Biology 21 - Section 01-Lec (4747) and Section 01L-Lab (5457)

Comparative Anatomy

Course Outline
Fall 2017

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Lecture Thu 12:40-1:40 pm in S226 Laboratory Thu 1:50-5:10 pm in S226

Course Description

Biology 21 is a 4-credit, 6-hour course with laboratory and lecture components, open to students who have completed Biology 14, and have passed the CUNY Math and English exams. It fulfills one of the two (Group V) laboratory course requirements for Biology majors.

This section is offered in a partial online format. Students are expected to know BlackBoard, WORD, and Email (including attachments) as well as have access to the Internet and spend significant time doing online reading and writing assignments. Course fulfills writing intensive graduation requirement. Honors enrichment component option available for students with a G.P.A. of 3.2 or higher.

Form, structure, classification and adaptive modifications of vertebrates, animals with backbones. Through dissections, representative vertebrates [dogfish, cat] are studied; vertebrates’ major body systems and development of various representative structures are compared; relationships between form and function, and the use of certain structures in specific environments.

Required Text:
Vertebrates – Comparative Anatomy, Function, Evolution, Seventh Edition

Dale W. Fishbeck & Aurora Sebastiani

Required Laboratory Equipment:
Full length lab coat
Disposable non-latex gloves
Goggles
Dissecting kit with: scalpel, blades, probe, scissors, forceps
Closed shoes (no open toed shoes)
Course Outcomes

1. Recognize the relationships between form and function in vertebrates.
2. Compare anatomy and body systems across the vertebrate classes, identifying similarities and differences, and conjecturing on adaptive modifications through natural selection.
3. Recognize the significance of embryonic development in vertebrate anatomical formation.
4. Further develop skills in observations and manual dexterity through careful and comprehensive dissection of representative vertebrates, recognizing their specialized design adaptations.
5. Conduct research as part of a class project utilizing knowledge of comparative anatomy.

Academic Integrity

Academic integrity means that all the work you do in this course (exams, quizzes, reports, papers, etc.) is your OWN work and no one else’s. It includes not cheating on exams or quizzes in any way, as well as avoiding plagiarism in your writing. Plagiarism is using anyone else’s work or ideas without proper attribution. This means that if you quote, paraphrase, or even describe in your own words, an idea that comes from someone else’s writing, you MUST acknowledge that author in parentheses at the end of the sentence or sentences in which you have summarized his or her idea. Plagiarism, whether intentional or not, is taken seriously and can result in a failing grade. It is almost always **very** obvious if you do it, so don’t risk it. If you are not sure how to reference a source, ask the instructor for help. Your instructor adheres to CUNY policy on academic integrity, which can be found in your student handbook or online at [http://www.kingborough.edu/Academic_Integrity_Policy.pdf](http://www.kingborough.edu/Academic_Integrity_Policy.pdf). These sources explain the policy in detail and give examples. Please be aware that academic dishonesty may result in a failing grade on the exam or in the course, as well as dismissal from the college. Additional websites that may be of use include: turnitin.com, citationmachine.com and plagiarism.org. (Polizzotto, K., personal communication, 2008).

Civility Statement

As an institution of higher education, Kingsborough Community College and its faculty and staff are committed to its entire student body. As such, we strive to interact with each student equitably and professionally while providing an environment of mutual respect and civility.

In the event a student has an allegation charge brought against him/her that is a breach of the Henderson Rules to Maintain Public Order or the Campus Code of Conduct, an immediate investigation will commence followed by a conciliation conference to determine the appropriate outcome within a thirty day period.

The Judicial Affairs process at Kingsborough Community College is critical in providing an agenda for safety, yet simultaneously offering protection of the rights of students who may have been accused of being in violation of the Henderson Rules to Maintain Public Order and/or the Campus Code of Conduct. These rights have been afforded to each Kingsborough student under the bylaws that were established in 1969.

