Transparency Master: Methanogens—One Type of Archaebacterium

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Bacterial taxonomy is currently undergoing a revolution. Biochemical taxonomy has provided evidence that Kingdom Prokaryota might legitimately be divided into two separate kingdoms: Eubacteria and Archaebacteria. The Eubacteria include the commonly recognized species of "true" bacteria (green sulfur bacteria, purple bacteria, spirochaetes, cyanobacteria, clostridia, and actinomycetes). Archaebacteria are a distinct group displaying unique characteristics:

1) lack of muramic acid in their cell walls (this substance is a characteristic inclusion in eubacterial cell walls);

2) cell membranes composed mainly of a branched chain lipid;

3) distinctive RNA polymerase structures; and,

4) transfer RNA's lacking ribothymidine.

Though classification of the Archaebacteria is currently in a state of flux, many workers currently place them in two groups, with thermoacidophiles constituting one group and methanogens and halobacteria comprising a second group. The methanogens are an interesting and important archaebacterial group, so our focus here will be on them.

Methanogens are morphologically diverse, varying in shape from spherical to long filamentous rods. Physiologically, however, all methanogens display consistent characteristics: they are strict anaerobes and have the unusal metabolic capacity to produce methane gas.

One genus of methanogens is *Methanosarcina*. A drawing of *Methanosarcina*, suitable for reproduction as an overhead projector transparency, can be found on the next page. As shown in the drawing, cells of *Methanosarcina* normally occur in aggregates. Thick cell walls form boundaries around each of the cells in the aggregate. Cells are arranged in a way similar to the organization of the segments of an orange. Each cell contains methane gas vesicles (these appear as hexagonal packets in cross section and as ellipsoids in longitudinal section). Cytoplasm of these cells contains large concentrations of ribosomes and regions where DNA is localized.

Cells within *Methanosarcina* aggregates divide independently. They do this by developing a cell membrane—cell wall partition bissecting one of the "orange section"-shaped cells.

Reference

FOX, G.E., *et al.* 1980. The phylogeny of prokaryotes. *Science* 209:457.

(This drawing was made from an electron photomicrograph (36,000x). Original *Mikrobiolgiya* 40:674-80.)

Code:

1. Collapsed methane gas vesicle
2. Cross section of a gas vesicle (hexagonal shape)
3. Longitudinal section of gas vesicle (ellipsoidal shape)
4. Localized region of DNA
5. Cell wall
6. Cell membranes and walls between cells of the aggregate
7. Ribosomes (each dark spot is a single ribosome)