What's Bugging Your Cows?

Rumen microbes, a cow's best friend.

Without microbes, a cow's digestive system would shut down and she would starve to death.

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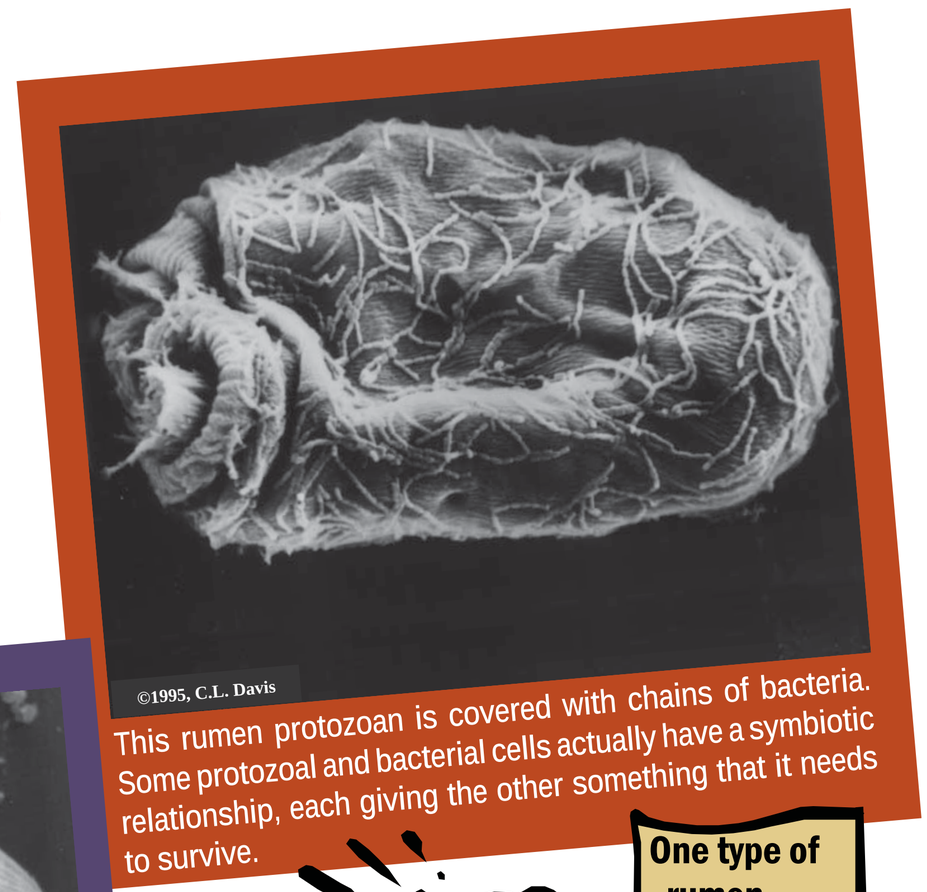
The large microbe is a type of protozoan. The creature that looks like a tadpole attached to the side of the protozoan is a fungal spore. The smaller, rod-shaped beasts lining the underside of the protozoan are bacteria.



