

BROOKDALE COMMUNITY COLLEGE

# Biology 206 Syllabus Vertebrate Zoology



---

**CODE:** BIOL 206

**TITLE:** Vertebrate Zoology

**DIVISION:** STEM

**DEPARTMENT:** Biology

**COURSE DESCRIPTION:** This course is designed for the science major, pre-professional or advanced health science student. Through classroom and laboratory experiences, the student will demonstrate an understanding of probable origins of, and be able to identify in detail, the anatomical characteristics of organisms of the phylum Chordata. Starting with the primitive Amphioxus and progressing to the complex mammals, the student will demonstrate an understanding of the ontogenic and phylogenic relationships of the three chordate subphyla and seven vertebrate classes. Laboratory experiences include detailed dissection of representative organisms. **NOTE: This course is offered only in the Spring term.**

**PREREQUISITES:** A grade of “C” or higher in BIOL 102 or BIOL 112.

**PREREQUISITES OR COREQUISITES:**

**COREQUISITES:**

**CREDITS:** 4

**LECTURE HOURS:** 3

**LAB/STUDIO HOURS:** 3

---

**REQUIRED MATERIALS:**

Textbook: VERTEBRATES: Kenneth V. Kardong, Eighth Edition, 2019; McGraw-Hill Publishing Company

Lab Manual: COMPARATIVE ANATOMY: Dale W. Fishbeck and Aurora Sebastiani, Third Edition, 2015; Morton Publishing Company

**ADDITIONAL TIME REQUIREMENTS:**

Additional weekly lab time is required. (See instructor)

**COURSE LEARNING OUTCOMES:**

- The student will demonstrate an understanding of, and be able to identify in detail, the anatomical characteristics of members of the phylum Chordata. Beginning with the primitive Amphioxus and progressing to the complex mammals. (Mathematical/Scientific Reasoning/Information Literacy)
- The student will demonstrate an understanding of the ontogenic and phylogenic relationships of the three chordate subphyla and several vertebrate classes. (Mathematical/Scientific Reasoning/Information Literacy)

**GRADING STANDARD:**

**A student must have an average of 65% or better for the classroom component and an average of 65% or better for the laboratory component of the course in order to earn a passing grade for the course.**

Upon completion of the course, grades will be assigned as follows:

<b>A</b>	<b>=</b>	<b>92 – 100%</b>
<b>A-</b>	<b>=</b>	<b>89 – 91%</b>
<b>B+</b>	<b>=</b>	<b>86 – 88%</b>
<b>B</b>	<b>=</b>	<b>82 – 85%</b>
<b>B-</b>	<b>=</b>	<b>79 – 81%</b>
<b>C+</b>	<b>=</b>	<b>76 – 78%</b>
<b>C</b>	<b>=</b>	<b>70 – 75%</b>
<b>D</b>	<b>=</b>	<b>65 – 69%</b>
<b>F</b>	<b>=</b>	<b>&lt;65%</b>

**Unit examination results will be reported as the grade assigned by the faculty calculated to the first decimal place. These grades will be weighed according to course grading policy. In calculating the course grade, 0.5 will round up to the next numerical grade and 0.4 will round down to the next lower numerical grade.**

A grade of C or better is required in all pre-requisite courses. Career studies courses must have a grade of C or better to count toward the Mathematics / Science Program – Biology Option.

Students are permitted to withdraw from the course without penalty until approximately 80% of the semester is complete. Please see term schedule for the exact deadline.

At the end of the semester, application for an Incomplete may be made if a student with proper documentation needs to complete no more than one lecture exam and/or one laboratory practical. The granting of an Incomplete is at the discretion of the instructor.

