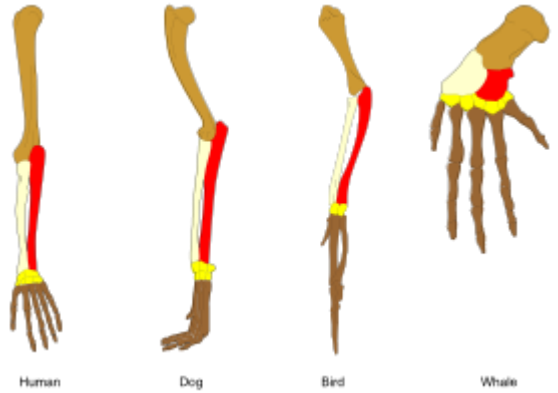
Secaucus Board of Education

Comparative Anatomy

Course Code: 4221

Science Department



Born on August 2016

Aligned to the NJSLS – Science (2014), Technology (2014), 21st Century Life and Careers (2014), ELA (2016) and Mathematics (2016)

Adopted by the Secaucus Board of Education on August 25, 2016

District Equity Statement

The Board of Education directs that all students enrolled in the schools of this district shall be afforded equal educational opportunities in strict accordance with the law. No students shall be denied access to or benefit from any educational program or activity or from a co-curricular or athletic activity on the basis of the student's race, color, creed, religion, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, gender identity or expression, socioeconomic status, or disability. The Board directs the Superintendent to allocate faculty, administrators, support staff members, curriculum materials, and instructional equipment supplies among and between the schools and classes of this district in a manner that ensures equivalency of educational opportunity throughout this district. The school district's curricula in the following areas will eliminate discrimination, promote mutual acceptance and respect among students, and enable students to interact effectively with others, regardless of race, color, creed, religion, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, gender identity or expression, socioeconomic status, or disability:

1. School climate/learning environment
2. Courses of study, including Physical Education
3. Instructional materials and strategies
4. Library materials
5. Software and audio-visual materials
6. Guidance and counseling
7. Extra-curricular programs and activities
8. Testing and other assessments.

Excerpt from Secaucus Board of Education, Policy 5750, Edited September 2016

Course Description

Comparative Anatomy is a science elective that continues the study of life science through the comparative study of the organ systems of invertebrate and vertebrate animals. Laboratory activities will involve various dissections and/or interactive exercises to provide the knowledge of structure (anatomy) and function (physiology) of certain organisms. Laboratory experiences are an integral part of the course and will include a large number of dissections meant to contrast the anatomy of lower level animals and the human body.

Students interested in taking Comparative Anatomy should have successfully passed some level of Biology in high school. The course is divided into four (4) units focusing on:

- Membranes and Enzymes
- Human Anatomy & Physiology
- Classification
- Practical Anatomy

A majority of the course will focus on the dissections of a number of specimens in the Kingdom Animalia. This curriculum is based on approximately 128 class periods.

Course Modifications (ELLs, Special Education, Gifted and Talented)

The course instructor will determine, with the assistance of guidance counselors, teacher assistant/aides, and/or special education teachers, what modifications will be made for his/her students. Such examples of modifications can include, but not be limited to:

· Extended time as needed
· Modification of tests and quizzes
· Preferential seating
· Alternative/Formative assessment (projects)
· Effective teacher questioning (ranging from simple recall to higher order critical thinking questions)
· Supplemental materials
· Cooperative learning
· Teacher tutoring
· Peer tutoring

· Differentiated Instruction

Interdisciplinary Connections

The following NJSLS for ELA, Mathematics, College and Career Readiness and Technology depict what standards align to the science standards taught in this Comparative Anatomy Course.

