digestibility
- Protein can improve value of low quality roughages
- DFM and other additives can be beneficial but not in all cases.