**COURSE CONTENT:**

Unit One:	Chordate Development, Histology & Anatomic Directions
Unit Two:	Chordate Body Plan, Evolution & Taxonomy
Unit Three:	SubPhylum Vertebrata & Class Agnatha
Unit Four:	The Cartilaginous and Bony Fishes
Unit Five:	Early Tetrapods I
Unit Six:	Early Tetrapods II
Unit Seven:	Aves
Unit Eight:	Mammalia

**DEPARTMENT POLICIES:**

**Attendance** during class and laboratory sessions is strongly recommended for optimum performance in biology courses.

**Lecture exams** will be given in class or in the Testing Center, depending on instructor preference.

**Laboratory practicals** will be given during laboratory sessions, in accordance with schedules provided by the lab instructor. Exams and practicals must be taken at the times designated by the instructor or lab instructor. A student who misses a lecture exam or laboratory practical must provide prior notification and proper documentation in order to take the exam or laboratory practical. The acceptance of said prior notification and proper documentation will be determined by the instructor.

**Documentation** must be provided within one week of the student's return to the classroom for a make-up exam or laboratory practical to be scheduled. A student who is unable to provide proper documentation for a missed exam or laboratory practical will be given a grade of zero for that exercise. Students may not re-take exams or laboratory practicals on which they perform poorly.

**Requirements** for the completion of laboratory are listed in the laboratory responsibility sheets for individual courses. Requirements for course completion are listed in individual instructor syllabi.

A **student must** have an average of 65% or better for the classroom component and an average of 65% or better for the laboratory component of the course in order to earn a passing grade for the course.

**COLLEGE POLICIES:**

As an academic institution, Brookdale facilitates the free exchange of ideas, upholds the virtues of civil discourse, and honors diverse perspectives informed by credible sources. Our College values all students and strives for inclusion and safety regardless of a student's disability, age, sex, gender identity, sexual orientation, race, ethnicity, country of origin, immigration status, religious affiliation, political orientation, socioeconomic standing, and veteran status. For additional information, support services, and engagement opportunities, please visit [www.brookdalecc.edu/support/](http://www.brookdalecc.edu/support/)

For information regarding:

- ◆ Brookdale's Academic Integrity Code
- ◆ Student Conduct Code
- ◆ Student Grade Appeal Process

Please refer to the **STUDENT HANDBOOK AND BCC CATALOG.**

**NOTIFICATION FOR STUDENTS WITH DISABILITIES:**

Brookdale Community College offers reasonable accommodations and/or services to persons with disabilities. Students with disabilities who wish to self-identify, must contact the Disabilities Services Office at 732-224-2730 or 732-842-4211 (TTY), provide appropriate documentation of the disability, and request specific accommodations or services. If a student qualifies, reasonable accommodations and/or services, which are appropriate for the college level and are recommended in the documentation, can be approved

**ADDITIONAL INFORMATION:**

**Course Website: Biology Department information and BIOL 206 resources are available on the Brookdale website: <http://www.brookdalecc.edu/stem-institute/biology/>**

**MENTAL HEALTH:**

- Mental Health Crisis Support: From a campus phone, dial 5555 or 732-224-2329 from an external line; off-hours calls will be forwarded to BCC police (2222 from a campus phone)
- Psychological Counseling Services: 732-224-2986 (to schedule an appointment during regular hours)

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#1 of 8 units**

**4.0**  
Credits

Name of Unit: Chapter 1: Chordate Development, Histology and Anatomic Directions

Unit Objectives: Review early chordate development through neurulation; identify the principle tissues of the chordate body and correctly use anatomic terms and directions.