NJSLS - ELA/Literacy:

- RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS1-1),(HS-LS1-6)
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1- 1),(HS-LS1-6)
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6)
- WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HSLS1-3)
- WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3)
- WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS-1-1),(HS-LS1-6)
- SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2),(HS-LS1-4),(HS-LS1-5),(HS-LS1-7)

NJSLS - Mathematics:

- MP.4 Model with mathematics. (HS-LS1-4)

- HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4)
- HSF-BF.A.1 Write a function that describes a relationship between two quantities. (HS-LS1-4)

NJSLS – Technology:

- 8.1.12.A.1 Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
- 8.1.12.A.2 Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
- 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
- 8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
- 8.1.12.A.5 Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

NJSLS – 21st Century Life and Careers:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Unit 1 Lesson Plan – Membranes and Enzymes			
Teacher:	SHS Science Faculty	**Time Frame:**	14 days
Grade:	**11**	**School:**	SHS
Subject:	**Membranes and Enzymes**		

AP Standards	
Instructional Objective: (condition, behavior, standard)	**Essential Knowledge** 2.A.3 - Organisms must exchange matter with the environment to grow, reproduce and maintain organization.
	Essential Knowledge 2.B.1 - Cell membranes are selectively permeable due to their structure.
	Essential Knowledge 2.B.2 - Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.
	Essential Knowledge 2.B.3 - Eukaryotic cells maintain internal membranes that partition the cell into specialized regions.
	Essential Knowledge 4.B.1 - Interactions between molecules affect their structure and function.
NJSLS – Science	
DCI	**HS-LS1-1** Construct and explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells
	HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis

Essential Questions	
(What questions will the student be able to answer as a result of the instruction?)	
• How can materials be transported through a cell membrane, specifically in regards to transport proteins? • Describe the difference between a hypotonic and a hypertonic solution. • When is facilitated diffusion a necessary method to transport molecules across a cell membrane? • How do enzymes control reaction rates inside organisms?	
Knowledge & Skills	
By the end of this unit, students will know: • Cell Membranes are selectively permeable. • The cell membrane is composed of a phospholipid bilayer • The phospholipid bilayer is described as a "Fluid Mosaic" model because it is composed of different components that can move throughout the membrane. • Transport Proteins lie within the phospholipid bilayer of a cell membrane and aid in transport of molecules across the membrane. • Diffusion, osmosis, facilitated diffusion, and active transport are ways in which molecules move across a membrane. • Enzymes lower the activation energy of reactions • Enzymes are affected by environmental conditions.	By the end of this unit, students will be able to: • List the reasons a semi-permeable membrane in the cell is essential to cell functions. • Use dialysis tubes to describe hypotonic and hypertonic solutions. • Describe the different methods of membrane transport, and which methods require an input energy, and which methods do not require an input of energy. • Calculate the concentration of solutions and compare the internal and external concentrations. • Describe the catalytic cycle of an enzyme. • Use graphs to determine the optimal environmental conditions of an enzyme.

Assessment
During the Smart Notebook lesson designed to introduce concepts, students will be continually questioned on these concepts using a combination of class work/homework questions and the SMART Response system. Classwork and Homework questions will be discussed as a class and misconceptions will be addressed by the teacher prior to the formal evaluations listed below. Lab 1 Quiz: Diffusion Lab 2 Quiz: Osmosis Quiz 1: Membranes/Diffusion Quiz 2: Osmosis/Plasma Membrane Quiz 3: Enzymes Unit Test

Pacing Guide

Day	Topic	Classwork	Homework
1	Membranes & Diffusion	SMART Notebook Slides 5-30; Questions #1-11	#12-22 Study for Quiz
2	Concentration Activity	Concentration Activity Part 1 Quiz 1	

3	Diffusion Lab or Virtual Diffusion Lab	Diffusion Lab	Analysis Study for Quiz
4	Osmosis	Lab Quiz 1 SMART Notebook Slides 31-46; Questions #23-29	#30-36
5	Concentration Relationships	Concentration Activity Part 2	
6	Osmosis Lab	Osmosis Lab	Analysis Study for Quiz
7	Transport Through Proteins	Lab Quiz 2 SMART Notebook Slides 47-71; Questions #37-47	#48-57 Study for Quiz
8	Enzymes	Quiz 2 SMART Notebook Slides 5-23; Questions #58-66	#67-70
9	Enzymes	Enzymes Activity	Analysis

10	Temperature, pH Inhibition	SMART Notebook Slides 24-50; Questions #71-76	#77-82
11	Allosteric Regulation	SMART Notebook Slides 51-64; Questions #83-85	#85-88 Study for Quiz
12	Review	Quiz 3 MC/FR	MC/FR
13	Review	Vocabulary Concept Mapping MC/FR	MC/FR
14	Test	Unit Test	Pre Assessment Genes: Vocabulary Concept Mapping

*Lessons are based on 40m.periods and may need to be adjusted to fit the instructor.

