Exam 2

Enumeration of bacteria: determining how much bacteria is present

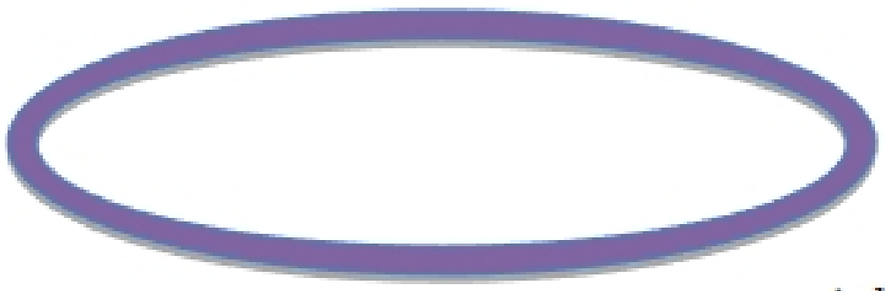
-physical measurement: weigh the sample (difficult to do)
-direct chemical measurement: test for some specific chemical component (uncommon due to lack of chemical components)
-chemical activity: rate of oxygen production, CO_2, etc.
-turbidity: optical density; via spectrophotometer (cannot tell living from dead, influenced by size, 10^7)
-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

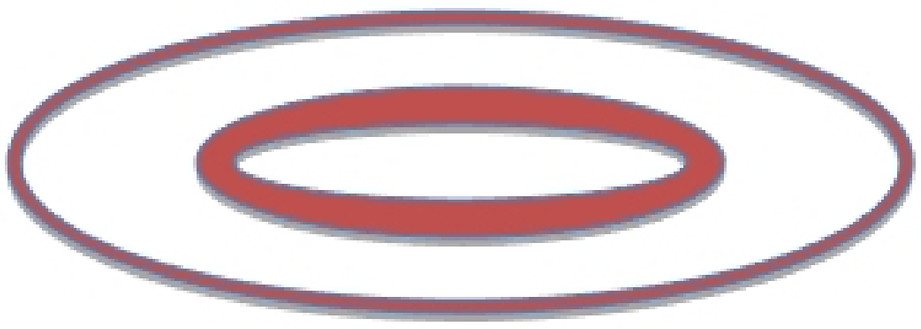
Archaea: ancient bacteria; single celled microorganisms, no nucleus, possesses genes and metabolic pathways tht are closely related to eukaryotes (esp transcription and translation), use more energy than any other kingdom (organic cpds, sugars, ammonia, metal ions, or hydrogen gas), usually live at extremes

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)



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

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_2) into useable forms

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 pyruvate to be utilized by the cell 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, CO2 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.

Physiological identifiers:

Archaea: glycerol-ether lipids, D-amino acids, long lipid chains with multiple side chains to prevent archaeal membranes from leaking at high temps, lipid monolayers with a single molecule with two polar heads fused to resist harsh environments – circular genetics; smaller than most genomes; monocystronic – one gene per promoter
Halophiles: have acidic proteins that resist denaturing effects of salts
Methanogens: proteins for methanogenesis; fermentation for acetic acid dismutation to produce methane and carbon dioxide.
Psychorphiles: survive in very cold temperatures; sea ice sheets
Thermophiles: survive in very hot temperatures; steam vents; enzyme for PCR isolated from thermophiles

R-factors: resistance transfer factor; plasmid that codes for *antibiotic resistance*. Passed through bacterial conjugation between species. Spread through pilli to inject to different bacterium via mating bridge. Only 15 base pairs long, so easily transferrable. Some plasmids carry multiple resistance factors.

Viruses:

Conjugation: transfer of genetic material (plasmid) between bacterial cells by direct cell-to-cell contact through horizontal gene transfer. Regarded as bacterial equivalent of sexual reproduction since it exchanges genetic material. Benefits may include antibiotic resistance, xenobiotic tolerance, or utilization of metabolites.
Transduction: DNA transferred from one bacteria to another by a virus. Does not require physical contact between the cell donating and cell receiving; DNase resistant; Stably introduce a foreign gene into host cell's genome. May be lytic or lysogenic; Lytic cycle – production of new phage particles which are released by the lysis of the host. Lysogenic – phage chromosome is integrated into bacterial chromosome where it can remain dormant. Once induced, the phage genome is activated and the cell goes into lytic phase.
Transformation: genetic alteration of a cell resulting from the direct uptake and incorporation of exogenous genetic material from its surroundings through the cell membrane. Bacteria must be competent, which may occur as a time-limited response to environmental conditions such as starvation/cell density.

Microbial control:

-alteration to membrane permeability, damage to proteins and nucleic acids
-physical:
-heat: TDP: lowest temp when all microorganisms are killed
TDT: minutes when all are killed
DRT: 90% of bacteria are killed
-moist heat: coagulations of proteins/breaking of H bonds
-boiling: kills vegetative cells, viruses, fungi in 10 mins
-**autoclave:** 121 C at 15 psi; kills all org and spores in 15 mins