EEB 2245/2245W Spring 2009

Study guide for exam #1

Questions for the exam will be drawn from topics covered in lecture. You will not be required to remember complicated formulas, but you will be expected to solve problems similar to those on the homework problems without referring to notes. The exam will consist of a combination of short answer questions and problems similar to those on the homework. You will not be required to remember complicated formulas, but you will be expected to solve these problems without referring to notes. You may be required to provide definitions of key concepts or to distinguish among them.

Evolutionary pattern and evolutionary process

- Know the difference between evolutionary pattern and evolutionary process.
- Be able to describe and recognize the differences between special creation, Lamarckism, and modern evolutionary theory.
- Be able to describe and recognize the differences between microevolution and macroevolution. It would be a good idea to know the definitions provided in the outline of lectures from 1/20 and 1/22.

Evolutionary change

- Remember the example of plumage color in house sparrows, and be able to explain how it is an example of evolutionary change.
- Be able to define evolutionary change (at the level of microevolution).
- Be able to define the key terms in the definition of evolutionary change. There are two, and they're both defined in the outline of lectures from 1/20 and 1/22.

Population genetics

- Be able to explain the relationship between population genetics and Mendelian genetics and between population genetics and evolutionary biology.
- Hardy-Weinberg
    - Be able to state the four assumptions underlying Hardy-Weinberg.
    - Be able to identify the evolutionary processes associated with violating each assumption.
    - Be able to calculate allele frequencies and genotype frequencies from counts of alleles or genotypes.
    - Be able to calculate the expected number of individuals in different genotype classes when genotypes are in Hardy-Weinberg.
    - Be able to suggest evolutionary processes that could produce an observed deviation from Hardy-Weinberg proportions.
- Genetic drift

  - Be able to provide a definition of genetic drift and to identify when it's important.
  - Be able to state at least 2 of the 3 additional assumptions about a population that make it "ideal".
  - Know how to interpret the importance of drift in terms of the *effective* population size and how the *effective* population size differs from the number of individuals you would count in that population.
  - Know the basic consequences of genetic drift. Seven are listed in the outline of lectures from 1/27 and 1/29
- Migration
  - Know how migration for a population geneticist is different from migration for an ornithologist.
  - Know how to calculate the migration rate from the population size and the number of individuals that are migrants.
  - Know how to calculate the consequences of migration, given an allele frequency in the population, an allele frequency in migrants, and a migration rate.
- Drift & migration
  - Given the effective population size and the migration rate, know how to determine whether drift or migration will be the predominant process in the population.
  - Be able to draw a simple graph illustrating the distribution of allele frequencies among populations given particular values of the effective population size and the migration rate.
- Non-random mating
  - Be able to name at least two ways in which there may be departures from random mating.
  - Know how genotype and allele frequencies change as a result of inbreeding.

Natural selection

- Be able to list the assumptions underlying the theory of evolution by natural selection. Either the three assumption version I originally introduced (the one that uses Darwin's logic) or the simpler two assumption version (the more modern version) will be accepted.
- Be able to describe the case of *Biston betularia* and how it provides an example of evolution by natural selection.
- Be able to distinguish between selection within a generation and evolution by natural selection.
- Be able to describe an experiment that would be necessary to show that there is evolution by natural selection in response to predators in *Anolis sagrei*.
- Be able to describe an example in which selection operates simultaneously at different levels, e.g., the *t* allele in house mice or the experiments on *Tribolium castaneum*.