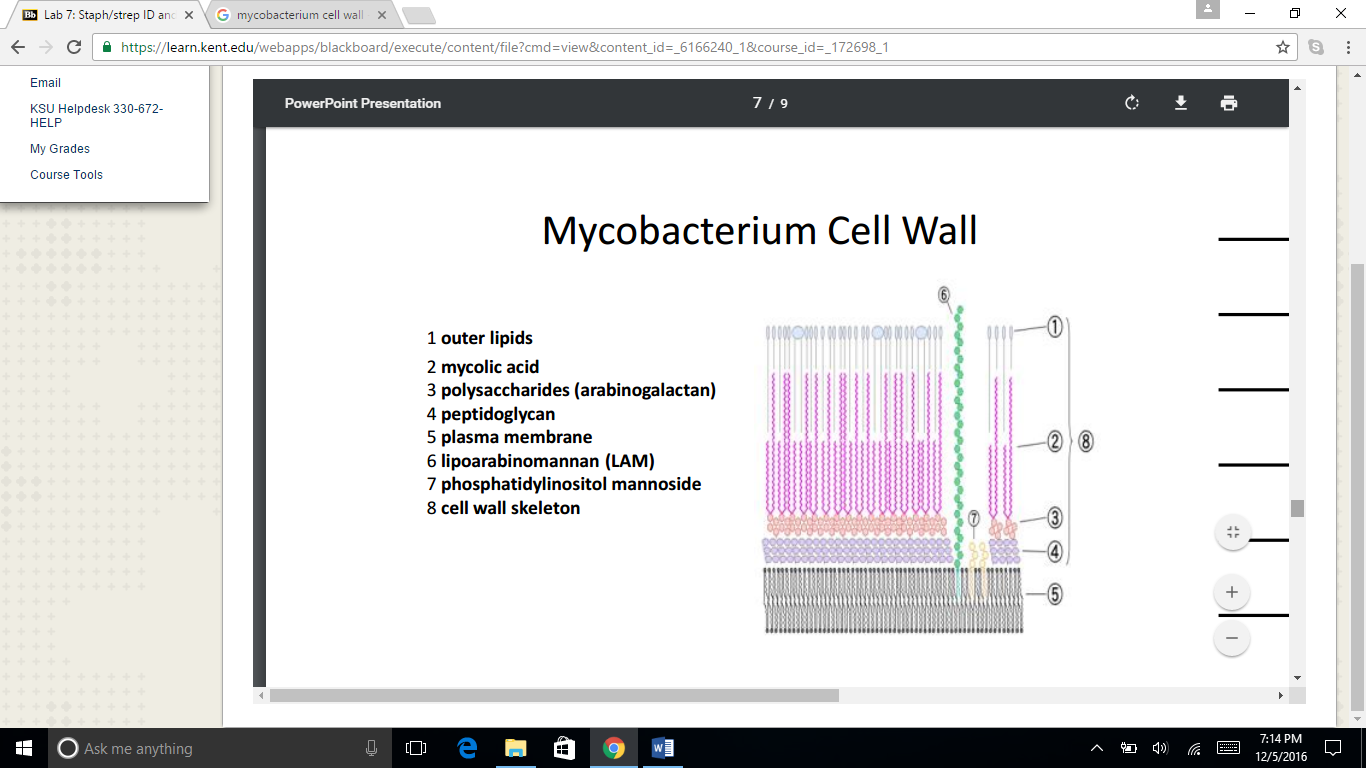
* Staph and Strep Lab
  + *Staphylococcus*
    - Common fauna of skin and mucosal tissue
    - Clustered, Gram-positive organisms
    - Specific strains:
      * *Staphylococcus aureus*
        + Normal part of skin flora that also acts as an opportunistic pathogen and is resistant to harsh environmental conditions
      * MRSA: Methicillin-resistant strains
        + Source of many nosocomial infections
        + Can be hospital or community acquired
      * *Staphylococcus epidermidis*, *Staphylococcus saprophyticus*
        + Other pathogenic Staph strains
  + *Streptococcus*
    - Chains of Gram-positive organisms
    - Various strains can cause strep throat, meningitis, pneumonia, endocarditis, and necrotizing fasciitis
      * *Streptococcus pyogenes* causes strep throat
    - Can distinguish strains based on blood hemolysis (destruction of blood cells)
      * α hemolytic: Fe reduced in hemoglobin giving a greenish-yellow zone in the agar around the colonies
      * β hemolytic: blood cells are completely destroyed leaving a clear zone on blood agar
      * γ hemolytic: hemolysis is not induced and the agar under/around the colony is unchanged
    - Lancefield groups: strep species categorized by their surface antigens
      * Group A & B: many beta-hemolytic strep pathogens (*S. pyogens* and *S. agalactiae*)
      * Group C: animal pathogens
      * Group D: many species reclassified as *Enterococcus*, common in large intestine
* Staph and Strep Tests (Beyond Gram and Hemolysis)
  + Catalase test: test for the presence of catalase enzyme
    - Bubble forms if catalase positive, no bubble is catalase negative
    - False positives possible if red blood cells are transferred from agar plate
  + Bacitracin test: bacteria tested with topical antibiotic
    - Done on a blood agar plate if the organism is catalase positive
    - Done on a mannitol salt agar plate if the organism is catalase negative and beta-hemolytic
    - Coagulase test: test for the presence of coagulase
      * Done is organism is bacitracin resistant
      * Positive result indicated by solidification of liquid
    - Gelatin tube test: test for the ability for an organism to produce an exoenzyme (called gelatinase)
      * Done if organism is bacitracin sensitive
      * Positive result indicated by degradation of gelatin i=to liquid
  + MR-VP test: tests for acidity and presence of acetoin
    - Red results indicate positive results (otherwise negative)
    - Done if organism is catalase negative and *not* beta-hemolytic
  + PYR test: test done for detection of l-pyrrolidinyl arylamidase enzyme
    - Red if positive and orange if negative
