

## **Exam 1**

**Pasteur:** studied lactic acid formation, disproved spontaneous generation, developed anthrax and rabies vaccine

**Lister:** antiseptic surgery

**Jennings:** (Jenner?) Cowpox vaccine

**Snow:** studied epidemiology (how diseases spread) by mapping cholera infection around a specific water pump

**Koch:** "Father of microbiology"; first figured out the cause of anthrax is bacteria; developed Koch's postulates to ID the causative agent of particular diseases:

- 1) microorganism/pathogen present in all cases of the disease
- 2) the pathogen can be isolated and grown in pure culture
- 3) pathogen from pure culture must cause the disease when inoculated into a healthy, susceptible host
- 4) the pathogen can then be reisolated and shown to be the same as the originally inoculated pathogen

**Woese:** defined the archaea by phylogenetic taxonomy of 16S rRNA

**Enumeration of bacteria:** determining how much bacteria is present

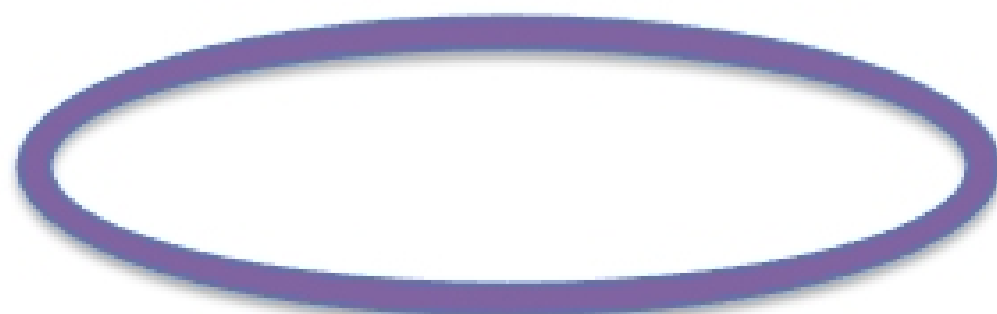
- physical measurement: weigh the sample (difficult to do)
- direct chemical measurement: test for some specific chemical component (uncommon due to lack of chemical components)
- chemical activity: rate of oxygen production, CO<sub>2</sub>, etc.
- turbidity: optical density; via spectrophotometer (cannot tell living from dead, influenced by size, 10<sup>7</sup>)
- plating: counting of viable cells on plate
- hemostat: physically counting (inaccurate)
- Coulter count: emergency immunology, very expensive
- gravitometric: centrifuge down sample (must normalize first)

**Bacteria:** prokaryotic cells; DNA not isolated to a structure, no membrane bound organelles, extrachromosomal DNA, carbohydrate layer of peptidoglycan (PDG) forming a cell wall around the outer membrane, have structures for movement

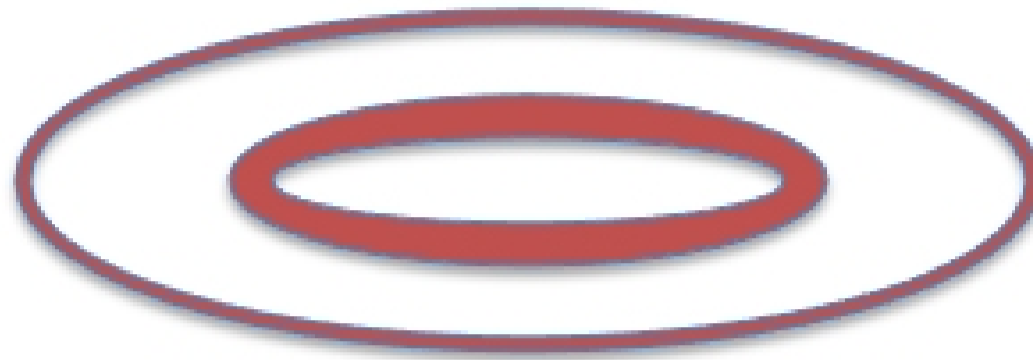
**Archaea:** ancient bacteria; single celled microorganisms, no nucleus, possesses genes and metabolic pathways tht are closely related to eukaryotes (esp transcription and translation), use more energy than any other kingdom (organic cpds, sugars, ammonia, metal ions, or hydrogen gas), usually live at extremes

**Eukarya:** animal cells that contain a nucleus and other membrane bound organelles, divide by mitosis to produce two genetically identical cells and meiosis for diploid cell production

