* 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