**BIOL 160 – General Zoology**

**Course Study Guide**

This guide summarizes the most important concepts from each of the chapters we will cover this semester.

**Chapter 22 – Descent with Modification**

1.Be able to explain the process of natural selection

2.Be able to explain the evidence for evolution (e.g., direct observation of evolutionary change, fossil record, etc.)

3. Be able to explain the concept of homology

4.Be able to interpret a phylogenetic (=evolutionary) tree

**Chapter 23 – Evolution of Populations**

1. Be able to describe what is meant by the term geographic variation

2.Know that mutations are the ultimate source of genetic variation and be able to describe different types of mutations

3. Know why sexual reproduction increases genetic variation

4. Be able to explain the concept of Hardy-Weinberg equilibrium and be able to calculate allele and genotypic frequencies in a population of organisms

5.Be able to explain how deviations from Hardy-Weinberg assumptions (e.g., small population size, natural selection, gene flow, etc.) affect allele frequencies and genotypic proportions

6.Be able to explain founder effect and population bottlenecks

7. Know the difference between directional, stabilizing, and disruptive selection

8. Be able to explain the process of sexual selection

9.Be able to name and describe several factors that maintain genetic variation in a population despite the tendency of natural selection to reduce genetic variation

10. Know why natural selection is unable to construct ‘perfect’ organisms

**Chapter 24 – The Origin of Species**

1. Know the biological species concept

2. Be able to explain the concept of reproductive isolation including the various types of prezygotic and postzygotic isolating mechanisms

3. Be able to explain (in detail) the processes of allopatric and sympatric speciation

4. Be able to describe the various outcomes of secondary contact among populations in a hybrid zone (e.g., reinforcement, fusion, stability)

5. Be able to explain the concepts of phyletic gradualism and punctuated equilibrium

6. Be able to discuss the amount of genetic change necessary for speciation to occur

7. Be able to explain the terms microevolution and macroevolution

**Chapter 25 – History of Life On Earth**

1. Be able to describe a plausible scenario for the origin of life on earth and the evidence for such a scenario

2. Be able to explain relative dating of fossils and absolute dating of fossils

3. Be able to explain how radiometric dating is done

4. Know the relative sequence of key events in the history of life on earth and the approximate times when these events occurred (e.g., the origin of photosynthesis and the increase in atmospheric O2 took place 2.7-2.2 BYA; the origin of eukaryotic cells occurred 2.1 BYA, etc.)

5. Be able to discuss changes in species diversity in relation to adaptive radiations and mass extinctions

6. Be able to explain how major changes can occur in body form due to changes in rate and timing of developmental events and changes in regulatory genes

7. Understand that evolution is not goal oriented

**Chapter 26 – Phylogeny and the Tree of Life**

1. Be able to define the terms phylogeny, systematics, and taxonomy

2. Know what is meant by the term binomial nomenclature

3. Be able to identify nodes, clades, and sister taxa from a phylogenetic tree

4. Be able to interpret a phylogenetic tree

5. Understand the difference between homoplasy, homology, synapomorphy, and symplesiomorphy

6. Know how phylogenies are constructed using the approach called cladistics (=phylogenetic systematics)

7. Be able to distinguish monophyletic, paraphyletic, and polyphyletic groups

8. Be able to explain the concept of parsimony

9. Know the difference between orthologous genes and paralogous genes

**Chapter 32**

1. Be able to describe/define an animal

2. Be able to describe the early steps in animal development (including cleavage, formation of a blastula, and gastrulation)

3. Know the structures and tissue layers associated with a gastrula (e.g., blastopore, ectoderm, endoderm, etc.)

4. Know why animals are considered to be closely related to choanoflagellates

5. Be able to briefly describe the early radiations of animals (Ediacaran, Cambrian explosion)

6. Know that animal body plans are characterized by symmetry, the number of tissues and their types, and the condition of the body cavity

7. Know the tissue types and some organs/organ systems derived from them (e.g., ectoderm gives rise to the integument and central nervous system)

8. Be able to describe the difference between acoelomate, coelomate, and pseudocoelomate organisms and be able to give an example of an organism for each type of body cavity

9. Be able to describe the differences between protostome and deuterostome development (cleavage, coelom formation, fate of the blastopore)

10. Be able to describe the similarities and differences between animal phylogenies derived from morphological/developmental data versus genetic/molecular data

**Chapter 33**

1. Be able to describe the characteristics of the major invertebrate animal phyla: Porifera, Cnidaria, Platyhelminthes, Annelida, Mollusca, Nematoda, Arthropoda, Echinodermata. [For example, know that cnidarians are diploblastic organisms that are radially symmetrical and include jellies, corals, and hydras.]