Unit 2 Lesson Plan – Human Anatomy & Physiology			
Teacher:	SHS Science Faculty	**Time Frame:**	50 days
Grade:	**11**	**School:**	SHS
Subject:	**Human Anatomy & Physiology**		

AP Standards	
Instructional Objective: (condition, behavior, standard)	**Essential Knowledge** 1.B.1 - Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.
	Essential Knowledge 1.B.2 - Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested
	Essential Knowledge 2.C.2 - Organisms respond to changes in their external environments.
	Essential Knowledge 2.D.2 - Homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments.
	Essential Knowledge 2.D.4 - Plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis.
	Essential Knowledge 3.E.1 - Individuals can act on information and communicate it to others.
	Essential Knowledge 3.E.2 - Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.
NJSLS - Science	

<table>
<tr><td rowspan="2">DCI</td><td>HS-LS1.2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multi-cellular organisms.</td></tr>
<tr><td>HS-LS1.3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.</td></tr>
<tr><td colspan="2">Essential Questions</td></tr>
<tr><td colspan="2">• What systems exist in the human body?
• What is the importance of homeostasis in an organism?
• Compare ectotherms and endotherms.</td></tr>
<tr><td colspan="2">Knowledge & Skills</td></tr>
<tr><td>By the end of this unit, students will know:

• In order to keep internal operations efficient and operating at optimal levels, homeostatic mechanisms react to changing external factors.
• Endotherms maintain higher internal temperatures than their environments using structures such as hair, fat and feathers.
• Ectotherms mirror their internal temperature to their environment. When temperatures go up, ectotherm activity increases.
• The nervous system, excretory system, lymphatic system, immune system, respiratory system, circulatory system, endocrine system are all major systems in the human body which maintain our day to day functions.</td><td>By the end of this unit, students will be able to:

• Give examples of both ectotherms and endotherms, and describe how they regulate their body temperatures.
• List the functions of all the major body systems and the way in which they operate.
• Describe the three main types of “eaters” (herbivores, carnivores, and omnivores), and give examples of organisms that fall into these categories.</td></tr>
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Assessment
During the Smart Notebook lesson designed to introduce concepts, students will be continually questioned on these concepts using a combination of class work/homework questions and the SMART Response system. Classwork and Homework questions will be discussed as a class and misconceptions will be addressed by the teacher prior to the formal evaluations listed below. Quiz 1: Organ Systems Unit Test Other Tests/Quizzes as determined by the instructor Text: Miller/Levine 'Biology', 2014

Pacing Guide

Day	Topic	Classwork	Homework
1 - 4	Structure & Function – Epithelial Tissue	SMART Notebook Slides 6-21; Questions 1-4	#8-10
5 - 10	Connective, Muscle, & Nervous Tissue	SMART Notebook Slides 22-36; Questions 5-7	#11-13
11 - 20	Integumentary, Skeletal, & Muscular Systems	SMART Notebook Slides 37-54; Questions 14-18	#35-38
21 -30	Nervous, Endocrine, Lymphatic, Respiratory,	SMART Notebook Slides 55-79; Questions	#39-44

	& Urinary Systems	19-26	
31 - 40	Digestive & Circulatory Systems	SMART Notebook Slides 80-104; Questions 27-34	#45-52
41 - 45	Homeostasis	Quiz 1: Organ Systems SMART Notebook Slides 105-116; Question 53-55	#56-58
46 - 48	Review	MC/FR Review	MC/FR
	Review	Vocabulary Concept Mapping MC/FR	MC/FR
49 - 50	Test	Unit Test	Final Exam Review

*Lessons are based on 40m.periods and may need to be adjusted to fit the schedule of the instructor

Unit 3 Lesson Plan – Classification			
Teacher:	SHS Science Faculty	**Time Frame:**	9 days
Grade:	**11**	**School:**	SHS
Subject:	**Classification**		
AP Standards			
Instructional Objective: (condition, behavior, standard)	**Essential Knowledge 1.B.2** Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.		
NJSLS - Science			
DCI	**HS-LS1-1** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells		
Essential Questions			
• What is binomial nomenclature? • How does a cladogram show relationships between organisms? • How are plants and animals placed into taxa?			
Knowledge & Skills			
By the end of this unit, students will know: • *Genus species* is the modern way of classifying an individual. • Domain, Kingdom, Phylum, Class, Order, Family, Genus, and Species are the steps of	By the end of this unit, students will be able to: • Observe the characteristics of different plant and animal species, and determine their evolutionary history.		

scientific classification. • The closer two organisms are on a cladogram, the more characteristics they share and the closer related they are. • Plants are classified based on their vascular system, seeds, and flowers. • Animals are classified based on body plan. • Homo sapiens are of the phylum chordate, meaning that they have a backbone.	• Construct a cladogram of organisms and identify shared characteristics. • Be able to trace Homo sapiens lineage from Domain to species.

