**General Biology Study Guide**

This study guide is currently complete through Exam 3 materials. More information will be added as we progress through the class and cover more material. Remember, the blue, underlined words and phrases are links to basic information related to that topic. *To open, right click on the link.*

**TEST 1**

**Introduction to Biology**

* What is biology? Why is the study of biology important?
* What are [viruses](https://sitebuilder.homestead.com/~site/builder/stage.jsp?pageId=x7662632f696e74726f64756374696f6e2d746f2d67656e6572616c2d62696f6c6f67792d3130302e787066" \t "_blank)? Are they alive or not? Support your answer.
* What are some characteristics of [prokaryotic cells](https://sitebuilder.homestead.com/~site/builder/stage.jsp?pageId=x7662632f696e74726f64756374696f6e2d746f2d67656e6572616c2d62696f6c6f67792d3130302e787066" \t "_blank)?
* List and describe the prokaryotes we met in lecture.
* Are prokaryotes good or bad? Support your answer.
* What are some characteristics of [eukaryotic cells](https://sitebuilder.homestead.com/~site/builder/stage.jsp?pageId=x7662632f696e74726f64756374696f6e2d746f2d67656e6572616c2d62696f6c6f67792d3130302e787066" \t "_blank)?
* List and describe some of the eukaryotes we met in lecture.
* Living things adapt and [evolve](https://sitebuilder.homestead.com/~site/builder/stage.jsp?pageId=x7662632f696e74726f64756374696f6e2d746f2d67656e6572616c2d62696f6c6f67792d3130302e787066" \t "_blank) (change). Describe some of the examples of change that we covered in lecture.
* Describe what is extraordinary about how argonaut octopi breed.
* What major threat are Tasmanian devils currently facing?

 **Chemistry Basics**

* Understand how atoms, molecules and compounds are represented using chemical symbols & formulas.
* Describe the subatomic parts of an atom.
* Define "atomic number", "atomic mass" & "mass number."
* What are isotopes. How does the "atomic mass" relate to isotopes?
* What makes an isotope radioactive? What does "radioactive decay" mean?
* What do the "groups" on the periodic table relate to?
* What do the "periods" on a periodic table relate to?
* What is the maximum number of electrons that an atom can have in its inner orbital?
* What are valence electrons and why are they important?
* What is the maximum number of electrons that an atom can have in its valence shell?
* Understand how atoms, molecules and compounds are represented using chemical symbols & formulas.
* What is an ionic bond? An ionic compound?
* What is a covalent bond?
* What makes a covalent bond polar? Nonpolar?
* What is an oxidation reduction reaction? What happens when a substance is oxidized?

What happens when a substance is reduced?

* Compare and contrast acids bases and salts.
* Describe what makes a solution acidic or basic.
* Understand the relationship between ions and pH.
* Know enough about the pH scale to understand which numbers represent acidic, neutral and basic substances.
* Explain the relationship between the terms "ions", "salts" & "buffers".
* Explain what it means that the pH scale is logarithmic.
* Explain the difference between an inorganic and an organic molecule.
* Understand why is carbon such a big deal to organic chemistry.
* Understand what a monomer and a polymer are.
* What are carbohydrates, proteins and nucleic acids made of? What is the monomer (subunit) of each organic molecule called? What is the polymer called? Use the Study Table of Organic Macromolecule presented in this lecture to make a study guide.
* What are the different types of lipids covered in this lecture?

**Biological Cells**

*Prokaryotic Cells*

* Understand, and be able to define the structural components of [prokaryotic cells](http://www.scienceprofonline.com/cell-biology/prokaryotic-cell-parts-functions-diagrams.html%22%20%5Ct%20%22_blank).
* What is the difference between a vegetative cell and an [endospore](http://www.scienceprofonline.com/microbiology/what-is-a-bacterial-endospore.html%22%20%5Ct%20%22_blank)?
* Understand how [prokaryotic cells reproduce](http://www.scienceprofonline.com/microbiology/binary-fission-cell-division-reproduction-prokaryotes.html%22%20%5Ct%20%22_blank).
* Understand the importance of the [bacterial cell wall](http://www.scienceprofonline.com/microbiology/bacterial-cell-wall-structure-gram-positive-negative.html%22%20%5Ct%20%22_blank). What makes a [Gram+ cell](http://www.scienceprofonline.com/microbiology/gram-positive-bacteria-cell-wall.html%22%20%5Ct%20%22_blank) different than a [Gram- cell](http://www.scienceprofonline.com/microbiology/gram-negative-bacteria-cell-wall.html%22%20%5Ct%20%22_blank); how the differences impact control of microorganisms.
* Which types of organisms are prokaryotes?
* Know the example prokaryotes that we discussed in lecture and the information that was provided with each example.