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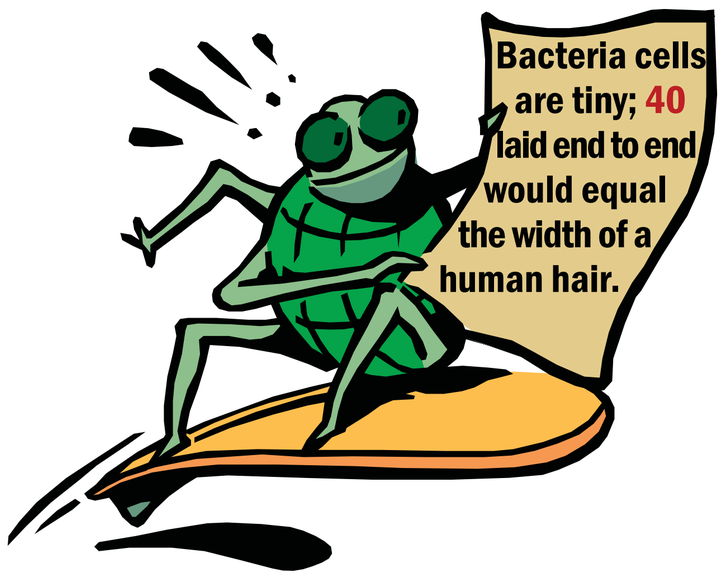
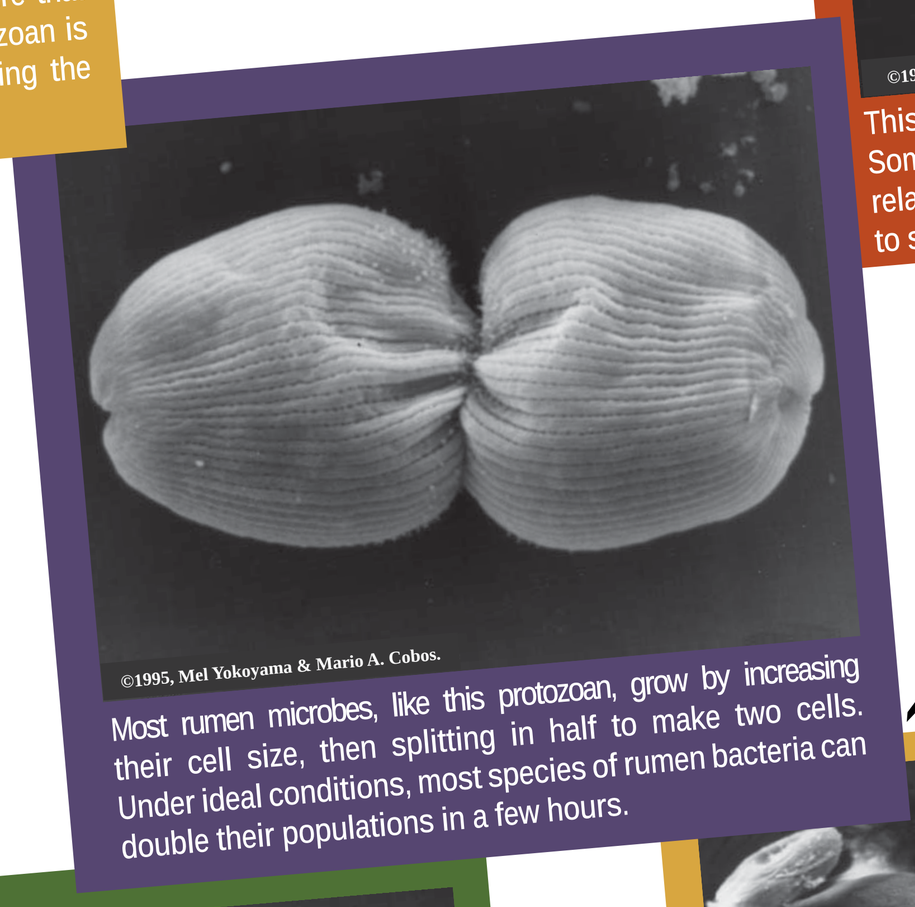
This rumen protozoan is covered with chains of bacteria. Some protozoal and bacterial cells actually have a symbiotic relationship, each giving the other something that it needs to survive.





