BACTERIAL METABOLISM

1. Most types of nutrients can be converted into pyruvate.
    - Simple sugars are converted into pyruvate in a process known as glycolysis.
        - A few bacteria can use a sugar called mannitol in metabolism. They include *Staph aureus*, *Enterococcus faecalis*, and *Enterobacter*.
    - Amino acids such as tryptophan and cysteine can be converted into pyruvate
        - Indole positive bacteria can convert tryptophan into pyruvate.
        - Sulfur positive bacteria can convert cysteine into pyruvate.
    - Glycerol, a component of fat, can be converted into pyruvate.
2. Pyruvate can be fermented into:
    - Lactic Acid
        - *Lactobacillus*
        - *Homo sapiens*
    - Mixed Acids
        - Most medically significant bacteria
        - Methyl Red (MR) test identifies mixed acid fermenters.
    - Ethanol
        - Yeast---*Saccharomyces cerevisiae* and *Candida albicans*
    - 2,3-Butanediol
        - *Enterobacter* is known for this. A test called the Voges-Proskauer (VP) helps identify *Enterobacter*.
3. Pyruvate can be further broken down into acetyl CoA.
    - Fatty acids can be converted into acetyl CoA and thus be used to make ATP.
    - Some amino acids can be converted into acetyl CoA.
        - Amino acids must be deaminated in order to enter the Krebs cycle. This produces ammonia as a byproduct. Ammonia can be converted into urea. Some bacteria (such as *Proteus*) can use urea in the Krebs cycle.
4. During the Krebs cycle, electrons from acetyl CoA are gathered up.
    - Gas is usually given off during this process.
5. The electrons are then passed down a chain of enzymes in the cell membrane of the bacteria.
    - Each enzyme is more electronegative (think magnetic) than the one before.
    - At the end of the chain, a final electron acceptor is waiting. It could be oxygen or some other strong "magnetic" substance.
6. ATP synthase is also waiting at the end of the chain, and it uses the energy of moving electrons to synthesize ATP…. lots of ATP!

Obligate aerobe: It can only make ATP using oxygen as its final electron acceptor. Interestingly, it cannot even ferment if oxygen is not present.

Obligate anaerobe*:* *Clostridium* cannot tolerate the presence of oxygen. Oxygen generates damaging free radicals (such as hydrogen peroxide). To live in its presence, an organism must make catalase and/or superoxide dismutase. Catalase breaks hydrogen peroxide down into oxygen and water. *Clostridium* lacks both of these enzymes.

Facultative anaerobe: Most bacteria familiar to us can use oxygen as a final electron acceptor, or use a variety of other substances as a final electron acceptor.