*Eukaryotic Cells*

* What are the [two basic types of biological cells](http://www.scienceprofonline.com/cell-biology/prokaryotic-and-eukaryotic-two-types-of-biological-cells.html%22%20%5Ct%20%22_blank)?
* Know the structural components of [eukaryotic cells](http://www.scienceprofonline.com/cell-biology/eukaryotic-cell-parts-functions-diagrams.html%22%20%5Ct%20%22_blank) (organelles & other cellular components) and the function of each.
* Know the components of the eukaryotic [endomembrane system](http://www.scienceprofonline.com/cell-biology/endomembrane-system-eukaryotic-cell.html%22%20%5Ct%20%22_blank) and how this system of membranes functions to move materials into, out of, and within the cell.
* ​How are eukaryotic cells similar to [prokaryotic cells](http://www.scienceprofonline.com/cell-biology/prokaryotic-cell-parts-functions-diagrams.html%22%20%5Ct%20%22_blank)? How are they different?

**Metabolism, Diet & Nutrition**

* Understand difference between catabolism and anabolism, and what these reactions have to do with [metabolism](http://www.scienceprofonline.com/metabolism/why-do-we-breathe-aerobic-cellular-respiration.html%22%20%5Ct%20%22_blank).
* What is [ATP](http://www.scienceprofonline.com/chemistry/what-is-nucleotide-adenosine-triphosphate-atp.html%22%20%5Ct%20%22_blank), and what is its significance in metabolism.
* Where does metabolic energy originate? How is it captured? What organelles and pigments are involved?
* Understand what [fermentation](http://www.scienceprofonline.com/metabolism/cellular-metabolism-what-is-fermentation.html%22%20%5Ct%20%22_blank) is.
* Which types of metabolism are most energy efficient & least energy efficient?
* How many [ATP molecules](http://www.scienceprofonline.com/chemistry/what-is-nucleotide-adenosine-triphosphate-atp.html%22%20%5Ct%20%22_blank) can an organism that uses fermentation create from one molecule of glucose?
* What is a food calorie (kilocalorie)?
* ​Understand how many food calories (kilocalories) are in a gram of [carbohydrate](http://www.scienceprofonline.com/chemistry/organic-chemistry-what-is-a-carbohydrate.html%22%20%5Ct%20%22_blank), [protein](http://www.scienceprofonline.com/chemistry/what-are-proteins-amino-acids-peptide-bonds.html%22%20%5Ct%20%22_blank) & [fat](http://www.scienceprofonline.com/chemistry/what-is-a-lipid-organic-chemistry-fats-phospholipids-waxes-steroids.html%22%20%5Ct%20%22_blank).
* What are macronutrients and micronutrients?
* What is the relationship between carbohydrates and fiber?
* What is the difference between complete and incomplete proteins?
* What are the differences between saturated and unsaturated fats? Are all fats bad? Which type is healthier?
* What are essential fatty acids?
* How do you calculate the calories in alcohol?
* What is the difference between vitamins & minerals?

**Mitosis & Meiosis**

* What is the relationship between replication and [mitosis](http://www.scienceprofonline.com/genetics/cell-division-what-is-mitosis.html%22%20%5Ct%20%22_blank)?
* What are the two main phases of the cell cycle?
* What are the stages of mitosis, and what happens at each phase?
* If [DNA](http://www.scienceprofonline.com/genetics/what-is-dna-deoxyribonucleic-acid.html%22%20%5Ct%20%22_blank) is condensed into chromosomes, is the cell in interphase or mitosis?
* If the DNA is condensed into chromosomes, can [replication, transcription and translation](http://www.scienceprofonline.com/genetics/nucleic-acid-function-DNA-replication-transcription-translation.html%22%20%5Ct%20%22_blank) occur? Why or why not?
* If the DNA is not condensed, if it is in the form of chromatin, is the cell in interphase or mitosis?
* If a cell has a total of 6 chromosomes, how many chromosomes will each of its daughter cells have after mitosis? How many after meiosis?
* How are mitosis & meiosis similar? How do they differ? Be specific.
* What is cytokinesis and when does it occur?
* How does cytokinesis of a plant and [animal cell](http://www.scienceprofonline.com/cell-biology/animal-cell-parts-functions-diagrams.html%22%20%5Ct%20%22_blank) differ?
* What are homologous chromosomes? What does a pair of unduplicated homologues look like?
* Explain the difference between [duplicated and homologous chromosomes](http://www.scienceprofonline.com/genetics/genetics-terminology-difference-duplicated-homologous-chromosomes.html%22%20%5Ct%20%22_blank).
* Explain the difference between [chromosomes and sister chromatids](http://www.scienceprofonline.com/genetics/genetics-terminology-chromosomes-sister-chromatids.html%22%20%5Ct%20%22_blank)?
* How do homologues and sister chromatids differ?

