I. Short Answer Questions DO ALL OF THEM, PLEASE

SAQ #1. What are the key assumptions that, if true, would lead a population to Hardy Weinberg equilibrium in one generation? Please list and briefly explain 5 totally different assumptions.

SAQ #2. What can one conclude if a population is censused and its genotype frequencies are found to be significantly different from Hardy-Weinberg expectation?

SAQ #3. Please explain the three conditions that are required for evolution to occur by Natural Selection.

SAQ #4. Please describe at least two **totally different** and biologically realistic scenarios by which evolution might occur by genetic drift.

SAQ #5. What is a "heterozygote advantage" and explain how might this lead to the maintenance of genetic variation by Natural Selection? You may use a real example if you choose.

SAQ #6. Please briefly define meiotic drive, and explain why it is so rarely observed in natural populations.

SAQ #7. What is the evidence that the ground finches of Isla Daphne Major (Galapagos Islands) have evolved through natural selection? [You should invoke the three conditions (or four as stated in Chapter 2 of the text) of natural selection (SAQ #3 above).]

SAQ #8. What is the Cambrian Explosion or Metazoan Radiation? Specifically, what occurred during the Cambrian and why was it unique in comparsion to other radiations?

SAQ #9. What are reproductive isolating mechanisms (RIMs) and why are they important for speciation? Give an example of at least one prezygotic and one postzygotic RIM in your answer.

SAQ #10. What are the implications of the statement that "natural selection acts on existing traits"? How does this constrain the possible outcomes of evolution?

SAQ #11. What is the relationship of macroevolution to microevolution, as stated by the Modern Synthesis? Why does the concept of "punctuated equilibrium" challenge this relationship?

SAQ #12. Contrast the two types of allopatric speciation: dichopatric and peripatric.

Part II. Longer Answer Questions (20 points each).
You must do (LAQ#1 or LAQ#2) and (LAQ#3 or LAQ#4).

For LAQ #1 and LAQ#2, cross out the question you are NOT answering.

LAQ #1. This question will assess your understanding of "chance" in evolution and challenge you to integrate information from several different lectures.
Chance is considered by some to play an important role in macroevolution. Address the possible roles of chance in evolution during both (a) speciation (10 pts) and (b) extinction / adaptive radiation events (10 pts).

OR

LAQ #2. This question will assess your understanding of extinctions and adaptive radiations.
What happens in the course of a mass extinction / adaptive radiation cycle?

(a) Describe the causes of **either** the Late Permian extinction **or** the Cretaceous-Tertiary boundary extinction. Provide examples of the geological evidence of the "ultimate" cause of the extinction (what big geological event occurred) and discuss the more "proximate" causes of death of various biota.

(b) How do the rates of mass extinction events differ from background extinction? What kind of loss of species and families are experienced? What types of species survive and participate in the ensuing adaptive radiation?

LAQ #3. This question will assess your understanding of the computer simulations of microevolutionary processes.

(a). Following a bit of algebra, one can show that under directional selection against allele "a" (with fitnesses of AA, Aa, and aa equal to w0, w1, and w2), the rate of evolution (or Δq) equals

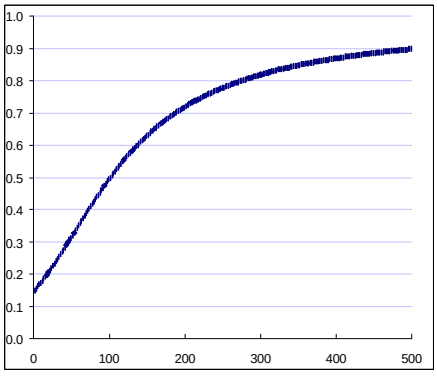
$$\Delta q = (p*q / wbar) * (q*(w2-w1) + p*(w2-w0))$$

Please explain in words, what are the principal conclusions from this equation regarding the rate of evolution.

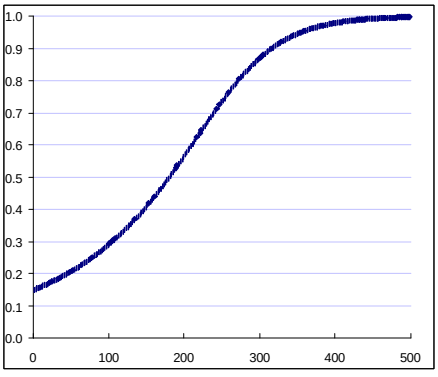
(b). What is the predicted outcome of a finite mutation rate of "A" into "a" at a rate alpha (α) with a backward mutation rate of beta (β) with starting frequencies of p and q? What is the theoretical prediction for the values of p and q after a long time? SHOW ALL WORK.

(c). Consider the two cases for directional selection at right:

w0	w1	w2
1	1	0.95



w0	w1	w2
1	0.96	0.95



Why does evolution proceed initially much more rapidly in the case at left?
Why does evolution lead to fixation of "A" much sooner in the case at right?

LAQ #4. This question will assess your understanding of coevolution.

(a). Please briefly define coevolution:

(b). Please briefly explain two ways in which coevolution differs from evolution.

(c). Offer **and briefly explain** a biological example of how coevolution could have resulted from selection due to competition.

(d). Offer **and briefly explain** a biological example of how coevolution could have resulted from selection due to a predator prey interaction.

(e). Offer **and briefly explain** a biological example of how coevolution could have resulted from selection due to mutualism.

(f). Is coevolution a micro- or macro-evolutionary process? Please briefly explain your reasoning.