

STUDY GUIDE FOR EXAM I - Spring 2017

NOTE: This guide is not a substitute for coming to class, taking notes and reading your text. It is merely a general checklist that should help guide you through your readings. Just because I may have missed a detail or two on this study guide doesn't mean it's unimportant. If we covered it in class or if it's in the assigned readings, it's fair game.

The best study guide of all is the combination of your notes and text readings. The self-test questions at the end of each chapter are an excellent indicator of how well you're understanding the material.

Finally, be sure to read all the notes and your text completely. There will be a review session on Tuesday, Feb 9 at 5pm, but I am not a walking set of Cliff's Notes. If a term or concept is on the study guide, it means you should be able to get all the information you need from the text and notes. If something isn't clear, I'll be happy to explain it. But ***don't ask me to define things that you should be looking up on your own.*** You will learn them better that way.

Text Readings: Chapter 1, 22, 23, 25 (pp 520-524; 532-539)

For an excellent overview of misconceptions about natural selection and adaptation, go here:

http://evolution.berkeley.edu/evolibrary/article/misconcep_01

(And keep clicking on the "next" buttons at the bottom right of each page when you're done.)

Other links are there for your information, and to complement the lecture material for your better understanding. Remember: it's more important for you to understand how things work, than to memorize minute details of examples used to illustrate concepts! The stories and examples are there to help you understand HOW THINGS WORK.

Biodiversity

Know the meaning/significance of: biodiversity, taxonomy, systematics, holotype, paratype, conspecific, species, population, nuclear genome, organelle genome,

What is the significance of inbreeding and outbreeding, with respect to genetic diversity and genetic "health" of a species?

Understand the nature of the anthropocentric, biocentric, and ecocentric points of view in conservation. Be able to recognize examples of each.

Know the meaning/significance/examples of: indicator species, keystone species, endangered species, threatened species, endemic species, exotic species, invasive exotic species, allelopathy

Finally, be sure you are familiar with the scientific method and the scientific definitions of hypothesis, theory, law, inductive vs. deductive reasoning, etc. The link at the end of Lecture 1 will help you review these, if you're a little rusty.

The History of Evolutionary Thought

Know the general age of the universe, solar system, earth. How long as life been on earth (at least as far as current research tells us)? How long has Homo sapiens existed on earth?

Know the contributions of each of the following to modern evolutionary theory, and know a little bit about each person: Plato, Aristotle, Francesco Redi, Lazzaro Spallanzani, Anton von Leewenhoek, Louis Pasteur, Jean Baptist Lamarck, Charles Darwin, Alfred Russell Wallace, Stanley Miller and Harold Urey.

What is epigenetic inheritance? (How is it somewhat related to the early ideas of Lamarck?)

Know the meaning/significance of spontaneous generation, abiogenesis. Is the origin of life the same as the evolution of life?

Understand the significance of neutral evolution, first proposed by Mootoo Kimura.

The Darwinian Revolution

What was Darwin doing when he devised his famous theory of evolution by natural selection?

Know the meaning/significance of: HMS Beagle, Captain John Fitzroy, the Galapagos Islands, uniformitarianism, catastrophism, artificial selection, the contributions to Darwin's theory of George Cuvier, Thomas Malthus, Rev. John Henslow, etc.

Know Darwin's four tenets of evolution by natural selection, how to apply them, and how to recognize examples in nature of the "tenets in action." What is the meaning of Darwin's term "descent with modification"?

What is meant by adaptive, maladaptive, and neutral traits?

Understand the meaning of the phrase "survival of the fittest" in the context of Darwinian evolution. You may think you already know. But just be sure to read the section on this topic in the notes from Lecture 2 so you really

do know. You have been alerted.

Know the meaning of the word "tautology". Is the term "survival of the fittest" a tautology? Is the term meaningful in terms of Darwinian evolution?

Be able to address the common **misconceptions** about evolution and explain why they are incorrect.

Evidence for Evolution: Fossil Record

Understand the differences between the basic methods used to date fossils, and of what use each type is, considering the age and type of fossil you have to work with. What is meant by "half life"? Which isotopes are best for dating relatively recent fossils? Which are most commonly used to date extremely ancient ones?

Understand the idea of spontaneous generation. How did the experiments/discoveries of Francesco Redi, Anton van Leeuwenhoek, Lazzaro Spallazani and Louis Pasteur affect's people's acceptance of this idea?

What was the significance of Stanley Miller and Harold Urey's apparatus and experiment? What did they find?

Know the contribution of John Sutherland, et al. to our understanding of the formation of early biological macromolecules (we watched the video in class; it's the one introduced by Neil DeGrasse Tyson).

Evidence for Evolution: Homology of Form, Embryos, Genes

Know the four basic lines of evidence that support the fact of evolution

Know the meaning/significance of: homology, analogy, primitive vs. derived character, (plesiomorphy vs. apomorphy, and symplesiomorphy vs. synapomorphy), convergent evolution.

Know how the study of symplesiomorphies and synapomorphies across species is applied to the study of their evolutionary relationships. (Your workshops and the laboratory exercise on Systematics will help with this.)