**TEST 2**

**Embryonic Development**

* Understand how early human embryonic development unfolds from fertilization to the gastrula stage.
* Understand which tissues and body systems arise from each of the three embryonic derm layers (ectoderm, mesoderm, endoderm).
* What type of cell division is responsible for growth and development of non-sex cells (somatic cells) in humans.
* Be able to summarize what you learned from the video we watched in class - “Your Inner Fish” .

**Tissues**

* Know and be able to recognize the 4 tissue types.
* What are the three types of muscle tissue? Be able to recognize skeletal muscle microscopically.
* What are the types of connective tissue?
* Be able to recognize skeletal tissue.
* What type of cells make up neural tissue? Be able to recognize this cell type.
* In what two ways are epithelial cell classified? Know the different types of epithelial tissue.
* We did not cover Organ Systems, so there will not be any questions on this.

**HEREDITY**

* Genotypes, phenotypes, alleles, homozygous, heterozygous; know what these terms mean.
* Know who Mendel was, and be able to explain his contribution to science.
* Understand what potential genotype underlies a dominant or a recessive phenotype (remember the bent finger examples and the other examples of simple inheritance that we covered in the chart.)
* Understand Mendel’s Laws of Dominance, Segregation and Independent Assortment.
* Understand the genetic terms; character, trait, hybridization, true-bred.
* Be able to do a Punnett Square cross for simple traits, as we covered in class.
* What is incomplete dominance?
* What does codominance mean?
* Explain ABO bloodtypes. What blood type is best to have if you are receiving blood? What is the best blood type to have if you are donating blood? Why?

**GENE EXPRESSION: TRANSCRIPTION & TRANSLATION**

* ​Understand how [RNA molecules](http://www.scienceprofonline.com/genetics/ribonucleic-acid-rna-structure-and-function.html%22%20%5Ct%20%22_blank) are made through the process of [transcription](http://www.scienceprofonline.com/genetics/nucleic-acid-function-DNA-replication-transcription-translation.html%22%20%5Ct%20%22_blank).
* What [nucleic acid](http://www.scienceprofonline.com/chemistry/nucleotides-nucleic-acids-atp-rna-dna.html%22%20%5Ct%20%22_blank) base is used in the construction of RNA that is not utilized in DNA molecules? What nucleic acid based is not used in RNA molecules that is used in the construction of [DNA](http://www.scienceprofonline.com/genetics/what-is-dna-deoxyribonucleic-acid.html%22%20%5Ct%20%22_blank)?
* How is transcription similar to [replication](http://www.scienceprofonline.com/genetics/genetic-replication-copying-dna.html%22%20%5Ct%20%22_blank)? How is it different?
* Understand how protein molecules are made through the process of [translation](http://www.scienceprofonline.com/genetics/nucleic-acid-function-DNA-replication-transcription-translation.html%22%20%5Ct%20%22_blank).
* What types of RNA are involved in translation and what are their roles?
* What is the ‘triple code’? What is its role in the structure of proteins build through translation?
* What is a codon? What is an anti-codon?
* What is epigenetics?
* Be familiar with the *Henrietta’s Tumor* & *Inheritance* Radiolab episodes

**MISC**

* Be familiar with all assigned reading associated with Test #2 (see Homework & Reading Schedule).

**TEST 3**

**EVOLUTION**

• Who were the main contributors to pre-Darwinian explanations of evolution? How did they explain how living things change over time? (We covered Lamarck, Kamerer)

• How did Darwin come up with his explanation of evolution? (Do not be fooled by how brief this question is. The answer is not brief.)

• Explain how natural selection works. (Do not be fooled by how brief this question is. The answer is not brief.)

• How did our in-class exercise with the forks and beans model how evolution by natural selection works?

• What did Darwin mean by the term "fitness"?

• Explain the difference between natural and artificial selection. Describe two examples of artificial selection.

