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<u>BIO</u>	<u>104</u>	<u>PRINCIPLES OF BIOLOGY II</u>	<u>BIOLOGY 103</u>
Prefix	No.	Course Title	Prerequisite

Credit Hours: 4 Contact Hours: Lecture 3 Laboratory 3

I. COURSE DESCRIPTION

This is an introduction to basic principles of evolution and a survey of plant and animal diversity including classification, morphology, physiology and reproduction and the fundamental principles of ecology. Laboratory is required.

II. GENERAL COURSE COMPETENCIES AND OBJECTIVES

Upon successful completion of BIO 104, the student should have at least 70% mastery of the following competencies.

The student should be able to:

- A. Be able to state the conditions necessary for evolution to occur.
- B. Be able to discuss the evidences for evolution.
- C. Be able to define what a species is, how speciation occurs and isolating mechanisms..
- D. Be able to trace the evolutionary lineage of Homo sapiens..
- E. Recognize and classify common examples of each major animal phylum.
- F. Discuss organic evolution among the various animal groups and develop an understanding of the phylogenetic relationships between the major animal phyla.
- G. Describe anatomical parts used to carry out life functions within selected individuals from each major phylum and develop an understanding of how environmental conditions can modify these structures.
- H. Describe the ecological habitat each major animal group prefers and the niches that they fill.
- I. Discuss the economic impact the various animal groups have on mankind.
- J. Be familiar with the principles and practices of botanical taxonomy and classification.
- K. Recognize both the diversity and the relationships that exist among the organisms commonly grouped together as “plants”: cyanobacteria, algae, fungi, bryophytes and vascular plants.
- L. Recognize typical plant structures and their functions in plants.
- M. Understand the following general functions that must be performed by plants in order to maintain life: metabolism, growth and reproduction.
- N. Recognize the importance of plants to man and the environment.

III. COURSE OBJECTIVES

The student will be required to demonstrate that he has attained each general course competencies by performing the objectives listed under each competency. The student should be able to:

- A. State the conditions necessary for evolution to occur.
 1. Be able to distinguish between acquired characteristics vs. natural selection.
 2. Be able to discuss the need for genetic variation..
 3. Be able to relate changing environmental conditions and time to the process of evolution.
 4. Be able to discuss the role of competition to the evolutionary concept.
 5. Be able to work Hardy-Weinberg problems.
 6. Be able to relate how mutations, non-random mating and gene flow can effect evolution.
 7. Know what is meant by the founder effect and the bottleneck effect in relation to genetic drift.
 8. Be able to recognize examples of the following forms of selection: disruptive, directional, stabilizing

- B. Discuss the evidences of evolution.
 1. Know the various eras and periods of the geological time table. Be able to give approximate times and important events relative to each.
 2. Be able to discuss the significance of the fossil record and give illustrations of groups which clearly show evolutionary trends.
 3. Discuss Darwin's finches and mammalian life forms found in Australia as example of adaptive radiation.
 4. Be able to discuss artificial selection and domestication as evidence of evolution.
 5. Be able to discuss anatomical features as evolutionary evidence; know what homology and analogy mean as related to anatomical features.

- C. Define what a species is, how speciation occurs and isolating mechanisms.
 1. Define speciation and sympatric vs. allopatric speciation.
 2. Know the significance and give examples of ecological and behavioral isolation.
 3. Give examples of geographical isolation.
 4. Be able to list and define both prezygotic and postzygotic isolating mechanisms.
 5. Be able to discuss the role of polyploidy in plant evolution.
 6. Know the difference between punctuated equilibria and gradualism theories of evolutionary rates.

- D. Trace the evolutionary lineage of Homo sapiens.
 1. Know who the Prosimians are as well as the difference between the following groups: Anthropoids, Hominoids and Hominids
 2. Know the features of primates important to the development of modern man.
 3. Be able to distinguish a new world monkey from an old world monkey anatomically.
 4. Be able to trace the lineage of Homo sapiens from the first Hominid to today's form.

- E. Recognize and classify common examples of each major animal phylum.

