Biology 3A
Final Exam - Study Guide. The exam will consist of multiple choice, true-false, "fill-in", and short answer.
Total of 100 points

The following is by no means everything on the test. This guide emphasizes main topics that are covered on the test in one fashion or another. Review your lecture notes in detail and the textbook to clarify and expand on concepts discussed in class. Study groups can help because you will really learn the material if you can teach it to someone. Don't forget to use your textbook's glossary and index to help define terms and find subjects.

Chapter 22: Descent with modification

- Understand and/or know how to define the following concepts/terms: evolution, natural selection, biotic environment, abiotic environment, adaptation; scala naturae, artificial selection, vestigial organs, embryonic development, catastrophism, "inheritance of acquired characteristics", uniformitarianism, biogeography, fossil record, "missing links", endemic species, homology, analogy, "tinkering vs. engineering", convergent evolution, common ancestor,
- Know the contribution of the following philosophers/scientists to the development of evolutionary biology: Plato, Aristotle, Carolus Linnaeus, Comte de Buffon, Erasmus Darwin, George Cuvier, Jean-Baptiste Lamark, Charles Darwin, James Hutton, Charles Llyell
- What type of evidence did Comte de Buffon and Erasmus Darwin consider when proposing that species were not fixed?
- What were the four commonly accepted pre-Darwinian worldviews discussed in lecture?
- What were the key observations that Darwin made during the voyage of the Beagle that suggested to him that species could evolve?
- What are the three observations and two inferences that lead to Darwin's description of the process of natural selection?
- What kind of information can be obtained from studying the fossil record?
- What are the five main lines of evidence for evolution? Know the examples discussed in lecture and in your textbook.

Chapter 23: The evolution of populations

- Understand and/or know how to define the following concepts/terms: macroevolution, microevolution, discrete characters, quantitative characters, genetic effects, environmental effects, polymorphism, population, average heterozygosity, nucleotide variability, cline, geographic variation, reproductive isolation, Hardy-Weinberg (H-W) principle, gene pool, fixed alleles, genetic drift, gene flow, natural selection, bottleneck effect, founder effect, relative fitness, reproductive success, sexual selection, mate competition (intrasexual selection), mate choice (intersexual selection), sexual dimorphism, "the good gene hypothesis", gene-environment interaction, heterozygote advantage, frequency-dependent selection,
- What is the smallest unit of evolution? Why?
- What are the sources of phenotypic variation? What are the sources of genetic variation? Why is genetic variation important for evolution? How can genetic variation be quantified? Know how to calculate average heterozygosity and nucleotide variability.
- What type of genetic mutations can contribute to genetic diversity? What is the relationship between the effects of mutations and their environment?
- What is the H-W equilibrium? What does it tell us about the evolutionary status of a locus in a population? What are the 5 conditions for a population to be under H-W equilibrium? If a locus in a population is not under H-W equilibrium, what does that tell us about that locus and/or population? Given some information about the frequency of one allele, know how to calculate the frequency of the other allele, the frequency of each homozygote and

the frequency of heterozygotes for that locus. Finally, be able to tell whether a particular locus is at H-W equilibrium.

- What are the three main evolutionary agents discussed in lecture? How do they cause gene frequencies to change over time? Know examples.
- How does population size affect the consequences of genetic drift? What are the likely consequences of genetic drift, in particular when it involves bottleneck or founder effects?
- What are the consequences of gene flow into populations locally adapted at particular loci?
- What are the three modes of natural selection? Does natural selection tend to erode genetic variation? Why? What are the 6 factors discussed in lecture that tend to maintain genetic variation in natural populations? Know examples.
- How can secondary sexual traits (e.g. male coloration, large display feathers, courtship behavior, large tusks, etc) evolve by natural selection if they tend decrease survival of the bearers?
- What are the two forms of balancing selection? What are the examples for each type that were discussed in lecture?
- Why can't natural selection produce "perfect" organisms? Know the 4 main reasons discussed in your textbook and during lecture.

Chapter 24: The Origin of Species

- Understand and/or know how to define the following concepts/terms: biological species concept, other species concepts (morphological, ecological, phylogenetic), reproductive isolating mechanisms, speciation, prezygotic mechanisms, post-zygotic mechanisms, habitat isolation, temporal isolation, behavioral isolation, mechanical isolation, gamete isolation, reduced hybrid viability, reduced hybrid fertility, hybrid breakdown, sympatric speciation, allopatric speciation, autopolyploidy, allopolyploidy, adaptive radiation
- Understand the 5 prezygotic reproductive isolating mechanisms and the 3 postzygotic reproductive isolating mechanisms discussed in lecture and in your textbook.
- What are the two main processes through which speciation can occur? Know examples.
- How can mutation, natural selection, and genetic drift contribute to allopatric speciation?

Finally, know how to interpret a cladogram and how to construct a simple cladogram based on a data matrix.