Assessment

During the lessons designed to introduce concepts, students will be continually questioned on these concepts using a combination of class work/homework questions and the SMART Response system. Classwork and Homework questions will be discussed as a class and misconceptions will be addressed by the teacher prior to the formal evaluations listed below.

Pacing Guide

Day	Topic	Classwork	Homework
1	Classification & Naming	SMART Notebook Slides4-19; Questions #1-4	#5-8
2	Phylogeny	SMART Notebook Slides20-28; Construct a Cladogram Activity Questions #9-14	#18-22

3	Domains	SMART Notebook Slides 29-45; Questions 14-17	#23-26
4	Kingdom Plantae	Quiz 1 SMART Notebook Slides 46-68; 18-23	#33-37
5	Classification Lab	Lab	Analysis
6	Kingdom Animalia	Lab Quiz SMART Notebook Slides 69-80; Questions; 38-42	#43-48
7	Review	Quiz 2 MC/FR	MC/FR
8	Review	Vocabulary Concept Mapping MC/FR	MC/FR
9	Test	Unit Test	Pre Assessment Eco: Vocabulary Concept Mapping

*Lessons are based on 40m.periods and may need to be adjusted to fit the instructor.

Unit 4 Lesson Plan – Practical Anatomy (Dissections)			
Teacher:	SHS Science Faculty	**Time Frame:**	55days
Grade:	**11**	**School:**	SHS
Subject:	**Comparative Anatomy**		

AP Standards	
Instructional Objective: (condition, behavior, standard)	**Essential Knowledge 1.B.2** Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.

NJSLS - Science	
DCI	**HS-LS1-1** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells
	HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multi-cellular organisms.

Essential Questions

- What are the defining characteristics of sponges?
- How are Cnidarians different from all other animals?
- What is a flatworm? A roundworm? An annelid?
- What are the distinguishing characteristics of a mollusk?
- What are the distinguishing characteristics of an arthropod?
- What are insects?
- How are aquatic and terrestrial arthropods different?

- What are some of the defining characteristics of fish?
- What makes an amphibian different from other animals?
- What are the defining characteristics of fish?
- How do birds fly?
- What makes a mammal unique?

Knowledge & Skills	
By the end of this unit, students will know: **Introduction to the Animal Kingdom** An animal is a multicellular, eukaryotic heterotroph whose cells lack cell walls. Animals are specialized to carry out the following essential functions: feeding, respiration, circulation, excretion, response, movement, and reproduction. In general, complex animals tend to have high levels of cell specialization and internal organization, bilateral body symmetry, cephalization, and a body. **Sponges** Sponges are classified as animals because they are multicellular, heterotrophic, have no cell walls, and contain a few specialized cells. The movement of water through a sponge provides a simple mechanism for feeding, respiration, circulation, and excretion. **Cnidarians** Cnidarians are soft-bodied, carnivorous animals that have stinging tentacles arranged in circles around their mouth. They are the simplest animals to have body symmetry and specialized tissues.	By the end of this unit, students will be able to: • Observe the characteristics of different animal species, and compare them to the human body • Construct a cladogram (or any other graphical organizer) of organisms and identify shared characteristics. • Identify the differences among animals of different phyla