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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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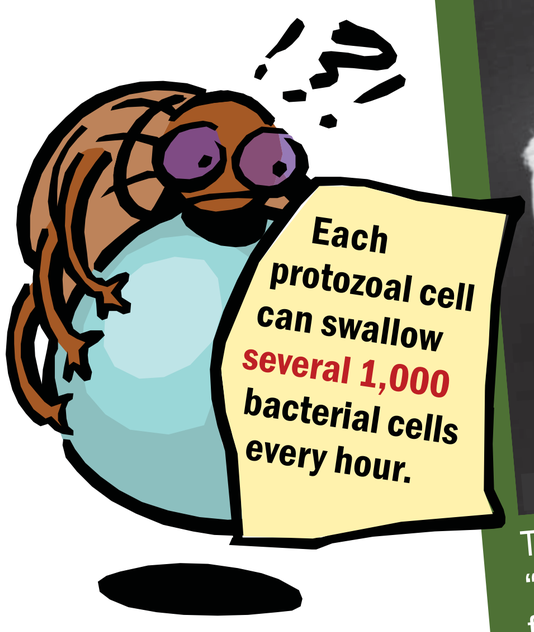
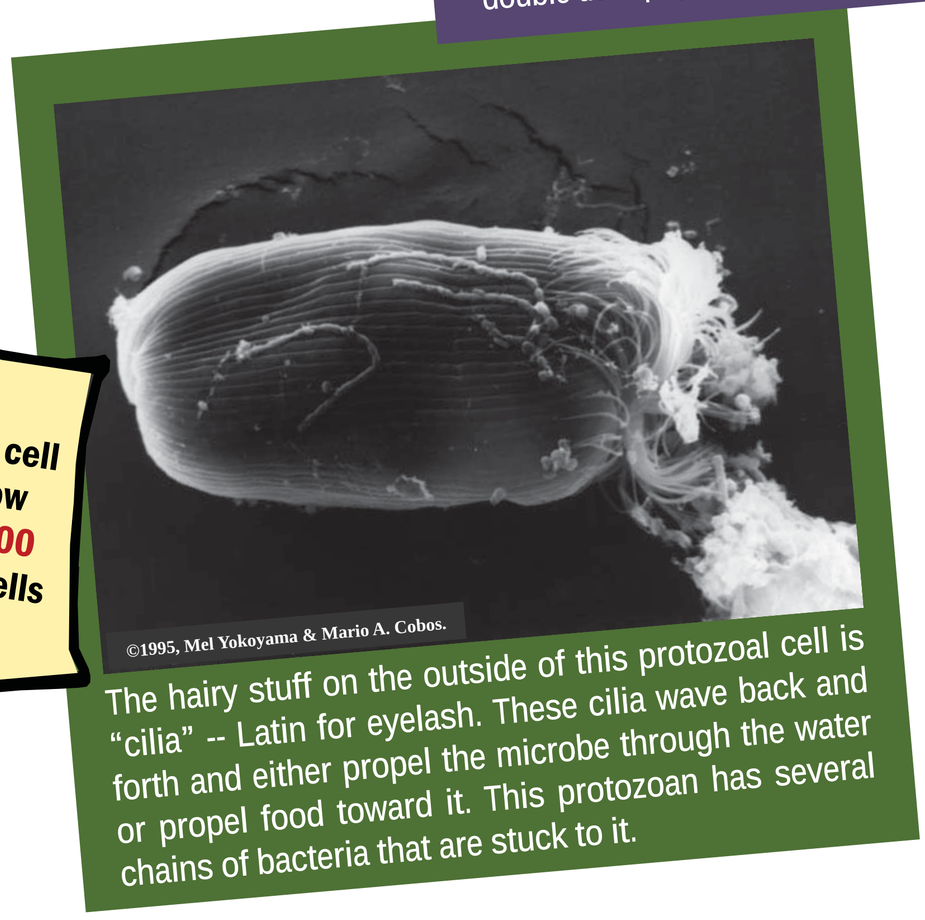
This is one of the biggest rumen protozoa. Protozoal cells are much larger than bacterial cells; some can almost be seen with the naked eye.





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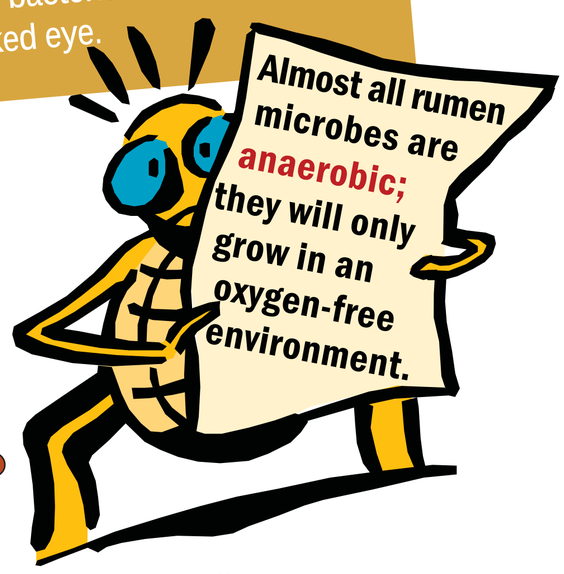
The hairy stuff on the outside of this protozoal cell is "cilia" -- Latin for eyelash. These cilia wave back and forth and either propel the microbe through the water or propel food toward it. This protozoan has several chains of bacteria that are stuck to it.