1. List the major taxa used in the animal kingdom.
2. State the major rules of nomenclature and apply them to hypothetical situations.
3. Be able to recognize and correctly place examples of each of the following animals into the correct phyla:

a. Porifera	h. Annelida
b. Cnidaria	i. Arthropoda
c. Ctenophora	j. Echinodermata
d. Platyhelminthes	k. Chordata
e. Nematoda	
f. Rotifera	
g. Mollusca	

4. Be able to correctly place examples of the following phyla into the correct class (and/or correct subphyla):

a. Cnidaria	e. Arthropoda
b. Platyhelminthes	f. Echinodermata
c. Mollusca	g. Chordata
d. Annelida	

F. Discuss organic evolution among the various animal groups and develop an understanding of the phylogenetic relationships between the major animal phyla.

1. Identify the metazoa.
2. Discuss the syncytial and colonial flagellate theories of metazoan evolution including the pros and cons of each theory.
3. Describe the various types of symmetry and be able to recognize examples of each.
4. Describe the differences in embryonic development between diploblastic and triploblastic organisms. Also, be able to label the various germ layers, ectoderm, mesoderm and endoderm.
5. Be able to construct a cladogram for all of the phyla listed in A. 3 above.

G. Describe anatomical parts used to carry out life functions within selected individuals from each major phylum and develop an understanding of how environmental conditions can modify these structures.

1. Identify the following morphological parts on a sponge: osculum, spicules, mesenchyme, spongocoel, gemmules, base, choanocytes, pores, epidermis, incurrent canals, and gastrodermis.
2. Relate how sponges feed, respire, excrete nitrogenous wastes, react to environmental stimuli, and reproduce both sexually and asexually.
3. Identify the following anatomical features on the examples listed:
 - a. Obelia medusa: tentacle, mouth, manubrium, ring canal, gastrovascular cavity: Obelia polyp feeding polyp and reproducing polyp..
 - b. Aurelia: epidermis, gastrodermis, mesoglea, tentacles, cnidoblasts, nematocysts, canals, gonads, oral end and aboral end.
 - c. Hydra: base, gastrovascular cavity, epidermis, hypostome, tentacles, cnidoblasts, nematocysts, gonads, mesoglea and oral end.
 - d. Metridium: epidermis, gastrodermis, mesoglea, septa, base, oral end, aboral end, cilia,

- siphonoglyph, acontia, gonads and gastrovascular cavity.
4. Tell how Cnidarians feed, respire, excrete nitrogenous wastes and reproduce, both sexually and asexually.
 5. Identify Pleurobrachia.
 6. Describe the difference between acoelomates, pseudocoelomates and coelomate animals. Identify the following areas on a bilaterally symmetrical animal: dorsal, ventral, anterior, posterior, lateral, medial, proximal, cross section and longitudinal section.
 7. Identify the following morphological parts on each example listed below:
 - a. Planarian: eyespots, flame cells, auricles, pharynx, mouth, intestines.
 - b. Clonorchis sinensis: mouth, pharynx, intestine, oral sucker, ventral sucker, ovaries, oviduct, uterus, vagina, yolk gland, testis, vas deferens, and gonopore (genital pore).
 - c. Taenia pisiformis: scolex hooks, suckers, strobila, proglottides (immature, mature, gravid).
 8. Give the means of feeding, respiration, excretion, reaction to stimulation, and reproduction both sexual and asexual for the platyhelminthes.
 9. Identify the following morphological parts on Ascaris lumbricoides in both longitudinal and cross sections: mouth, epidermis, pharynx, longitudinal muscle, anus, pseudocoel, ovaries, intestine, oviducts, uterus and vagina.
 10. Identify the following anatomical parts on rotifers: pseudocoel, corona, cilia, pharynx, mastax, foot.
 11. Distinguish between a complete and an incomplete digestive system.
 12. Describe rotifers as to their feeding habitat preferences, respiration, excretion, stimuli and reproduction both sexually and asexually.
 13. Identify the morphological parts on the individual listed below.
 - a. Chitin: valve, mantle, pallial groove, foot, head, gills and anus.
 - b. Bivalve: right valve, left valve, mantle, foot, gills, labial palps, anterior adductor muscle, posterior adductor muscle, excurrent siphon, incurrent siphon, umbo, periostracum, prismatic, nacre, hinge tooth, hinge ligament, mouth, digestive gland, gonad, intestine, pericardial sinus and heart.
 - c. Snail: valve, head, tentacles, anus, gonopore, mouth, radulla, lung ovotestis, oviduct, vagina, seminal receptacle, dart sack, penis, heart, coelom and mantle.
 - d. Squid: head, foot, mantle, pen, siphon, tentacles, arms, mouth, beak, gonad, ink sac, digestive gland, and gills.
 14. Identify the morphological parts listed for each example below:
 - a. Earthworm (Lumbricus): prostomium, mouth, somites, clitellum, sperm grooves, anus, setae, pharynx, esophagus, crop, gizzard, intestine, heart (aortic arch), dorsal blood vessel, nephridium and septa.
Cross-section: cuticle, epidermis, circular muscle, longitudinal muscle, coelom, intestine, typhlosole, chlorogogen tissue, dorsal blood vessel, ventral blood vessel, ventral nerve cord, giant nerve fibers.
 - b. Sandworm (Nereis): prostomium, peristomium, mouth, tentacles, jaws, parapodia, somites and anus.
Cross-section: parapodium, epidermis, intestine, mesentery, nephridium, and ventral nerve cord.
 - c. Leech (Hirudo): posterior sucker, mouth, pharynx, crop, ceca, intestine, anus, somites.
 15. Describe how annelids feed, respire, excrete nitrogenous wastes, react to stimulation and reproduce both sexually and asexually.
 16. Give the characteristics that are unique to the arthropods.

