BIOL 300 – Foundations of Biology
Summer 2017 – Telleen
Exam #1 Study Guide

Disclaimer: This outline is designed to help you organize the major topics that we have covered since the last exam and help you study. However, you need to be familiar with all of the material covered in class, not just the general topics listed here. This study guide is meant to be used in conjunction with the lecture outlines and your own notes, not as a substitute for them.

Exam #1 will cover the material from the beginning of the course through Lecture 6 (Transport Across Membranes). Questions will be a variety of styles. You do NOT need to bring a scantron.

I. Defining Life and Diversity of Life
- A. Know the types of criteria that used to define life
- B. Be able to propose and critically analyze a list of proposed criteria to define life
- C. Why isn't a single criteria sufficient to define life?
- D. Are viruses alive? Defend your position
- E. Understand the basic system of classification used to categorize organisms
- F. Know the three Domains
- G. Be able to explain and use binomial nomenclature
- H. Be able to explain what a phylogenetic tree is and what they represent

II. Science and the Scientific Method
- A. Understand what science is and what its goals are
- B. Know what is meant by the terms **empirical** and **falsifiable** and how they relate to science
- C. Be able to explain what a model is and why making predictions is important
- D. Be able to outline the basic process of the Scientific Method and apply it simple problems
- E. Understand why the Scientific Method is iterative and self-correcting
- F. Know what variable and controls are in the context of scientific experiments
- G. Be able to explain the difference between hypotheses and theories
- H. Be able to distinguish between observation and inference, and explain why this distinction is important
- I. Be able to explain and apply Ockham's Razor
- J. Be familiar with the 4 general theories that unify biology as a science

III. Basic Chemistry, Bonding, and Water
- A. Understand what matter and atoms are
- B. Be able to describe the general structure of atoms (including the subatomic particles they are composed of)
- C. Know the relationship between elements, atomic mass, and atomic number, and how they relate to atoms and subatomic particles
- D. Understand what ions and isotopes are
- E. Know what a molecule is
- F. Be able to explain and give examples of the three types of chemical bonds and how electrons contribute
- G. Know the difference between polar and nonpolar covalent bonds
- H. Understand the terms hydrophilic and hydrophobic
- I. Understand why water (H_2O) is such an important molecule for life (and how hydrogen bonds contribute)

J. Understand the basic chemistry of water and hydrogen ions (H^+)(including polarity, ionization, and pH).

IV. Biochemistry and Macromolecules

A. Know what organic molecules are and how they relate to life
B. Be able to explain what a polymer is
C. Understand what macromolecules are and be able to describe the four major groups of biological macromolecules (including what monomers they are made from!)
D. Understand what a peptide bond is and how the different levels of protein structure (e.g. 1^o, 2^o, etc) relate to each other.
E. Know what is meant by the term **denatured** in the context of proteins and be familiar with the general roles that proteins play in biological systems
F. Know the function of DNA, the general structure of nucleotides, and the different bases that are present in DNA and RNA
G. Understand why the two strands of DNA molecules are held together
H. Know what carbohydrates are, their functions, and different types (e.g. mono- and di-saccharides, complex carbohydrates, etc.)
I. Know the definition of lipids and how they differ from the other three classes of macromolecules
J. Understand the general structure of fats and oils, as well other types of lipids discussed in class (including their functions).
K. Be able to explain how you could test for various macromolecules if you are given an unknown (e.g. Biochemistry lab).

V. Life on Earth and Cells

A. Understand how life is defined (and why this is a contentious issue)
B. Understand possible mechanisms for the initial formation of life on Earth
C. Understand the tree of life and the evidence that all life on Earth is related
D. Be able to explain the Cell Theory and what a cell is
E. Be able to explain why the surface area to volume ratio of a cell is important
F. Know generally how big cells are compared to other structures/object/people/etc.
G. Be able to explain how we are able to look at and study cells even though most are too small to see (e.g. microscopy, different types of microscopes, etc)
H. Understand the similarities and differences between prokaryotic and eukaryotic cells
I. Be able to describe the general structure of eukaryotic cells, including membrane structure, the organelles, and other subcellular structures (as well as the functions of all these things within cells)
J. Know the parts of the light microscope, how to calculate magnification, etc. (e.g. Microscopy lab)

IV. Membranes and Transport

A. Understand the general structure and components of biological membranes
B. Be able to describe the various ways molecules can enter and exit cells by crossing the membrane
C. Be able to define and explain diffusion
D. Understand what concentration gradients and equilibrium are and how they relate to diffusion
E. Be able to define and explain osmosis
F. Know what is meant by aquaporins and semi-permeable membranes (and how they relates to osmosis)
G. Know what is meant by osmotic concentration and how the terms isotonic, hypotonic, and hypertonic relate to it

H. Understand what is meant by the terms endocytosis, exocytosis, phagocytosis, and pinocytosis.
I. Be able to describe receptor-mediated endocytosis
J. Be able to explain selective permeability
K. Understand the distinction between selective diffusion and facilitated diffusion
L. Be able to define active transport and describe the two main types of channel proteins involved