**BI 101 Topic List and Suggested Activities**

**Using Openstax: Concepts Biology**

Chapter 1: Nature of Science (an Introduction)

* Characteristics of living organisms – properties of living things
* Hierarchy of organization (cell, tissue, organ, etc.)
	+ Possible Lab: Look at prepared slides of human cells/tissues
* Scientific method
	+ Any Inquiry lab
* Deductive reasoning
* Accuracy vs precision
* Experimental design (dependent/independent variables, control vs experimental, data analysis)
* Taxonomy \*\*
	+ Possible activity: Follow or build a Dichotomous key

Chapter 2: Chemistry Overview

* Atomic structure (nucleus vs electrons, subatomic particles and charge)
* Atomic number and atomic mass
* Electron shells (reactive vs non reaction)
* Significance of the Hydrogen atom
* Significance of the Carbon atom
* Chemical bonds (covalent, ionic, van der waals, hydrogen)
* Essential elements (examples, criteria, importance)
* Acids, Bases and pH
	+ Possible lab: pH of cow’s milk and other household items
* Properties of water (cohesion, adhesion, states of matter)
	+ Possible activity: Surface tension on a penny
* Hydrophilic and hydrophobic interactions
* Macromolecules (monomer vs polymer, function, structure)
	+ Possible lab: chemical composition (introduce biurets, benedicts, iodine indicators, etc)
* Saturated vs unsaturated fat
* Protein folding and the meaning of denaturation
	+ Possible lab: Enzyme activity across conditions (heat or pH) \*\*

Chapter 3: The Cell

* Cell theory
* Differences between prokaryotes and eukaryotes
* Organelles (recognize and identify major function)
	+ Possible activity: Cell as a factory lab
	+ Possible activity: Cell Craft (online game/simulation lab)
* Structure and significance of the plasma membrane
* Structure and significance of ribosomes
* Transport across the membrane (types and factors that affect rate)
	+ Possible lab: Dialysis tubing experiment and diffusion across a membrane
* Diffusion vs Osmosis
	+ Possible lab: comparison of diffusion rates with solid vs liquid in liquid or on agar
	+ Possible lab: comparison of diffusion rates based on molecular mass
	+ Possible lab: color chromatography
* Tonicity (hypertonic, hypotonic and isotonic)
	+ Possible lab: diffusion across different concentrations
* Active transport

Chapter 6: Cell Replication

* Haploid vs diploid cells
* Somatic vs gametic
* Structure of chromosomes
	+ Possible activity: chromosome simulation
* The cell cycle
* Mitotic clock
* Phases of mitosis and number of product cells/content
	+ Possible lab: examine onion root tips \*\*
* Characteristics of cancer cells
	+ Possible lab: Collecting cancer – causing changes kit (Carolina)
* Apoptosis

Chapter 7: Sexual Replication

* Phases of meiosis and number of product cells/content
	+ Possible lab: examine fish blastocyst
	+ Possible lab: Understanding reproduction and chromosomes kit (Carolina)
* Errors – nondisjunction outcomes
* Unique events in Meiosis (oppose to mitosis)
* Chromosome/chromatid structure
* Spermatogenesis vs oogenesis
* Alternations to chromosome structure , types and how to identify them

Chapter 8: Mendelian Genetics

* Genotype/Phenotype, Homozygous/heterozygous, dominant/recessive
* Degrees of dominance
* Punnet Squares
* True breeding vs hybrids
* Genotype vs phenotype
	+ Possible lab: Single gene inheritance inventory
* Pedigree analysis
* Law of segregation and law of independent assortment
	+ Possible activity: Dragon genetics
	+ Possible Lab: starburst 3 generation inheritance pattern
* Chromosomal theory of inheritance
* Linked genes – reading a linkage map and sex linked diseases

Chapter 9: Molecular Genetics

* Chargaff’s rules
* Structure and function of DNA
	+ Possible lab: DNA extraction
* Semiconservative replication of DNA
* Central dogma of molecular biology
	+ Possible activity: Ice Cream Sundae Synthesis (cpalms.org)
* Replication (leading vs lagging, function of important enzymes)
* Transcription
* Translation
* Understanding why the genetic code is said to be redundant
* Regulation/control (DNA level, transcriptional or translation, etc)
	+ Possible lab: Differential Gene Expression (Dozier & Rana 2009 NSF HER#0634296) \*\*

Chapter 10: Biotechnology

* PCR – explain the process/procedure and significance of Taq polymerase
* DNA Sequencing - How to read Gel Electrophoresis
	+ Possible lab: RFLP + Gel run
	+ Possible activity: Explore personal variation with finger print analysis
* Cloning – explain the process/procedure and significance
* Gene Therapy – explain concept and the 2 potential techniques
	+ Possible lab: bacterial transformation
* Vaccination – explain concept and significance
	+ Possible activity: Herd immunity simulation
* GMOS – explain concept and be able to discuss pros and cons
	+ Possible lab: GM food extraction (Carolina)

Chapter 11: Evolution

* Hardy-Weinberg principle and criteria
* Be able to describe/ recognize: Genetic drift, Bottleneck, Founder effect
	+ Possible lab: Gene variation and selection using beans
* Natural selection vs adaptive evolution
* Be able to describe the differences in directional, disruptive and stabilizing selection
* Be able to describe punctuated vs gradual speciation
* Be able to explain and identify examples of habitat, temporal, behavioral, mechanical isolation
* Understand the effect of Reinforcement, fusion and stability on a hybrid zone
* Be able to describe pre/post zygotic barriers
* Allopatric vs sympatric speciation
* Be able to recognize different species concepts

\*\*Indicates it comes up in other sections/units well