    - Done if organism if catalase negative *and* beta-hemolytic
* Endospores: tough, resistant structure some bacteria are capable of forming in order to survive poor environmental conditions
  + Can be used to differentiate bacterial taxa
  + Keratin: protein that provides the tough outer covering of spores
  + Relevant genera:
    - *Bacillus*
    - *Clostridium*
  + Staining:
    - Malachite green: primary stain used for endospores
      * Steam used to drive stain into spores
      * Cells then de-stained
    - Safranin: counterstain used to stain vegetative cells and spore mother cells
    - We stained *Bacillus megaterium* in the lab
      * Heat-fixed organism prior to staining with malachite green
      * *E. coli* was the negative control
* Acid Fast: selective stain used to identify members of the genus *Mycobacterium*
  + *Mycobacterium*: genus of Actinobacteria including pathogens known to cause serious diseases in mammals
    - Relevant species:
      * *Mycobacterium tuberculosis*: causers tuberculosis
      * *Mycobacterium leprae*: causes leprosy
    - Unique due to the presence of mycolic acid
  + Mycolic acid: waxy substance giving acid-fast cells a higher affinity for the primary stain (carbol fuchsin) and resistance to decolorization by an acid alcohol solution
    - Also prevents Gram staining *Mycobacterium*
  + Staining procedure:
    - Add Carbol fuchsin (lipid-soluble stain that is able to enter acid-fast positive cells)
      * Driven into cells via steam heating
    - Acid alcohol decolorizer added to remove carbol fuchsin from non-acid-fast cells
    - Methylene blue added as the counterstain for non-acid-fast cells (malachite green can also be used)
  + 
* Simulated Epidemic
  + “Important Terms to Know:
    - Epidemiology: study of the movement of disease through a population
    - Epidemics: widespread prevalence of a disease in a population
    - Common source epidemic: many individuals are infected through a common source
    - Propagated transmission epidemic: a disease is passed from one individual to another
    - Index case: first incident of a disease outbreak
    - Incidence: number of new cases of a disease occurring among a defined population within a specific period
    - Prevalence: total number of existing cases in a population
    - Quarantine: forced separation of those who have been exposed to an infectious agent to slow or prevent transmission
  + Procedure:
    - TSA plate: Tryptic Soy Agar plate
      * Divided into a control, round 1, and round 2 sections
    - Candy handed out, one candy was inoculated with *S. marcascens*
    - Control section “inoculated” with clean glove (should be no growth)
    - Then two rounds hand-shaking!