17. List the information requested below for members of each arthropod class.
Body regions, number of antennae, number of legs, type of mouth parts, means of respiration, type of development and principle habitat.
18. Identify the morphological parts listed below:
 - a. Grasshopper: head, thorax, abdomen, labrum, labium, mandible, maxilla, compound eye, spiracle, tympanum, wings, legs, mouth, pharynx, esophagus, crop, gizzard, stomach, intestine, rectum, anus, gonad, heart, hemocoel, ventral nerve cord, ganglion, brain and malpighian tubules.
 - b. Crayfish: rostrum, antennae, compound eyes, carapace, cephalothorax, abdomen, telson, uropods, walking legs, cheliped, mandible, 2 pairs of maxilla, 3 pairs of maxillipeds, sex of individual, mouth, pharynx, stomach, intestine, anus, green glands, heart, gonads, digestive gland, gills, ventral nerve cord, ganglion and brain.
 - c. Spider: cephalothorax, abdomen, fangs, ocella, spinnerets, anus, legs and book lungs.
19. Describe the water vascular system of the echinoderms and tell how it is used in locomotion and feeding.
20. Discuss how members of the various classes of echinoderms feed, respire, remove wastes and reproduce.
21. Identify the anatomical parts listed for each organism:
 - a. Starfish: arms (rays), central disk, oral surface, aboral surface madreporite, stone canal, radial canal, ring canal, ampulla, tube feet, ambulacral groove, gills, pedicellariae, mouth, stomach, gonad and digestive glands.
 - b. Sea urchin: mouth, Aristotle's lantern, tube feet, spines, ossicles, gonads and digestive gland.
22. Describe the 3 unique Chordate characteristics and list the various subphyla of Chordates.
23. Identify the following parts on Amphioxus.
Longitudinal Section: dorsal fin, oral hood, cirri, mouth (Buccal cavity), pharynx, gill bars, bill slits, endostyle, intestine, liver (digestive gland), anus, atrium, atriopore, gonad, brain, nerve cord, notocord, myosepta and myotomes (myomeres).
Cross-Section: dorsal fin, myomeres, myosepta, coelom, pharynx, gill bars, gill slits, endostyle, digestive gland, gonads and metapleural folds.
24. List the unique characteristics of vertebrates.
25. Describe the lampreys as to their: means of feeding, means of respiration, removal of nitrogenous wastes, level of behavior.
26. List the characteristics of Cyclostomata that make them primitive vertebrates.
27. Identify the following structures of the chondrichthyes: spiracle, pectoral fins, pelvic fins, claspers, heterocercal tail, lateral line and placoid scales.
28. Describe the following parts found within an example of Osteichthyes: premaxilla, maxilla, mandible, operculum, nostril, lateral line, pectoral fins pelvic fins, anal fin, dorsal fin, caudal fin, scales, mouth pharynx, gill, gill bar, gill raker, gill filament, swimbladder and stomach.
29. Identify the following parts on the frog: musculature, ventral side, myohyoid, deltoid, pectoralis, external oblique, rectus abdominis, linea alba, triceps femoris, adductor longus, sartorius, adductor magnus, gracilis major, musculature, dorsal side, deltoid, longissimus dorsi, latissimus dorsi, triceps femoris, gluteus, semimembranosus, gracilis minor, gastrocnemius, tibialis anticus, tibialis posticus, semitendinosus, peroneus and tendon of Achilles.