2. Know the characteristics of the clades Lophotrochozoa and Ecdysozoa and the phyla that belong to these clades

**Chapter 34**

1. Be able to name and describe the four synapomorphic characters of chordates

2. For each of the clades of chordates (cephalochordates through mammals and everything in between) be able to name their diagnostic characteristics (e.g., Chondrichthyes have placoid scales and a cartilaginous skeleton)

3. Know where key evolutionary innovations arose in the phylogeny of chordates (e.g., know that the presence of jaws defines a clade called gnathostomes and that this clade contains Chondrichthyes, Actinopterygii, Sarcopterygii (Actinistia, Dipnoi), Amphibia, Sauropsida, and Mammalia)

4. Know that key evolutionary innovations within the chordate are often associated with increases in the number of Hox gene clusters or other genes that are important in development

5. Be able to explain the selective pressures that led to movement of vertebrates onto land

6. Be able to describe the structure of an amniotic egg and functions of the membranes

7. Be able to discuss major trends in hominin evolution

**Chapter 40**

1. Be able to discuss the hierarchical organization of animal body plans

2. Know the four main tissue types and be able to give an example of each (e.g., bone is a type of connective tissue)

3. Know that coordination and control of the animal body is a function of the endocrine and nervous systems, and these systems differ in speed and specificity

4. Know that animals may be regulators or conformers

5. Know that homeostasis is based on negative feedback

6. Be able to discuss the differences between ectotherms and endotherms

7. Be able to name and describe the four ways that animals exchange heat with the environment (e.g., convection, conduction, etc.)

8. Be able to name and describe adaptations that help animals thermoregulate

9. Know that energy needs are influenced by size, activity, and the animal’s environment

10. Be able to explain energy allocation in animals (e.g., minimally, energy is allocated to maintain cell activity and function, if additional energy is available, it can be used in growth or storage, etc.)

11. Know how scientists determine metabolic rate

12. Be able to explain the concepts of basal metabolic rate and standard metabolic rate

13. Be able to explain the relationship between size and metabolic rate

**Chapter 41**

1. Be able to describe the diets of herbivores, carnivores, and omnivores

2. Be able to name and describe macronutrients (e.g., carbohydrates)

3. Be able to name and describe essential nutrients (e.g., vitamins)

4. Be able to explain the difference between undernourishment and malnourishment

5. Be able to name and describe the four stages of food processing

6. Know the difference between intracellular and extracellular digestion

7. Be able to describe digestion by tracing the movement of food through the human digestive system. Know the pathway that food takes, along with each of the specialized organs and their role(s) in the process.

8. Know that evolution has modified the digestive tracts of animals. For example, herbivores tend to have long digestive tracts with specialized chambers for bacterial breakdown of cellulose.

**Chapter 42**

1. Know that the circulatory and respiratory systems are tightly coupled

2. Know that, in simple organisms, a gastrovascular cavity functions to distribute substances to body cells, but in larger organisms, a circulatory system is necessary

3. Know the three primary functions of the circulatory system and the three components of the system.

4. Be able to explain the difference between open and closed circulatory systems

5. Know the difference between single and double circulatory systems

6. Be able to describe the path of blood flow through a mammal, including the chambers of the heart and the major vessels

7. Be able to explain the cardiac cycle

8. Be able to explain the function of the atrioventricular and semilunar valves

9. Know that exchange of substances between the blood and the interstitial fluid takes place in the capillaries and that this exchange is strongly influenced by differences in blood pressure and osmotic pressure

