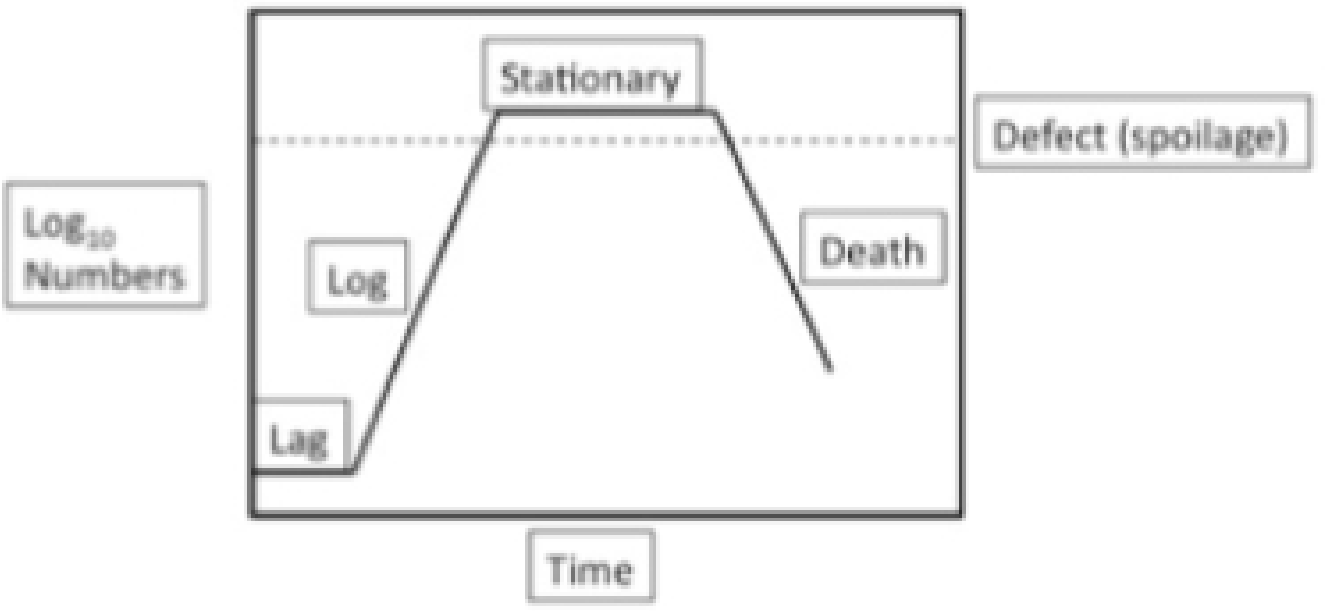
Food Microbiology – An Introduction 10/16/2014

I. Microbiology - The study of "small life."
   A. Bacteria: Eubacteria,
      1. Eubacteria – Proteobacteria, Gram-negatives
      2. *Archaebacteria*
   B. Viruses
      1. Virology – study of viruses
      2. Enteric human pathogenic viruses (e.g., Noroviridae)
   C. Fungi:Molds,Yeast
      1. Mycology – study of fungi
   D. Protozoa – parasitology
      1. Parasitic protozoa (e.g., *Toxoplasma, Cryptosporidium*)
      2. Nematodes, trematodes (e.g., *Taenia* - tapeworm, *Anisakis* - sushi, *Trichina* – cause of trichinosis; consuming undercooked meat)
   E. Others

II. Bacteria: Small, unicellular organisms
   A. Structural Characteristics:
      1. Cell wall & outer membrane
      2. Unicellular organisms unique from other microbes
      3. Cytoplasmic space/membrane
      4. Size: Approximately 0.5-2.0 micrometers (10^-6 m)
      5. No well-defined nuclear envelope/membrane
      6. One circular chromosome
      7. Binary Fission/Geometric Replication
      8. Asexual reproduction, geometric replication

B. Life Cycle/Phases of Growth: **** KNOW THESE



- Lag phase – beginning of the population when an organism moves into a new area; organism must identify sources of water & chemical nutrients
- Log phase – also known as exponential phase; orgs go 10, 100, 1000, etc; very rapid growth to where the organisms can double, triple, etc
- Stationary phase – growth slows down; has defect (spoilage) – spoiled food = a few billion cells in the organism

C. Composition
    1. Water: Primary component of cells (~70%)
    2. Remainder:
        a. Proteins, Polypeptides
        b. Carbohydrates/Sugars – bacteria import carbohydrates; ferment / utilize monosaccharide (glucose); some can ferment disaccharides (lactose);
        c. Lipids – energy extraction (as carbon sources) & formation of membrane lipids
        d. Minerals – useful to stabilize LPS of bacteria
        e. Nucleic Acids: DNA, RNA – can be used to classify organisms; plasmid – small circular piece that is useful for inserting genes to have an organism express a protein from, make outer membrane more permeable, naturally occurring, how bacteria share genetic material through horizontal transfer

III. Food Microbiology: The Good, Bad, and Ugly

A. Fermentation: Produces foods not otherwise possible! ;; fermentative microbes = the good; yield energy (ATP); highly controlled spoilage
    1. Fermentation: controlled, desirable spoilage
    2. Microbial conversion of food components into other compounds
    3. Sugars – acids, gases, EtOH
    4. Proteins – smaller peptides, ammonia, biogenic amine
    5. Lipids – fatty volatiles (e.g., propionic acid)

B. Pathogens: Microbial agents causing disease once consumed or after secretion of toxic substance into food that is consumed ;; the bad; disease-causing
    1. Infection: invasion and replication in body
    2. Intoxication: pre-formed toxin consumed
    3. Toxico-infection: release of toxin by organism during GI tract passage
    4. Pathogen Types & Examples:
        a. Bacterial (*Listeria monocytogenes*, *Salmonella* (cannot ferment lactose – main difference between this and ecoli, can replicate in epithelial cells particularly in vacuoles), *Clostridium botulinum*), Staph – enterotoxin; enteric / entero = gut, GI; shigatoxin – protein toxin that will contact your kidneys through your blood stream to inhibit kidney replication which leads to program cell death
        b. Fungal (*Aspergillus* spp., *Fusarium* spp.)
        c. Protozoal (*Toxoplasma gondii*, *Giardia lamblia*)
        d. Viral (Noroviruses, Hepatitis A)
        e. Nematodes/Trematodes (*Trichina spiralis*)
    5. Significance of differing pathogen types and disease
    6. Bacterial, fungal, viral
    7. Disease syndromes
    8. Mild gastroenteritis to death
    9. Parasitic organisms