Accessibility

Access-Ability Services (AAS) serves as a liaison and resource to the KCC community regarding disability issues, promotes equal access to all KCC programs and activities, and makes every reasonable effort to provide appropriate accommodations and assistance to students with disabilities. Please contact this office if you require such accommodations and assistance. Your instructor will be glad to make the accommodations you need, but you must have documentation from the Access-Ability office for any accommodations.
## LECTURE TOPICS AND SEQUENCE

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic(s)</th>
<th>Textbook Chapter(s)</th>
<th>Lab Manual Chapter(s)</th>
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<tr>
<td>1</td>
<td>Introduction</td>
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<td>Origin of Chordates</td>
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<td>The Vertebrate Story</td>
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| 1    | Laboratory Safety and Procedures  
      | Introduction  
      | Amphioxus Anatomy  
      | Lamprey Anatomy | Handout  
      | Introduction  
      | 3  
      | 14 |
| 2    | Dogfish Shark  
      | External Anatomy & Integument  
      | Skeletal System  
      | Muscular System | 15  
      | 16  
      | 17 |
| 3    | Dogfish Shark - continued  
      | Body Cavity & Mesenteries  
      | Digestive & Respiratory Systems  
      | Urogenital System | 18  
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| 4    | Dogfish Shark – continued  
      | Circulatory and Lymphatic Systems  
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      | Endocrine System | 21  
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| 5    | Perch | 24 |
| 6    | Necturus (Mud Puppy)  
      | External Anatomy & Integumentary System  
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      | Body Cavities & Mesenteries  
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      | Urogenital System  
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      | Endocrine System | 25  
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| 7    | Reptiles – Turtle, Snakes | Handouts |
| 8    | Birds | 43-51  
      | Cat/Mink - External Anatomy & Integumentary System  
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      | 57/Handout |

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LABORATORY TOPICS AND SEQUENCE - continued

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<td>Endocrine System</td>
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<td>Circulatory &amp; Lymphatic Systems</td>
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<td>Nervous System &amp; Sense Organs</td>
<td>59/Handout</td>
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<td>12</td>
<td>Cat/Mink – conclusion, Lab Clean-Up,</td>
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<td>Final Discussion</td>
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Safety:
1. Safety in the laboratory is paramount and is everyone’s responsibility.
2. A laboratory coat, goggles, gloves and closed shoes are mandatory. Students without these items will not be allowed to conduct experimentation, and will be asked to leave the laboratory room.
3. Observe all safety precautions as instructed in the laboratory. They are for your protection.
4. Each student is responsible for the safe and proper maintenance of their work area.
5. Bench tops, microscopes and all other laboratory equipment must be properly cleaned and stored and after use.

Extra Credit Assignment:
An extra credit assignment based on a field trip to the American Museum of Natural History will be provided with full details.

Notes:
1. All students are responsible for cleaning dissecting trays and instruments, and laboratory counters at the end of each lab session and extra hours. Suitable materials for cleaning will be provided.
2. Comparative anatomy is an intensive study of the features common to vertebrates. The organ systems of these animals will be studied with an evolutionary theme in order to show the gradual trend toward greater complexity and more specialization in higher vertebrates.
3. This course requires skill at dissection and mastery of much detail.
4. In this course you will dissect a number of representative vertebrate animals as your studies take you from the simple to the more complex organisms.
5. Dissection is an art that allows us to learn, and takes patience and practice. It is not mutilation.
6. All students are strongly encouraged to attend class sessions, read each assignment carefully, take accurate and complete notes, and ask questions.
7. Comparative anatomy is an exciting learning journey. Enjoy it!
Grading

Lecture
1. Exams - Three (3) lecture exams will be given on the dates indicated on the tentative schedule. Each will be graded on a scale of 100 points. No make-ups will be given. A missed exam counts as a zero for that exam. However, the lowest exam grade will be dropped at the end of the semester. The two (2) highest exam grades will be counted and comprise 15% of your final grade.

2. Weekly Assignments – Weekly Assignments are assigned on line via Blackboard and are due on line on the dates indicated on the calendar (also posted on Blackboard). For each week or part an assignment is late, 10 points will be deducted from your grade on that assignment. The Assignments comprise 15% of your final grade. Written assignments must be brought to class prior to submission by the group for credit on the assignment.

3. Final Exam – The final exam is cumulative and comprises 20% of the final grade. Details will follow on the final exam.

Laboratory
1. Practical Exams – Three (3) practical exams will be given on the dates indicated on the tentative schedule. Details for each will be provided in laboratory. Each practical exam will be graded on a scale of 100 points. No make-ups will be given. A missed practical exam counts as a zero for that exam. However, the lowest practical exam grade will be dropped at the end of the semester. The two (2) highest practical exam grades will be counted and comprise 15% of your final grade.

2. Labeled Photos – Labeled photos of dissected organisms will be due weeks 2-11. Each will be graded on a scale of 100 points. No make-ups will be allowed. Missed labeled photos count as a zero for that set of photos. However, the lowest grade will be dropped at the end of the semester. The remaining highest labeled photos grades will be averaged and will comprise 15% of your final grade. Details on the requirements for each set of labeled photos will be provided in class.