Internal anatomy: heart, right atrium, left atrium, ventricle, lungs, mouth, tongue, liver, stomach, small intestine, large intestine, urinary bladder, mesentery, gall bladder, pancreas, spleen, ovary, kidney, oviduct, fat body, and colon.

30. List 2 characteristics by which amphibians and reptiles may be separated.
 31. Identify the following parts found in some reptiles: carapace, Jacobsen's organ, plastron and hemipenes.
 32. Give a unique feature of birds.
 33. List 10 modifications in birds that are important for flight.
 34. Discuss the difference between altricial and precocial young birds.
 35. Give 2 features considered necessary to have a homoeothermic life style.
 36. List the unique characteristics found in mammals.
 37. List the 4 major types of teeth found in mammals and give their function.
- H. Describe the ecological habitat each major animal group prefers and the niches that they fill.
1. Know the role of the Poriferans, cnidarians and Ctenopharans within aquatic habitats and describe the relative abundance of each group.
 2. Discuss the parasitic Platyhelminthes and nematodes.
 3. Know the role of earthworms in terrestrial habitats and the Polychaetes within aquatic habitats.
 4. List the various classes of mollusks and describe their habitat requirements.
 5. List the various classes of arthropods and describe their habitat preferences.
 6. Describe the role of the major Echinoderm groups within their marine habitat.
 7. Discuss the habitat preferences of the various vertebrate groups.
- I. Discuss the economic impact the various animal groups have on mankind.
1. Discuss the significance of the parasite Platyhelminthes and nematodes to man.
 2. Describe the impact earthworms have in soil development, maintenance and fertility.
 3. Describe the mollusks that are beneficial and harmful to man.
 4. Discuss the financial losses caused by arthropods, particularly insects.
 5. Discuss the beneficial arthropods and how man uses them.
 6. Define the significance of each vertebrate group to man.
- J. State the principles and practices of botanical taxonomy and classification.
1. Define the following terms: kingdom, phylum (division), class, order, family, genus, species.
 2. Explain the assumptions that form the basis for our present phylogenetic system.
 3. Rank the following in terms of increasing or decreasing relationship: class, phylum, family, kingdom, order and species.
- K. Recognize both the diversity and the relationships that exist among the organisms commonly grouped together as "plants": cyanobacteria, algae, fungi, bryophytes and vascular plants.
1. Discuss the phylogenetic relationships that exist among the groups listed above.
- L. Recognize typical plant structures and their functions in plants.
1. Recognize the following structures and their functions in plant cells: cytoplasm, nucleus, mitochondria, endoplasmic reticulum, microtubules, flagella, vacuoles, cell wall,