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings page 163
1. Describe microlecithal, mesolecithal and macrolecithal as egg types characteristic of the chordates; identify isolecithal and telolecithal eggs in terms of yolk distribution.	
2. Describe the zygote as a diploid, single-celled embryo.	page 164
3. Define cleavage and describe the types of cleavage typical of each egg type.	pages 164-1647
4. Explain the importance of the blastula over the morula in terms of specialization and differentiation.	Class Discussion
5. Use the frog as an example to describe epiboly and invagination as the cell movements of gastrulation.	pages 167-168 and Class Discussion
6. Identify the three primary germ layers and the fates of each in the developing chordate body.	page 175 and Class Discussion
7. Describe neurulation and development of a dorsal hollow nerve chord as one of the primary chordate characteristics.	pages 168
8. Differentiate between organogenesis and histogenesis; name the four principle animal tissue types.	pages 176-177 and Class Discussion
9. Define epithelial tissues as forming coverings or linings and having little or no intercellular space.	pages 177-180, and Class Discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#1 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
10. Describe lateral adherences, free (apical) surfaces and basement membranes (basal surfaces) as the characteristic surfaces of epithelial cells and tissues; note specializations of these surfaces that may appear	pages 177-179
11. Differentiate between simple and stratified epithelial tissues.	page 179
12. Describe squamous, cuboidal and columnar as the characteristic shapes of epithelial cells.	pages 179-180
13. List examples of where the major epithelial tissue types would be found in the chordate body.	pages 179-180 and Class Discussion
14. Describe pseudostratified columnar epithelia and where it would be found in the chordate body.	page 179 and Class Discussion
15. Describe the classification of epithelia according to sensory, germinal, cuticular and glandular functions.	page 180, and Class Discussion
16. Differentiate epithelial from connective tissues in terms of intercellular space and matrix materials.	page 180 and Class Discussion
17. Differentiate between embryonic and adult connective tissues.	Class Discussion
18. Identify cell types, matrix materials and location in the body of the loose connective tissues.	pages 180-181, Class Discussion
19. Identify cell types, matrix materials and location in the body of the dense connective tissues.	pages 180-181, Class Discussion
20. Locate and describe the structure of serous membranes, mucous membranes and cutaneous membranes.	Class Discussion
21. Briefly describe the structure of muscle tissue.	pages 373-374 and Class Discussion
22. Briefly describe the structure of nerve tissue.	pages 177 and Class Discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#1 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
23. Define and differentiate the following terms: A. Superior (Cephalic) and Inferior (Caudal) B. Anterior (Ventral) and Posterior (Dorsal) C. Medial and Lateral D. Median E. Proximal and distal F. Central and Peripheral G. External (Superficial) and Internal (Deep) H. Parietal and Visceral I. Homology and Analogy J. Convergent, Divergent and Parallel Evolution K. Neotony and Paedogenesis (Paedomorphosis) L. Generalized and Specialized M. Higher and Lower Forms N. Simple and Advanced O. Degenerate, Vestigial Rudimentary	pages 15-18, Glossary, Class Discussion and Lab Manual
24. Describe the following anatomic planes: A. Sagittal, Mid-sagittal and Para-sagittal B. Coronal (Frontal) C. Transverse (Cross) D. Oblique	Page 16, Glossary, Class Discussion and Lab Manual
25. Describe Haeckel's and VanBaer's versions of the biogenetic law.	pages 201-204, and Class Discussion
26. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#2 of 8 units**

**4.0**  
Credits

Name of Unit: Chordate Body Plan, Evolution and Taxonomy

Unit Objectives: Describe: The body structure of the idealized chordate; the probably origins of the phylum and subphyla; and the major groups within the Vertebrata.