Cnidarians typically have a life cycle that includes two different-looking stages, a polyp and a medusa. Cnidarians include jellyfishes, hydras and their relatives, sea anemones, and corals. **Flatworms** Flatworms are soft, flattened worms that have tissues and internal organ systems. They are the simplest animals to have three embryonic germ layers, bilateral symmetry, and cephalization. Turbellarians are free-living marine or freshwater flatworms. Flukes are parasitic flatworms that usually infect the internal organs of their hosts. Tapeworms are long, flat, parasitic worms that are adapted to life inside the intestines of their hosts. **Roundworms** Roundworms are unsegmented worms that have pseudocoeloms and digestive systems with two openings—a mouth and an anus. Parasitic roundworms include trichinosis-causing worms, filarial worms, ascarid worms, and hookworms.Section 27-3: Annelids Annelids are worms with segmented bodies. They have a true coelom that is completely lined with mesoderm. Oligochaetes are annelids that typically have only a few setae and live in soil or fresh water. Leeches are typically external parasites that suck the blood and body fluids of their host. Polychaetes are marine annelids that have paired,	

paddlelike appendages tipped with setae. **Annelids** Annelids are worms with segmented bodies. They have a true coelom that is completely lined with mesoderm. Oligochaetes are annelids that typically have only a few setae and live in soil or fresh water. Leeches are typically external parasites that suck the blood and body fluids of their host. Polychaetes are marine annelids that have paired, paddlelike appendages tipped with setae. **Mollusks** Mollusks are soft-bodied animals that usually have an internal or external shell. The typical mollusk body plan has four parts: foot, mantle, shell, and visceral mass. Gastropods are shell-less or single-shelled mollusks that move by using a muscular foot located on the ventral side. Bivalves have two shells that are held together by one or two powerful muscles. Cephalopods are typically soft-bodied mollusks in which the head is attached to a single foot. The foot is divided into tentacles or arms. **Introduction to the Arthropods** Arthropods have a segmented body, a tough exoskeleton, and jointed appendages. In many groups of arthropods, continuing evolution has led to fewer body segments and highly specialized appendages for feeding, movement, and	

other functions. • When they outgrow their exoskeletons, arthropods undergo periods of molting. **Groups of Arthropods** • Arthropods are classified based on the number and structure of their body segments and appendages, particularly their mouthparts. • Crustaceans typically have two pairs of branched antennae, two or three body sections, and chewing mouthparts called mandibles. • Chelicerates have mouthparts called chelicerae and two body sections, and most have four pairs of walking legs. • Uniramians have jaws, one pair of antennae, and unbranched appendages. **Insects** • Insects have a body divided into three parts—head, thorax, and abdomen. Three pairs of legs are attached to the thorax. • The growth and development of insects usually involve metamorphosis, which is a process of changing shape and form. Insects undergo either incomplete metamorphosis or complete metamorphosis. • Ants, bees, termites, and some of their relatives form complex associations called societies. **Echinoderms** • Echinoderms are characterized by spiny skin, five-part radial symmetry, an internal skeleton, a water vascular system, and suction-cup-like	

structures called tube feet. • The water vascular system carries out many essential body functions in echinoderms, including respiration, circulation, and movement. • Classes of echinoderms include sea lilies and feather stars, sea stars, brittle stars, sea urchins and sand dollars, and sea cucumbers. **Invertebrate Evolution** • As animals became larger and more complex, specialized cells joined together to form tissues, organs, and organ systems that work together to carry out complex functions. • All invertebrates except sponges exhibit some type of body symmetry—either radial symmetry or bilateral symmetry. • Invertebrates with cephalization can respond to the environment more quickly and in more sophisticated ways than can simpler invertebrates. • Most invertebrates with bilateral symmetry also have segmented bodies. Over the course of evolution, different segments have often become specialized for specific functions. • Most animal phyla have a true coelom that is lined completely with mesoderm. • Worms, arthropods, and mollusks are protostomes, and echinoderms are deuterostomes. **Form and Function in Invertebrates** • The simplest animals break down food primarily through intracellular digestion, whereas more complex animals use extracellular digestion. • Respiratory organs have large surface areas that	

are in contact with the air or water. In order for diffusion to occur, these respiratory surfaces must be kept moist. • Most complex animals move fluid through their bodies using one or more hearts and an open or closed circulatory system. • Most animals have an excretory system that rids the body of metabolic wastes and controls the amount of water in their tissues. • Invertebrates show three trends in the evolution of the nervous system: centralization, cephalization, and specialization. • Invertebrates have one of three main kinds of skeletal systems: hydrostatic skeletons, exoskeletons, and endoskeletons. • Most invertebrates reproduce sexually during at least part of their life cycle. Depending on environmental conditions, however, many invertebrates may also reproduce asexually. **The Chordates** • A chordate is an animal that has, for at least some stage of its life, a dorsal, hollow nerve cord; a notochord; pharyngeal pouches; and a tail that extends beyond the anus. • The two groups of nonvertebrate chordates are tunicates and lancelets. **Fishes** • Fishes are aquatic vertebrates that are characterized by paired fins, scales, and gills. • The evolution of jaws and the evolution of paired fins were important developments during the rise of	