- plasmodesmata, plastids.
2. Describe the following tissues and their roles in plants: apical meristem, collenchyma, parenchyma, sclerenchyma, xylem, phloem, epidermis, periderm.
 3. Differentiate between simple and complex tissues.
 4. Describe the following tissue systems found in plants; identify them as simple or complex: ground, dermal, vascular.
 5. Identify the following and their roles in the plants in which they are found:
 - a. Bryophyta: gametophyte, sporophyte, archegonia, egg, sperm, antheridia, capsule, operculum, rhizoids, protonema, neck cells, thallus, gametes
 - b. Pterophyta: gametophyte, sporophyte, rhizomes, sperm, archeogonia, egg, prothallia, sori, fiddlehead, sporangia, annulus, spores, antheridia
 - c. Coniferophyta: leaves, cones (pistillate or staminate), pollen
 - d. Anthophyta: leaves- blade, petiole, stipules, veins, leaflets, epidermis, cuticle, stomata, guard cells, palisade and spongy cells, mesophyll.
roots- root cap, apical meristem, epidermis, pericycle, vascular cylinder, cortex, endodermis, xylem, phloem, vascular cambium, root hairs, regions of elongation, maturation and division.
stems- epidermis, phloem, xylem, vascular cambium, cortex, pith, bark, terminal bud, bud scales, lenticels, internodes, nodes, lateral buds, leaf scars.
flowers- sepals, petals, stamen, anthers, filament, carpel ovary, stigma, style, ovule receptacle, pollen grain, pollen sac.
seeds- epicotyl, hypocotyl, cotyledon, seed coat, embryo, scutellum, endosperm.
 6. Differentiate among and recognize examples of the following: roots- taproot and fibrous root; monocot and dicot; primary, secondary, and adventitious.
leaves- simple and compound; pinnate and palmate; net and parallel venation.
stems- monocot and dicot (herbaceous, woody).
flowers- zygomorphic and actinomorphic; perfect and imperfect; complete and incomplete.
seeds- monocot, dicot.
- M. Understand the general functions which must be performed by plants in order to maintain life: metabolism, growth and reproduction.
1. Metabolism
 - a. List the major functions of stems, roots and leaves, and the contribution of each to the maintenance of life.
 - b. Discuss the significance of photosynthesis to organisms.
 - c. Explain the photosynthetic pathways, using labeled diagrams and including the following: cyclic and noncyclic photophosphorylation, light reactions, dark reactions, Calvin-Benson (C-3) pathway, (C-4) CAM, PEP pathways, redox rx, pigments, photosystems.
 - d. Trace the movements of the following through the photosynthetic pathways: electrons, energy, H, CO₂, O₂.
 - e. Compare and contrast the following pathways: cyclic and noncyclic photophosphorylation; C-3 and C-4 pathways; light and dark reactions.
 - f. List the macronutrients required by plants and the general roles of inorganic nutrients in plants.
 - g. Define transpiration and discuss its significance.
 - h. Explain the movement of water through a plant, using the following terms: transpiration stream, guttation, root pressure, adhesion-cohesion-tension theory.
 - i. Explain the movement of organic materials through plants using the following terms: assimilate stream, source, sink, pressure-flow hypothesis, phloem, active transport,

passive transport, bulk flow.

2. Growth
 - a. Define the following: annual, biennial, perennial, wood, bark, growth rings, germination, dormancy, apical dominance, hormone. Differentiate between primary and secondary growth and indicate how each affects the size of a plant.
 - b. Discuss dormancy: causes, advantages, ways to break it.
 - c. Explain how the following factors are involved in germination: water, oxygen, temperature.
 - d. Discuss the relationship of following survival phases of a plant life cycle : multiplication, dispersal, assimilation, genetic variation.
 - e. Describe or discuss life cycles from the following groups and relate them to the four survival phases: moss, liverworts, ferns and angiosperms.
 - f. Begin with the apical meristem and ending with the secondary tissues produced during the first year's growth, trace the development of the stem, indicate the origin of each region in the discussion.
 - g. Begin with the apical meristem and end with the secondary tissues produced during the first year's growth, trace the development of the root; indicate the origin of each region in the discussion.
 - h. Explain how annual rings are formed.
 - i. Discuss the actions of hormones in general.
 - j. Describe the sources and effects of the following hormones: auxins, cytokinins, ethylene and gibberellins.
 - k. Define the following terms: tropisms, circadian rhythms, long-day plants, short-day plants, day-neutral plants, photoperiodism.
 - l. Discuss the chemical basis for photoperiodism.
 - m. Given a specific environmental condition, predict how the plant will respond and explain why it will respond this way.

- N. Recognize the importance of plants to man and the environment.
 1. Discuss the roles played by green plants in the environment.
 2. Discuss the economic importance of the following groups: bryophytes, ferns, gymnosperms and angiosperms.

IV. CLASS ACTIVITIES

- A. Lecture.
- B. A-V self instruction.
- C. A-V classroom instruction.

D. Weekly laboratory exercises.

V. CRITERIA FOR EVALUATION

The student will have demonstrated attainment of the general course competencies if he accumulates a total of 70 percent of the points possible from the following criteria:

- A. Scheduled lecture examinations.
- B. Laboratory examinations.
- C. The student will pass course with 70% accuracy.