• Why did we listen to the “New Nice” Radiolab episode on Russian silver foxes. How does this story relate to evolution?

• Explain how bacterial antibiotic resistance relates to evolution by natural and artificial selection

• Explain why the story of the Peppered Moth is so useful in demonstrating the power of evolution by natural selection.

• Our Evolution Main Page has the reading on evolution that you are responsible for. Scroll down that page and you will see the heading *EVOLUTION "Class Notes" READINGS.* The articles linked below this heading are the ones you should be familiar with.

**BIOLOGICAL CLASSIFICATION**

* What kind of evidence do scientists use to categorize and classify living things?
* Hierarchy of [biological classification](http://www.scienceprofonline.com/biology-general/what-are-biological-systematics-taxonomy-phylogeny.html) has nine major taxonomic ranks. What are they?
* Know the three domains and the forms of life each represents.
* [Binomial nomenclature](http://www.scienceprofonline.com/biology-general/biological-classification-binomial-nomenclature.html): Genus species; Know how to properly write the generic and specific name of a species.
* What is a dichotomous key? How many choices are at each decision point?

**VIRUS STRUCTURE**

* Understand what [viruses](http://www.scienceprofonline.com/microbiology/what-is-a-virus.html) are and how they differ from cells.
* Are viruses alive? Present a convincing argument for your case.
* Be able to describe the four types of [genetic material](http://www.scienceprofonline.com/chemistry/nucleotides-nucleic-acids-atp-rna-dna.html) that viruses can be made of. How is the genetic material of viruses different from that of living organisms? How is it similar?
* Understand the difference between an enveloped and non-enveloped virus.
* What are the three main structural elements that viruses can be made of. Which of these structural elements is not present in all viruses?
* Describe the different shapes of viruses.

**VIRUS REPRODUCTION**

* Know the difference between the viral intracellular and extracellular states.
* Understand the different ways that viruses can get into and out of cells.
* Compare and contrast the entry and exit of [bacteriophages](http://www.scienceprofonline.com/microbiology/what-is-bacteriophage-virus.html) with that of animal viruses.
* What is a bacteriophage?
* Explain what transduction is, and how it relates to bacteriophages and their host bacteria.
* In the Radiolab Podcast “Shrink” they described a group of new viruses that have been recently discovered. How are these viruses different than previously known viruses?

**VIRUS TYPES** (Meet the Viruses)

* Understand the difference between an enveloped and non-enveloped virus.
* Viruses have one of four different basic types of genomes. For each virus described in this lecture, know its genome type and whether it is enveloped or non-enveloped.
* Know the names and descriptions of the different types of herpes viruses. What is special about herpes viurses?
* HIV (Human-immunodeficiency-virus) is a retrovirus. Understand the key difference between a retrovirus and other types of viruses.
* Know which type of viruses can cause the [common cold](http://www.scienceprofonline.com/microbiology/why-do-people-catch-cold-viruses-in-summer.html).
* Be able to describe what HPV, is and its relationship to cancer.
* Understand, and be able to describe, the two ways we discussed that viruses can hide (in cells and in nature).
* Be able to describe the difference between modified live and killed virus vaccines.

**BACTERIAL TYPES** (Meet the Bacteria)

* Understand the three types of Archaea that we discussed.
* Understand the difference between Gram-positive and [Gram-negative bacterial cell walls](http://www.scienceprofonline.com/microbiology/bacterial-cell-wall-structure-gram-positive-negative.html).
* Know the information presented on the Gram-positive bacterial genera and species that we discussed.
* Name and describe the bacterial genera that produce [endospores](http://www.scienceprofonline.com/microbiology/what-is-a-bacterial-endospore.html). Are they Gram-positive or Gram-negative?
* Which species of bacteria are considered Gram-variable? Why?
* What is different about the [cell wall structure of Mycobacteria](http://www.scienceprofonline.com/microbiology/acid-fast-ziehel-neelsen-bacteria-stain-identify-mycobacteria-nocardia.html) when compared to the Gram-positive bacterial cell wall?
* Know the information presented on the Gram-negative bacterial genera and species that we discussed.
* Describe the important differences between encapsulated and unencapsulated Haemophilus influenzae.
* How is the life cycle of Chlamydia different than that of most bacteria?
* What bacteria causes syphilis? Describe the course of the disease.
* You are NOT responsible for knowing any of the different bacterial growth media (MacConkey’s, Mannitol Salt & Blood agar) presented in this lecture.