Three main groups of rumen microbes:

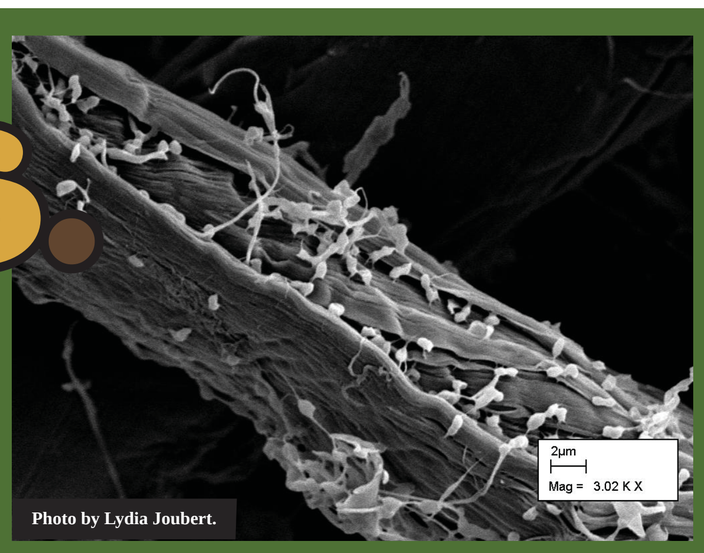
Bacteria: Carry out most digestion of sugars, starch, fiber, and protein for the cow.

Protozoa: They swallow and digest bacteria, starch granules, and some fiber.

Fungi: Make up only a small fraction of the rumen microbial population, but appear to be important in splitting open plant fibers to make them more easily digested by the bacteria.

You're not feeding your cows!

You're feeding their rumen microbes.



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

The rumen is the metabolic engine of the cow.

- About 2/3's of feed digestion takes place here.
- 90% of fiber digestion happens in the rumen.

Rumen microbes keep that engine running.

- The cow cannot directly utilize most feed components, even simple sugars.
- She relies on rumen microbes to convert feeds to volatile fatty acids (VFAs) that the cow absorbs and uses to make energy and milk.
- Without microbes, a cow's digestion would shut down and she would starve to death.

And microbes feed the cow!

- Rumen microbes typically contain 55% protein.
- On some rations the microbes provide **half** the total dietary protein need of the cow.

A Symbiotic Relationship

Microbes provide:

- labor to digest feed
- source of protein
- source of VFAs
- ability to digest forage

Cow provides:

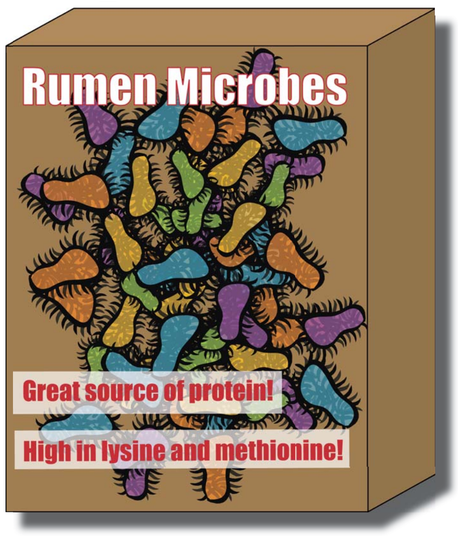
- water
- warmth
- grinding (cud chewing) of feed
- anaerobic (no oxygen) conditions

Why it's important to study rumen microbes:

We know so little about something so little.

- There are probably 1,000s of species of rumen bacteria, but only 2 dozen have been studied in detail.
- It appears that each cow has her own population of rumen bacteria; this seems to vary more between cows rather than within one cow fed substantially different diets.
- Identifying microbial populations may provide clues to improving animal performance.

They're a near-perfect source of protein for cows.



- Rumen microbial protein has almost the perfect mixture of amino acids, one that has not been duplicated in any ration.
- Rumen microbes are a particularly rich source of lysine and methionine, two amino acids that are difficult to supplement in dairy cattle rations.

They help cows make use of feed and by-products that people can't use.

- Most rumen bacteria attach themselves to feed particles, and fiber digestion will only occur by attached microbes.
- This allows cows and other ruminants to eat fibrous plants, like alfalfa and grasses, that people can't eat. And many of these plants are grown on land that isn't suitable for other crops. Thus, cattle produce food from land that might otherwise be under utilized.
- Cows are useful consumers of by-products from human food production (like citrus or beet pulp) and from grain ethanol production (dried distillers grains).