**Gram +:** stains purple, peptidoglycan layer outside the membrane; PDG integrated into membrane through teichoic acid



**Gram -:** stains red, propogated cell wall; thin layer of peptidoglycan, followed by periplasmic space between cytoplasmic membrane and peptidoglycan layer; second membrane of lipopolysaccharide (easily permeable - porins)



**Quorum Sensing:** bacterial mass communication for the entire colony to undergo some sort of shift; Salmonella - shifting of their flagella structure to confuse immune system of hosts to survive; Photoluminescence

**Spore production:** not a means of reproduction, means of survival; Bacillus

**Methanotroph:** utilize methane for energy, metabolic activity

**Nitrifying bacteria:** chemoautotrophs/chemolithotrophs; consume inorganic nitrogen compounds such as ammonia to nitrate

**Yogurt species:** Streptococcus thermophiles and Lactobacillus blugaricus; able to digest sugars in milk and produce lactic acid

**Mycobacterium:** specific genus of actinobacteria; contains pathogens known to cause serious diseases. Myco- meaning fungus; describes how these bacteria behave like fungi, growing mold-like on the surface of liquids when cultured.

**Enteric:** of or related to the intestines

**Nitrogenases:** enzymes used to fix atmospheric nitrogen gas (N<sub>2</sub>) into useable forms

**Microscopes:**

Light microscope: Mag 10 X to 1000X with oil. Limit of mag 0.2 um

Dark phase: dark background, light refracts thru organism. Visualize live bacteria and used for larger organisms

Phase contrast: specimen appears dark, useful for live, visualize flagella

Bright field: bacteria need mounted and stained, need specimen w high contrast

Transition Electron: e- pass through specimen, contrast dense and thin areas, immobilization and shaved thin. Up to 1 million times magnification

Scanning: specimen coated in metal, electron beam deflected off specimen; mag 15 to 100,000x - only surface of organisms can be seen

Scanning tunnel electron: shows three dimensional images; see DNA struc

**Lysozyme**: enzymes that break down bacterial cell walls by hydrolyzing the beta 1,4 glycosidic linkages of NAG and NAM. Found in secretions (tears esp)

**Groups of bacteria:**

Mycoplasma: lack a cell wall, parasitic/pathogenic, unaffected by common antibiotics, smallest bacteria, can survive anaerobically

Rhizobium: G- soil bacteria that fix nitrogen; associated w/ roots of legumes

Mycobacteria: pathogens; grows like fungus on the surface of liquids; G+ acid fast, have no endospores

Streptomyces: largest genus, G+, high GC content, produce spores, complex secondary metabolism and produce antibiotics

Cyanobacteria: photosynthetic, bluegreen algae, produce oxygen gas, chloroplasts from endosymbiant theory

Deinococcus: thick cell walls, G+ stain, have a second membrane, pink

Pseudomonads: G-, rod shaped, polar flagella

Rickettsia: non-motile, G-, non-sporeforming, cocci, rods, or threads. Obligate intracellular parasites/grown in tissue and embryo cultures, true cell walls

Clostridium: G+, obligate anaerobes producing endospores, rod shaped

Chlamydia: obligate intracellular parasites; cannot be grown

**Classification of bacteria**: arrangement, visual identification, gram stain, respiration, chemical presence

**Respiration**: how organisms break down organic substances for energy

Aerobic: presence of oxygen, sugars broken down to produce carbon dioxide, water, and energy. Creates lactic acid and has oxygen as final electron acceptor.

Anaerobic: fermentation; sulfate to hydrogen sulfide, nitrate to nitrite, nitrous oxide, nitrogen gas. Use hydrogen gas to produce methane or acetic acid. Glycolysis to make ATP, then makes acetyl coenzyme A to citric acid cycle and electron transport chain. Use nitrate, sulfate, CO<sub>2</sub> as final electron acceptor instead of oxygen

Fermentation: Carbohydrate gets broken down, but makes lactic acid instead of pyruvate. Some organisms go under alcoholic fermentation.

Facultative Anaerobic: able to perform aerobic or anaerobic depending on the oxygen content. Aerobic is more efficient, but can switch over easily.

**Media**: can be complex or simple; meets nutritional requirements

Undefined medium: Glucose for a carbon source, water, salts for bacterial growth, amino acids - source contains a variety of cpds

Defined medium: all chemicals known

Minimal media: no amino acids present, select against recombinants. Carbon source for bacterial growth, various salts to provide essential elements (Mg, N, P, S) to synthesize proteins and nucleic acids.