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. Review the four primary characteristics of the phylum Chordata: a. Dorsal hollow nerve chord b. Pharyngeal gill slits c. Notochord d. Post-anal tail.	pages 50-54 and Class discussion
2. Establish the body plan of the idealized chordate by describing the following structures and systems; being sure to cite similarities and differences to invertebrate patterns: a. Bilateral symmetry b. Regional differentiation c. Gills d. Notochord e. Nervous system f. Digestive system g. Kidneys h. Reproductive system i. Circulatory system j. Coelom k. Muscles l. Skeleton m. Appendages n. Segmentation	Chapters 1 & 2, and Class Discussion
3. Review the principles of modern evolutionary thought to include discussions of: Homology vs. analogy; genes and mutations; adaptation and evolution.	pages 15-16 and Class Discussion
4. Describe Annelid, Arthropods and Echinoderm Theories of Chordate Evolution by citing valid and invalid points of each; support the echinoderm theory as most plausible.	pages 74-80 and Class Discussion
5. Describe the probable line of descent of the chordate subphyla.	pages 48-50 and Class discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#2 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
6. Describe in detail the anatomy of amphioxus; citing the systems that do and do not support amphioxus as an example of an idealized chordate.	pages 61-66, Class Discussion
7. Describe briefly the anatomy of both adult and larval urochordates; discuss why some may consider the tunicates more advanced than amphioxus.	pages 66-70, Class Discussion
8. Discuss why the Hemichordata were once considered a chordate subphylum but today may be placed phylogenetically before the echinoderms.	pages 56-57, Class Discussion
9. Review briefly the major geologic eras listing what animal groups arose and/or became dominant during each.	pages 39-41
10. Assign each of the seven vertebrate classes into the following groups. a. Agnathostomes v. Gnathostomes b. Pisces vs. Tetrapoda c. Anamniotes vs. Amniotes d. Poikilotherms (Ectotherms) vs. Homeotherms (Endotherms)	page 86 and Class Discussion
11. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#3 of 8 units**

**4.0**  
Credits

Name of Unit: SubPhylum Vertebrata and Class Agnatha

Unit Objectives: Describe: The characteristics of the Vertebrata as a group; Extinct and living members of Class Agnatha emphasizing the sea lamprey as example

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. Characterize the Vertebrata in terms of brain, cranium, vertebrae and foramina.	pages 82-84 and Classroom Discussion
2. List and describe briefly the major taxonomic categories within the piscine group.	pages 86-104, Appendix D
3. Describe briefly the characteristics of Class Agnatha, Order Cyclostomata and the Ostracoderms.	page 86
4. Describe the Ostracoderms (Osteostraci) relating their characteristics to higher vertebrate groups as bases of probably evolutionary lines.	page 86 and Class Discussion
5. Describe briefly the life history of <u>Petromyzun marinus</u> .	Class Discussion
6. Describe the external anatomy of the lamprey.	Classroom Discussion
7. Describe the integument of the lamprey to include mucous cells, pigmentation and naked teeth.	page 216 and Classroom Discussion
8. Describe the skeleton of the lamprey to include the notochord, neural arches, skull and branchial basket.	page 255 and Classroom Discussion
9. Describe briefly the musculature of the lamprey to include specializations of branchial, lingual and buccal regions.	pages 388-390 and Classroom Discussion
10. Describe the anatomy of the digestive and respiratory systems of the lamprey; include the sagittal section of the head region.	pages 424-426, Chapters 13 & 11, Classroom discussion
11. Describe feeding and respiratory action in the adult and larval lamprey.	Chapters 13 & 11 and Classroom Discussion
12. Describe circulation in the lamprey as essentially the same as in amphioxus.	page 462 and Classroom Discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#3 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
13. Describe in detail the structure of a two chambered heart to include the great vessels	pages 474-478
14. List the major components of the venous system of the lamprey as an early vertebrate pattern.	pages 458-472 and Classroom discussion
15. Describe the archinephros and associated ducts in ammocetes.	page 546 and Classroom Discussion
16. Describe the opisthonephros and associated ducts in the adult lamprey.	page 551 and Classroom Discussion
17. Compare the structure and function of the coelomic funnels and glomeruli.	page 551 and Classroom Discussion
18. Describe the male and female reproductive systems of the lamprey; how do they depart from the idealized pattern.	pages 564-576 and Classroom Discussion
19. Identify the primary and secondary brain vesicles of the lamprey.	page 647
20. Identify the major adult brain structures and cranial nerves associated with the secondary brain vesicles.	pages 631-638, 652-662
21. Identify the major cavities and passages of the brain.	pages 647-650
22. Describe briefly the spinal cord and spinal nerves.	pages 630-631, 650
23. Differentiate between gray and white matter; note how its arrangement in the spinal cord can be used as evidence of advancement throughout the vertebrate group.	page 650, and Classroom Discussion
24. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#4 of 8 units**