3. Research Project – Each student will participate in a class research project focusing on the birds on and around the KCC campus. A group report will be submitted near the end of the semester for this project. Each group will also make an oral presentation with Powerpoint slides in the last lab session. Each student in the group will earn the same grade on this project. More details on the research project will follow. The Research Project comprises 20% of your final grade.

Grade Summary
Lecture: Exams 15% Laboratory: Practical Exams 15%
Weekly Assignments 15% Labeled Photos 15%
Final Exam 20% Research Project 20%
Total 50% Total 50%
Lecture + Laboratory = 50% + 50% = 100%

All assignments are due on the dates indicated on the tentative schedule or as announced in class. The grade on any assignment will be reduced by 10% for each week or part that it is submitted late.

Attendance Policy, WU and INC Grades
Attendance will be taken at the start of class. Any student not present when attendance is taken will be marked absent. If a student arrives late, it is the responsibility of the student to inform the instructor that he/she came late, and the absence will be changed to late. If a student does not inform the instructor he/she came late, that student remains marked absent for that class. Students who stop coming to class will earn a WU final grade. INC is only assigned if a student is passing the class and can pass the class if they take the final. All college policies regarding attendance and grades will be adhered to.
<table>
<thead>
<tr>
<th>Day</th>
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<th>Lecture</th>
<th>Lab</th>
<th>Notes</th>
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<td>Assignment 1 (Chapters 1 &amp; 2) due via Blackboard at 12noon</td>
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<td>Lab Practical 3 (on the Cat) and Presentations (Last lecture and lab)</td>
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*** Final Exam: Tue Dec 12 – Mon Dec 18, 2017 --- Day, Date, Time, Room – TBA ***
Student Objectives – Lecture

Ch. 1 - Introduction
1. Define anatomy and physiology and distinguish between the two.
2. Define comparative anatomy.
3. List the distinguishing characteristics of chordates.
4. List the distinguishing characteristics of vertebrates.
5. Discuss the historical aspects of the field of comparative anatomy and the key individuals who played a role in its formation.
6. Define morphological terms (symmetry, segmentation, etc.) and provide examples of each.
7. Define and describe phylogeny.
8. Interpret and use a cladogram.
10. Examine the fossil record.

Ch. 2 – Origin of Chordates
11. State the characteristics of Protochordates (Hemichordates and Urochordates)

Ch. 3 – The Vertebrate Story
12. Outline the vertebrate groups (Agnathans, Gnathostomes, Teleostomi, Tetrapods, Amniotes).
13. Distinguish the vertebrate groups using their unique characteristics.

Ch. 4 – Biological Design
14. Examine the sizes and shapes associated with vertebrates.
15. Study the basic principles of Biomechanics and Biophysics (ex. velocity, acceleration, force, diffusion, exchange) and how these principles are applied to vertebrate organisms.

Ch. 5 – Life History
16. Examine the embryological development of vertebrate organisms (fertilization, cleavage, gastrulation, neurulation).
17. Study organogenesis and tissue development in vertebrates (epithelial, connective, neural).
18. Explain the development of the coelom.
19. Study maturation in vertebrates.

Ch. 6 – Integument
21. List and discuss the general features of the Integument (Epidermis and Dermis) in vertebrates.
22. Discuss the phylogeny of Integument in fish, amphibians, reptiles, birds and mammals.
23. Discuss the specializations of the Integument (nails, claws, hooves, horns, antlers, baleen, scales, armor, mucus, color, etc.).

Ch. 7 – Skeletal System: The Skull
24. Discuss and distinguish between the Chondocranium, Splanchnocranium and Dermatocranium.
25. Provide an overview of skull morphology.
26. Discuss phylogeny of the skull in agnathans and gnathostomes.
27. Provide an overview of skull function and design.

Ch. 8 – Skeletal System: The Axial Skeleton
28. List and describe the basic components of the Axial Skeleton (vertebrae, ribs, sternum, gastralia).
29. Discuss the embryonic development of the axial skeleton in fishes and tetrapods.
30. Discuss the phylogeny of the axial skeleton in fishes and tetrapods.
31. Discuss mechanical design considerations in the vertebrate axial skeleton.

Ch. 9 – Skeletal System: The Appendicular Skeleton
32. List and discuss the basic components of the appendicular skeleton (fins, limbs).
33. Discuss the origin of paired fins.
34. Discuss the phylogeny of the vertebrate appendicular skeleton in fishes and tetrapods.
35. Discuss the evolution of the appendicular skeleton.
36. Discuss mechanical design considerations in the vertebrate appendicular skeleton (swimming, terrestrial locomotion, flight).