fishes. Fishes' adaptations to aquatic life include various modes of feeding, specialized structures for gas exchange, and paired fins for locomotion. On the basis of their basic internal structure, all living fishes can be classified into one of three groups: jawless fishes, cartilaginous fishes, and bony fishes. **Amphibians** An amphibian is a vertebrate that, with some exceptions, lays eggs in water, lives in water as a larva and on land as an adult, breathes with lungs as an adult, has moist skin that contains mucus glands, and lacks scales and claws. Early amphibians evolved several adaptations that helped them live at least part of their lives out of water. Bones in the limbs and limb girdles of amphibians became stronger, permitting more efficient movement. A set of lungs and breathing tubes enabled them to breathe air. Their sternum formed a bony shield that supports and protects the internal organs, especially the lungs. The three groups of living amphibians are salamanders, frogs and toads, and caecilians. **Reptiles** A reptile is a vertebrate that has scaly skin, lungs, and eggs with several membranes. Well-developed lungs; a double-loop circulatory system; an efficient excretory system; strong limbs; internal fertilization; and shelled, terrestrial eggs are the main adaptations that have contributed to the	

success of reptiles on land. • The four surviving orders of reptiles are lizards and snakes, crocodilians, turtles and tortoises, and the tuatara. **Birds** • Birds are reptile-like animals that maintain a constant internal body temperature. They have an outer covering of feathers, two legs that are covered with scales and are used for walking or perching, and front limbs modified into wings. • Birds have a number of adaptations that enable them to fly. These adaptations include highly efficient digestive, respiratory, and circulatory systems; aerodynamic feathers and wings; and strong chest muscles. **Introduction to the Mammals** • In addition to having hair and the ability to nourish their young with milk, all mammals breathe air and are endotherms that generate their body heat internally. • The first true mammals appeared during the late Triassic Period, about 220 million years ago. • The ability of mammals to regulate their body heat from within is an example of homeostasis. • As mammals evolved to eat foods other than insects, the form and function of their jaws and teeth became adapted to their diets. • The kidneys of mammals help maintain homeostasis by excreting or retaining excess liquid. **Diversity of Mammals**	

The three groups of living mammals are the monotremes, the marsupials, and the placentals. Marsupials bear live young that complete their development in a pouch. Monotremes lay eggs. In placental mammals, nutrients, oxygen, carbon dioxide, and wastes are exchanged between embryo and mother through the placenta. Similar ecological opportunities on the different continents have produced some striking examples of convergent evolution in mammals.	

Assessment

Lab Practical:

- Earthworm
- Crayfish
- Grasshopper
- Perch
- Clam
- Starfish
- Fetal Pig
- Cat

Miller and Levine's 'Biology' (2008), Chapters:

Chapter 26: Sponges and Cnidarians
Chapter 27: Worms and Mollusks
Chapter 28: Arthropods and Echinoderms
Chapter 29: Comparing Invertebrates

Chapter 30: Nonvertebrate Chordates, Fishes, and Amphibians
Chapter 31: Reptiles and Birds
Chapter 32: Mammals

Pacing Guide			
Day(s)	Topic	Classwork	Homework
1 - 8	Sponges and Cnidarians	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets
9 - 15	Worms and Mollusks	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets
16 - 22	Arthropods and Echinoderms	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets
23 - 26	Comparing Invertebrates	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets
27 - 32	Nonvertebrate Chordates, Fishes, and Amphibians	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets
33 - 37	Reptiles and Birds	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets

38 - 44	Mammals	Dissection worksheets Power point presentations	Anatomical Comparison Data Sheets
45 - 50	Review	Study Guide Practical review sheets	Study
51 - 55	Test Practical (Dissection based)	Final Exam/Practical Exam	

*Lessons are based on 40m. periods and may need to be adjusted to fit the instructor.