**4.0**  
Credits

Name of Unit: The Cartilaginous and Bony fishes

Unit Objectives: Describe the characteristics of extinct and living members of classes Chondrichthyes and Osteichthyes using the shark as principle example

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. Describe the placoderms relating their characteristics to higher vertebrate groups.	pages 94-95
2. Describe the probable evolution of jaws and development of the splanchnocranium.	pages 244-246
3. Describe autostylic, amphistylic and hyostylic jaw attachments of fishes.	pages 247-248
4. Describe the development of the chondrocranium.	pages 242-244
5. Describe briefly the dermatocranium of fishes.	pages 248-250
6. Identify the parts of a typical vertebra, distinguish between caudal and trunk vertebrae and characterize vertebrae according to various shapes of the centra.	pages 301-305
7. Distinguish between dorsal and ventral ribs, establish which represents the probable origin of tetrapod ribs.	pages 297-298 and Class Discussion
8. Identify the major components of pectoral and pelvic girdles and appendages.	pages 326-328
9. Describe the integument of fishes to include glands, chromatophores and scale types.	pages 216-218, 236
10. Describe the external anatomy of fishes including tail shapes.	Class Discussion
11. Describe the digestive system of fishes as a typical vertebrate pattern including: Teeth, structure of the gut wall, and serous membranes.	Chapter 13 and Class Discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#4 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
12. Identify the embryonic and adult urinary organs and ducts of fishes.	page 547
13. Differentiate between osmoregulators and osmoconformers; discuss varying tolerances of fishes to changes in salinity.	pages 555-563 and Class Discussion
14. Identify male and female reproductive organs and ducts.	pages 564-586 and Class Discussion
15. Describe the circulatory system of fishes to include aortic arches and single vessels	pages 458-469, and Class Discussion
16. List the requirements of a respiratory membrane; identify gill clefts and respiratory specializations in fishes.	pages 424-430, and Class discussion
17. Name the ten cranial nerves and list whether each is sensory, motor or mixed in function.	pages 631-638 and Class Discussion
18. Discuss advancements in spinal cord and spinal nerve structure in the fishes.	pages 630-631, 650 and Class Discussion
19. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#5 of 8 units**

**4.0**  
Credits

Name of Unit: Early Tetrapods I

Unit Objective: State the challenges of a terrestrial existence; explain the probable origin of superclass Tetrapoda from subclass Choanichthyes; describe the early tetrapod skeleton using classes Amphibia and Reptilia as specific examples.

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. State the challenges of a terrestrial existence and summarize anatomic changes in the tetrapod body to adapt to same.	Classroom Discussion  pages 101-102
2. List and describe briefly members of subclass Sarcopterygii (Choanichthyes).	pages 106-108
3. List and describe briefly members of class Amphibia.	pages 110-113
4. List and describe briefly members of class Reptilia.	pages 102-103
5. Support the probable origin of the Tetrapoda from the Crossopterygii as opposed to the Dipnoi based on limb structure.	pages 507-513, and Classroom Discussion
6. State the significance of labyrinthine teeth in relating Rhipidistia and Labyrinthodontia.	Class Discussion
7. Describe the use of rachitinous evidence (diplospondyly) in ascertaining probable relationships within the tetrapod group.	pages 242-245
8. Characterize the tetrapod skull as being composed of a dermal roof (dermatocranium), palatal complex (splanchnocranium) and brain case (chondrocranium).	pages 248-250
9. Describe the dermal roof of an early amphibian skull as being composed of tooth-bearing marginal bones, a longitudinal series along the midline, a circumorbital series, a temporal series and cheek bones.	