  + Results
    - Pink growth indicates presence of *S. marcascens*
    - Index case can be traced by following who shook hands with who
* Food Microbiology
  + We care about food safety because about 1 in 6 Americans suffer from food-borne illnesses every year (300,000+ hospitalized and 5000+ die)
  + Most common and straightforward method of testing food is the direct plate count(involves growing and counting CFUs that grow on foods)
    - Serially diluted blended food samples were put onto molten plate count agar
* Yogurt Synthesis
  + Yogurt is produced via fermentation of sugars found in milk
    - Can be consumed by lactose intolerant individuals
    - Helps regulate gut flora and fauna
    - Flavors produced by reaction byproducts
  + Most common organisms used
    - *Lactobacillus delbrueckii*
    - *Streptococcus thermophilus*
  + Important procedural notes
    - Milk was heated to 180OF (82OC) and then cooled to 110OF (43OC) *before* starter culture was added
    - Plastic wrap covering mason jar was punctured so that gases and moisture could escape
  + Important Observations
    - Consistency
    - pH (should be acidic)
    - Microscope check for presence of microbes
* Snyder Test: test for individual susceptibility to tooth decay
  + Mouth environment
    - Low pH
    - *Lactobacilli* and *Streptococci* can survive here
  + Test
    - Molten Snyder tubes have spit added to them
      * Control tubes remain green
      * Tubes change color to yellow after a certain time period (quicker change = more susceptible to dental caries)
* Eukaryotes
  + Endosymbiotic theory: mitochondria and chloroplasts were ancient bacteria that fused with ancestral eukaryotic cells
  + Algae: eukaryotes containing chloroplasts and carrying out oxygenic photosynthesis
    - Can be single-celled or multicellular
    - Lack cell specialization and tissue differentiation
    - Algae precursor may have engulfed a cyanobacterium and formed a chloroplast
    - Taxonomy:
      * Archaeplastida: green and red algae
      * Excavata: euglenoids (have flagella)
      * Chromalveolata: includes diatoms, dinoflagellates, and kelp
  + Fungi: eukaryotic kingdom consisting of non-photosynthetic organisms with chitin in their cells walls that can produce spores and reproduce asexually or sexually
    - Can be single-celled (yeast) or multicellular (filamentous)
    - Form fruiting bodies for reproduction
    - Major phylums
      * Basidiomycota: mushrooms
      * Ascomycota: sac fungi (ex. baker’s yeast)
      * Glomeromycota: obligate symbionts (for about 80% of plants)
      * Zygomycota: pinwheel fungi (ex. bread molds)
        + No longer recognized as a phylum
    - Anatomy:
      * Conidia: asexual fungal spores
      * Conidiophore: stalk to which conidia are attached
      * Sporangium: spores contained in a sac structure
      * Sporangiophore: stalk to which sporangia are connected
      * Hyphae: branching filaments making up mycelium of a fungus
        + Can be *septate* (separated by cell walls) or *coenocytic* (not separated by cell walls; continuous cytoplasm)
    - Importance:
      * Can be plant pathogens
      * Can be mycorrhizal (symbiotic with a plant/plants)
      * Can supply organic and inorganic nutrients to plants via breakdown of molecules
    - Microscopy:
      * Yeast only need a wet mount of methylene blue
    - Culturing:
      * May want to add ampicillin to a culture plate to kill off bacteria that can compete with the fungus
      * Want to incubate at room temperature (fungi have been growing at approximately that temperature!)
  + Lichens: mutualistic relationship between fungi and a photosynthetic partner
    - Algae, cyanobacteria, or both
    - Grow slowly and can survive extremely harsh environments
    - Fungus supplies nutrients while algae or cyanobacteria provides sugars
    - Ascomycota is the main phylum able to form lichens
* Winogradsky Column: microcosm used to observe nutrient cycling and microbial metabolism under varying conditions
  + Different organisms grow in different locations based upon metabolism
  + Organisms classified by energy source (photo or chemo), electron donor (organo or litho) and carbon source (hetero or auto)
  + Original columns were set up with different types of soil, water, and concentrating nutrients
    - Layers are aerobic water, anaerobic water, and anaerobic sediment
    - Sulfur reducers will be in the bottom layer