10. Know the function of the lymphatic system

11. Be able to describe the composition of blood

12. Be able to describe the functioning of hemoglobin

13. Know how atherosclerosis affects the circulatory system

14. Be able to describe the various types of respiratory organs in animals

15. Be able to describe differences in respiratory systems of animals (e.g., birds vs. mammals)

**Chapter 46 – Animal Reproduction**

1. Know the difference between asexual and sexual reproduction

2. Be able to discuss why most (>99%) animals reproduce sexually

3. Be able to explain hermaphroditism (both simultaneous and sequential)

4. Be able to explain the differences between internal and external fertilization

5. Be able to explain the ecology of reproduction, including the factors that influence reproductive effort and size of individual offspring

6. Be able to describe both male and female reproductive anatomy (e.g., know that male external reproductive structures are the penis and scrotum, and male internal reproductive structures are the testes, which consist of coiled seminiferous tubules)

7. Know the pathways that gametes follow in both male and female humans (e.g., in males, sperm form in the seminiferous tubules of the testes, pass through the epididymis, move into the vas deferens and then into the urethra)

8. Know the hormones (and their functions) associated with the reproductive systems in both male and female humans, including the menstrual cycle in females

9. Be able to briefly describe the events associated with conception, embryonic development, and birth

**Chapter 52 – Introduction to Ecology**

1. Be able to explain the hierarchical organization of ecology and the types of questions asked by ecologists studying each of these levels (e.g., population ecologists study birth and death rates, density, and dispersion while community ecologists study interspecific interactions such as predation, mutualism, and interspecific competition)

2. Be able to discuss the factors influencing the geographic distributions of species (e.g., dispersal, habitat selection, biotic factors, abiotic factors; see Fig. 52.17)

3. Be able to explain global climate patterns (see Figs. 52.3 ,52.4, and 52.5)

4. Be able to distinguish among the aquatic and terrestrial biomes we discussed in class (streams and rivers, estuaries, temperate grassland, temperate broadleaf forest, and tropical forest)

**Chapter 53 – Population Ecology**

1. Be able to define/describe a population
2. Be able to explain the concepts of density and dispersion, including the types of dispersion
3. Be able to explain the information contained in life tables
4. Be able to distinguish between type I, type II and type III survivorship curves
5. Be able to discuss (in detail) the concept of an organism’s life history
6. Be able to explain (in detail) the differences between r-selected and K-selected organisms
7. Be able to explain exponential, logistic, and Malthusian population growth
8. Be able to explain the difference(s) between density-dependent and density-independent mortality factors
9. Be able to describe a metapopulation
10. Be able to discuss the growth trajectory of the human population

**Chapter 54 – Community Ecology**

1. Be able to explain what is meant by the term ecological niche
2. Be able to describe some of the outcomes of interspecific competition (e.g., competitive exclusion, resource partitioning, and character displacement)
3. Be able to describe community-level biotic interactions such as predation, herbivory, parasitism, and mutualism
4. Be able to explain the concept of species diversity (e.g., why this depends on both richness and evenness)
5. Know what is meant by the terms food chain and food web
6. Be able to explain why food chains are relatively short (i.e., why they have a limited number of links or trophic levels)
7. Be able to describe keystone species
8. Be able to explain the difference between bottom-up and top-down control of community structure
9. Be able to explain how disturbance influences community structure and species richness
10. Be able to describe ecological succession (both primary and secondary) and why succession occurs
11. Be able to explain the equilibrium theory of island biogeography

**Chapter 55 – Ecosystems**

1. Be able to define the term ecosystem

2. Be able to describe trophic levels in a food web (we also covered this in chapter 54)

3. Be able to distinguish between gross primary production (GPP) and net primary production (NPP)

4. Be able to explain the biogeochemical cycles for water, carbon, nitrogen, and phosphorus, including the abiotic and biotic forms of these elements and the processes that are involved in their cycling. Also know what their significance is to living organisms

5. Know how humans have altered the carbon and nitrogen cycles

6. Know that decomposition and nutrient cycling rates influence biogeochemical cycles

7. Recognize that ecologists have recently begun to attempt restoration of degraded ecosystems