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
10. Describe the palatal complex of an early amphibian skull as being composed of pterygoid, vomer, palatine and quadrate elements.	page 250
11. Describe the brain case of an early amphibian skull as being composed of sphenoid, occipital, otic and ethmoid regions.	pages 250-253
12. Use the concept of cranial akinesis as supportive evidence of phylogenetic progression in reduction of the number of skull bones in the tetrapods.	Classroom Discussion
13. Summarize the fates of the visceral arches in amphibia and reptilia.	Chapter 7
14. Describe the temporal fenestrae of reptilian and higher tetrapod skulls.	page 265 and Classroom Discussion
15. Discuss briefly the structure of chelonian, rhynchcephalian, saurian, serpentine and crocodilian skulls.	Chapter 7 and Classroom Discussion
16. Construct a phylogenetic tree of the tetrapoda.	Classroom Discussion
17. Identify the jaw attachments of amphibia and reptilia (as well as the crossopterygii) as autostylic.	pages 247-248
18. Describe the axial skeleton of Amphibia, to include central types vertebral regions and girdles, using the necturus and frog as examples.	Chapter 8, pages 295-297, and Classroom Discussion
19. Describe the axial skeleton of reptiles, to include central types vertebral regions, girdles, and ribs.	Chapter 8, Pages 295-299
20. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#6 of 8 units**

**4.0**  
Credits

Name of Unit: Early Tetrapods II

Unit Objectives: Emphasizing the transition to land, describe the integumentary, cardiovascular, respiratory, digestive, urogenital and nervous systems of classes Amphibia and Reptilia.

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. Describe the structure of the amphibian integument noting especially the abundance of glands and the paucity of scales.	Chapter 6 and Classroom Discussion
2. Describe the structure of the reptilian integument noting especially the paucity of glands and the abundance of scales.	Chapter 6 and Classroom Discussion
3. Relate the structure of the reptilian vs the amphibian integument as modification for a terrestrial existence.	Classroom Discussion
4. Compare the structure of an artery, vein and capillary.	pages 453-455
5. Describe arteriovenous bridges, sinusoids, and erectile columns as specialized blood vessels.	Chapter 12 and Classroom Discussion
6. Review single and double circulatory systems; review portal systems.	pages 456-457 and Classroom Discussion
7. Describe the amphibian heart as a transitional structure ontogenically and phylogenically.	pages 479-481 and Class Discussion
8. Describe the primitive (embryonic) pattern of aortic arches and cite the fates of each in teleosts, urodeles, anurans and reptiles.	Classroom Discussion
9. Describe briefly the complete double circulatory system in the Crocodylia.	pages 484-489 and Classroom Discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#6 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
10. Describe the tetrapod respiratory system as an ontogenic and phylogenic modification of the piscine pharynx, relate the probable origin of lungs to physostomous swim bladders, list other derivatives of the pharynx.	Chapter 11 and Classroom Discussion
11. Describe amphibian respiration by relating time of life and habitat to reliance on cutaneous, bucco-pharyngeal and lung mechanisms.	pages 219-220, 430 and Classroom Discussion
12. Describe reptilian respiration as an adaptation to a terrestrial existence.	pages 433-434 and Classroom Discussion
13. Identify the allantois and cloaca as specialized respiratory mechanisms	pages 418-420 and Classroom Discussion
14. Describe choanae, oral glands, tongue and teeth in amphibia.	Chapter 13
15. Describe choanae, oral glands, tongue and teeth in reptilia; describe Jacobsen's (vomeronasal) organ.	Chapter 13 and page 668
16. Identify the embryonic (larval) and adult kidney in amphibia.	Chapter 14
17. Identify the embryonic and adult kidney in reptilia	Chapter 14
18. Describe the origin of the tetrapod urinary bladder.	pages 587-589
19. Compare amphibian and reptilian patterns of reproduction citing the aquatic or terrestrial characteristics of each.	Chapter 14 and Classroom Discussion
20. Describe the advantages of amniote development; describe urogenital specializations of male and female systems requisite to amniote reproduction.	Chapter 14 and Classroom Discussion
21. Describe briefly changes in brain and spinal cord correlative to a tetrapod/terrestrial existence.	Classroom Discussion