Ch. 10 – The Muscular System
37. List and describe the types and structure of muscle.
38. Describe basic muscle contraction on a microscopic and molecular level.
39. Discuss muscle mechanics in terms of length, tension, force, shortening and action.
40. Describe the embryonic origin of muscles.
41. Compare the anatomy of muscles across the vertebrates.

Ch. 11 – The Respiratory System
42. List and describe the vertebrate respiratory organs.
43. Explain ventilatory mechanisms.
44. Compare respiratory systems across the vertebrates.
45. Discuss gas exchange, including breathing in air and water.
46. Discuss the evolution of respiratory organs.

Ch. 12 – The Circulatory System
47. List and describe the components of the vertebrate circulatory system (blood, vessels, heart).
48. Distinguish between single and double circulation.
49. Describe the embryonic development of the cardiovascular system.
50. Compare blood vessels across the vertebrates.
51. Compare hearts across the vertebrates.
52. Discuss cardiovascular system specialized adaptations (fetal, placental, etc.) across the vertebrates.
53. List and describe the components of vertebrate lymphatic systems.
54. Discuss the form and function of vertebrate lymphatic systems.

Ch. 13 – The Digestive System
55. List and describe the components of the vertebrate digestive system, including accessory organs.
56. Describe the function and evolution of the vertebrate digestive system.

Ch. 14 – The Urogenital System
57. List and discuss the components of the vertebrate urinary system.
58. Describe in detail the structure and function of kidneys across the vertebrates.
59. Discuss the evolution of the vertebrate urinary system.
60. Describe the structure of the mammalian reproductive system.
61. Discuss the embryonic development of the vertebrate reproductive system.
62. Describe the reproductive tracts of vertebrates.
63. List and describe the components of female reproductive systems in vertebrates.
64. List and describe the components of male reproductive systems in vertebrates.
65. Compare external and internal fertilization across the vertebrates.
Ch. 15 – The Endocrine System
66. List and describe the organs of the endocrine system in vertebrates.
67. Discuss the phylogeny of endocrine organs in vertebrates.
68. Discuss the evolution of the endocrine system in vertebrates.

Ch. 16 – The Nervous System
69. List and discuss the types of cells in the vertebrate nervous system.
70. List and discuss the components of the vertebrate peripheral nervous system.
71. Discuss the functions of the vertebrate peripheral nervous system.
72. List and discuss the components of the central nervous system in vertebrates.
73. Discuss the functions of the central nervous system in vertebrates.

Ch. 17 – Sensory Organs
74. List and discuss the components of a sensory organ in vertebrates.
75. List and discuss general sensory organs in vertebrates.
76. List and discuss special sensory organs in vertebrates.

Student Objectives – Laboratory
1. List and demonstrate laboratory safety procedures.
2. Identify components of Amphioxus anatomy.
3. Identify components of Lamprey external anatomy.
4. Dissect and identify internal anatomical structures of the Lamprey.
5. Identify components of Dogfish shark external anatomy.
6. Dissect the Dogfish shark and identify internal components of the integumentary, skeletal, muscular, digestive, respiratory, urogenital, circulatory, lymphatic, nervous (sense organs) and endocrine systems.
8. Dissect the Perch and identify internal anatomical components.
9. Identify external anatomical components of Necturus (Mud Puppy).
10. Dissect Necturus and identify components of the integumentary, skeletal, muscular, digestive, respiratory, urogenital, circulatory, lymphatic, nervous (sense organs) and endocrine systems.
11. Identify external anatomical components of a Turtle.
12. Dissect a Turtle and identify components of the integumentary, skeletal, muscular, digestive, respiratory, urogenital, circulatory, lymphatic, nervous (sense organs) and endocrine systems.
13. Identify external anatomical and skeletal components of Birds.
14. Identify external anatomical components of the Cat and Mink.
15. Dissect the Cat and Mink and identify components of its integumentary, skeletal, muscular, digestive, respiratory, urogenital, circulatory, lymphatic, nervous (sense organs) and endocrine systems.
16. Compare the anatomical features of Amphioxus, the Lamprey, the Dogfish Shark, Perch, Necturus (Mud Puppy), Reptiles, Birds and the Cat/Mink.
17. Participate in a class research project, and report the findings in written format in the form of a lab report and in an oral presentation in lab.