Know what is meant by "Just So Stories", genotype, phenotype, ontogeny, heterochrony, neoteny, paedogenesis, paedomorphy, allometric growth, DNA (and the four "letters" of the DNA alphabet)

Be able to **recognize** examples of morphological, ontogenetic, and molecular homology among species.

Know the meaning/significance of vestigial and atavistic characters.

What is "**Evo Devo**"? What did Ernst Haeckel mean by the phrase "ontogeny recapitulates phylogeny"? Was he exactly correct? Understand why or why not.

Know the meaning/significance (in terms of ontogenetic homology) of: zygote, blastula, gastrula, gastrulation, blastopore, protostome, deuterostome, homeotic genes (what is their job? Check your text if you don't remember this from lecture, or Google it!)

What is a gastrea? What is its significance to animal evolution?

Know the meaning of heterochrony. How can this result in changes in species? What is the link between heterochrony, allometric growth, and paedomorphy? (See <http://www.bio.miami.edu/dana/dox/heterochrony.html>)

Evidence for Evolution: Biogeography

When did the continents begin to drift apart? When were they fully separated? Of what significance is this in terms of biological evolution? Understand the connection between continental drift and climate/climate change.

Know the meaning/significance of: biogeography, Pangaea, Laurasia, Gondwanaland, subduction zone, seafloor spreading zone, continental plate, oceanic ridge,

Understand how congruence of phylogenetic trees of organisms and geographical change can indicate evolutionary history shared by the organisms and the continents (and smaller land masses) on which they live.

Evidence for Evolution: Evolution Observed

Understand how recently observed incidences of microevolutionary change provide evidence that such processes have been occurring since life on earth began.

Know the meaning/significance of: Bergmann's Rule, evolution as compromise, reproductive isolation.

Know the different types and levels of reproductive isolating mechanisms (review them here:

http://www.bio.miami.edu/dana/dox/reproductive_isolation.html) and how they work.

Know the difference between microevolution and macroevolution, and be able to recognize examples of each.

Understand what is meant by "selfish" genes and how natural selection can be said to occur at the level of the gene. Who were/are the scientists that developed this idea? (Refer to the links at the beginning of Lecture 6)

The Forces of Evolutionary Change

Watch the two videos on Altruism and understand what is meant by biological/Darwinian fitness, kin selection and inclusive fitness. (If you're not sure...Google it!)

Know the meaning/significance of: gene, allele, population, deme, gene pool, polymorphism, homozygous, heterozygous, the tenets of evolution by natural selection

Know the meaning/significance of: microevolution, macroevolution, speciation, Know the various types of polymorphism one might find at the molecular level.

Know the difference between physiological and evolutionary adaptation, and how they are related.

Know the five factors that can cause a population to evolve.

Remember that while natural selection (and the other five HW factors) may occur at the level the individual organism, individual organisms do not evolve. Only populations evolve from one generation to the next.

Know the difference between somatic and germline mutations, and which one(s) are more likely to have direct evolutionary consequences. Is this the same across all organisms?

Know the definitions of various types of mutations, including point mutations, mutations of homologous pairs, and mutations of entire chromosome sets (polyploidy)

Know the meaning/significance of: polymorphism of a trait in a population, silent mutation, neutral mutation (and the difference between them). (Read the link on **codon bias** in lecture 6)

Know the meaning of: ploidy, haploidy, diploidy, polyploidy, autopolyploidy, allopolyploidy. What is the significance of hybridization and polyploidy with respect to evolution?

Know the definition/significance of: totipotent, multipotent, and pluripotent cells. What can each of them develop into? What types of organisms have them, and at which stages of their life cycle? What does this mean in terms of inheritance of germline vs. "somatic" mutations?

Understand the Classical Model, Balancing Selection Model, and Neutral Theory of evolution. Be able to recognize simple examples of each.

Understand the meaning/significance of: frequency-dependent selection, Batesian mimicry, Mullerian mimicry, search image as they relate to the Balancing Selection Model.

Understand the meaning/significance of: silent and synonymous mutations, neutral mutations, pseudogene, proteome, molecular clock as they relate to the Neutral Theory of Evolution (Motoo Kimura).

TIPS FOR EFFECTIVE STUDYING:

1. The Workshops will help you understand the exam material, and they should be considered part of your study material for the exam. Don't memorize the details or names of specific examples in the notes or text or workshops. Instead, try to understand the concept those examples are illustrating, and be able to recognize new examples of the same concepts. Memorization is fine for things like vocabulary and names of concepts. But the MOST important thing you can do is UNDERSTAND HOW THINGS WORK and apply this to new situations.

2. Read the textbook chapters and USE THE PRACTICE PROBLEMS AT THE END OF EACH CHAPTER TO TEST YOURSELF. They are an excellent gauge of how well you are actually understanding the material.

3. If you don't remember the definition or significance of something in the notes or this study guide...

GOOGLE IT.

Seriously! This is sometimes the BEST way to find multiple sources that will really help you understand these sometimes-tough concepts. And you'll learn other interesting things along the way!