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#6 of 8 units**

**4.0**  
Credits

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
22. Identify the cauda equina, pia-arachnoid, dura mater, terminal nerve, (spinal) accessory nerve and hypoglossal nerve.	pages 647-650, 631-635
23. Explain how observed behaviors contributed to the conclusion that the Crocodilia possess a neocortex.	Classroom Discussion
24. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#7 of 8 units**

**4.0**  
Credits

Name of Unit: Aves

Unit Objective: Describe the probable origins and adaptations for flight of class Aves

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. List and describe briefly the characteristics of class Aves.	pages 113-115 and Classroom Discussion
2. List and describe briefly examples of extinct and living members of class Aves.	pages 113-115 and Classroom Discussion
3. Explain the probable origins of the birds from bipedal dinosaurs.	pages 116 and Classroom Discussion
4. Describe the skeleton of birds as being modified for flight.	pages 359-360 and Class Discussion
5. Describe the integument of birds giving special attention to feathers (structure and types), scales, claws, glands, beaks and bills.	pages 221-228 and Classroom Discussion
6. Describe the digestive systems of birds noting differences from the general chordate pattern.	pages 530-531 and Classroom Discussion
7. Describe modification of the avian respiratory system to support the high metabolic demands of flight.	pages 437-438
8. Identify the embryonic and adult kidney types of birds, describe urinary system adaptations for flight.	Chapter 14 and Classroom Discussion
9. Describe specializations of the mullerian duct system for the production of a cleidoic egg	Chapter 14 and Classroom Discussion
10. Describe male and female reproductive specializations for flight	Classroom Discussion
11. Differentiate between altricial and precocious patterns of development	Classroom Discussion
12. Describe the pattern of aortic arches in birds.	page 466
13. Describe briefly advancements in the brains of birds.	Chapter 16 and Classroom Discussion
14. Successfully complete assigned laboratory experiences.	

**BIOL-206**  
Course #

**Vertebrate Zoology**  
Title

**#8 of 8 units**

**4.0**  
Credits

Name of Unit: Mammalia

Unit Objective: Describe the origins, diversity and characteristics of class Mammalia

Method of Evaluation: Unit Test

<b>Learning Objectives</b>	<b>Recommended Learning Experiences</b>
The student will be able to:	1. Class Discussion 2. Textbook Readings
1. List and describe briefly twelve characteristics of class Mammalia.	pages 121-126 and Classroom Discussion
2. Identify and describe briefly the subclasses, cohorts and orders of class mammalia.	pages 121-126 and Classroom Discussion
3. Explain the probable origin of the mammals using a tetrapod phylogenetic tree to establish relationships.	pages 121-126 and Classroom Discussion
4. Describe the structure of hair and its probable homologies; identify different types of hair and growth patterns.	pages 229-231 and Classroom Discussion
5. Describe the integumentary glands of the mammals.	pages 231-232
6. Describe bills, claws, nails, hooves, horns and antlers as derivatives of the mammalian integument; note homologies where applicable.	pages 233-236
7. Describe dentition in mammals; include dental formulae, diastemas and tusks.	pages 507-517 and Classroom Discussion
8. Compare and contrast the structure of a "typical" mammalian stomach to that of a polygastric (ruminant).	pages 531-532, Chapter 13
9. Describe the structure of the Mullerian ducts in monotremes ,metatheria and eutheria.	Chapter 14
10. Describe testicular descent in mammals.	Classroom Discussion
11. Describe the fate of the cloaca in male and female mammals; note the human female as an apparent exception to the pattern.	Chapter 14 and Classroom Discussion
12. Successfully complete assigned laboratory experiences.	