PUBLIC SCHOOLS OF EDISON TOWNSHIP

OFFICE OF CURRICULUM AND INSTRUCTION

ANATOMY AND PHYSIOLOGY

Length of Course:	Term
Elective/Required:	Elective
School:	High Schools
Student Eligibility:	Grades 11, 12
Credit Value:	5 Credits
Date Approved:	September 24, 2018

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STATEMENT OF PURPOSE

Anatomy and Physiology is an elective science course offered to twelfth graders. The course presents a comprehensive survey of the structure and functions of the human body. The Anatomy and Physiology course will investigate the relationships of the different body systems while applying previously learned biological concepts and skills. Students will learn how to define anatomical terms while studying how a body works to balance all of its processes. They will investigate how the muscles and skeletal systems work to achieve motion. And by studying the cardiovascular system, students will become aware of the interdependence with the respiratory system and intricate movement of cells through the human body. This course can serve as an introduction to a variety of life science careers while providing an appreciation for the workings of the human body.
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This curriculum guide was modified in 2018 by:

Laura Darrah – JP Stevens High School
Jennifer Przygoda - Edison High School

Coordinated by:

Laurie Maier - Supervisor of Science, Edison and JP Stevens High Schools

Course Objectives

By the end of the Anatomy & Physiology course, students will be able to:

NJSLS - Science/NGSS:

- **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 multicellular organisms
- **HS-LS1-3** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis
- **HS-LS3-2** Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) New genetic combinations through meiosis, (2) viable errors occurring during replication and/or (3) mutations caused by environmental factors.

9.2 Career Awareness, Exploration, and Preparation

- This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

8.1 Educational Technology

- All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

8.2 Technology, Engineering, Design and Computational Thinking

- All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Timeline

First Quarter Unit - Chapters 1 & 4: Introduction to Anatomy & Physiology and Tissues

Introduction:

- The common functions of all living things.
- Anatomy is structure, and physiology is function.
- Levels of organization.
- Overview of 11 organ systems.
- Homeostasis.
- Negative vs. positive feedback loops.
- Anatomical terms to describe body regions, anatomical positions and directions, and body sections.
- Body cavities, their membranes and organs.
- Career paths.

Tissues:

- Four types of tissues (epithelial, connective, muscular, neural)
- Cell shape and number
- Tissues as membranes.
- Response to injury.
- Effect of aging.
- Career paths.

Second Quarter Unit - Chapter 6: The Skeletal System

- Primary functions.
- Ossification and growth.
- Bone formation and resorption.
- Bone markings (surface features)
- Bones of the skull.
- Axial and appendicular skeletons.
- Joint types and their movement.
- Effects of aging and pathologies.
- Career paths.

Third Quarter Unit - Chapter 7: The Muscular System

- Primary functions.
- Connective tissue organization.
- Skeletal muscle fibers.
- Neuromuscular junction and contraction cycle.
- Muscle performance and muscle fiber type.
- Structural and functional difference of cardiac and smooth muscle.
- Origins, insertions and actions of key muscles.
- Identification of axial and appendicular muscles.
- Effects of aging and pathologies.
- Career paths.

Fourth Quarter Unit - Chapters 12, 13 & 15: The Cardiovascular and Respiratory Systems

Cardiovascular:

- Primary functions.
- External and internal anatomy and organization of the heart.
- Conduction system of the heart, and basic understanding of an ECG.
- Cardiac cycle, heart sounds and blood pressure.
- Effects of aging and pathologies.
- The structure of blood vessels.
- Arteries, arterioles, capillaries, venules and veins.
- Pulmonary and systemic circuits.
- Effects of aging and pathologies.
- Career paths.

Respiratory:

- Primary functions.
- Components of the system.
- Internal, external respiration and gas exchange.
- Rates of respiration.
- Effects of aging and pathologies.
- Career paths.

UNIT 1: INTRODUCTION TO ANATOMY & PHYSIOLOGY

Targeted State Standards (NJSLS-S/NGSS): HS-LS1.A, HS -LS1.B

Unit Objectives/Enduring Understandings:

- Define the anatomical terms used to refer to the body in terms of directions and geometric planes.
- Describe the major cavities of the body.
- Explain the relationship between cells, tissues, organs & organ systems.
- Understand homeostasis and how the body works to balance all processes.
- Identify the body's four basic types of tissues and describe their roles.
- Describe the characteristics and functions of each of the tissue types.

Essential Questions:

- How is the human body organized, and how do we study it?
- How does the body regulate and communicate with itself?
- How does the structure of body tissues allow for their specialized functions?

Optional Unit Assessment:

- See laboratory investigations and tests.
- ***Problem Based Pathology Research***: Students to be presented with an "unknown" pathology that they will have to diagnose based on their understanding of the system(s) affected.

	Core Content		**Instructional Actions**	
Disciplinary Core Ideas	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
LS1.A: Structure and Function Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the	Directional terms relating to anatomic position. The major cavities of the body and their subdivisions. The structural levels of organization of the human body. The major organ systems of the human body.	Describe the basic functions of living organisms. Explain the relationship between anatomy and physiology, and describe various specialties of each discipline. Identify the major levels of organization in living organisms.	<u>Laboratory Investigations:</u> (optional, but not limited to the following) - Anatomical Language Application Activity - X-ray analysis - Homeostasis Lab - Histology Slide Activity - Tissue concept mapping - Career Report related to the system.	<u>Formative Assessments:</u> Class Discussions Worksheets/Drafts with teacher feedback Pre-Assessments Exit tickets Informal polling

formation of proteins, which carry out most of the work of cells. (HS-LS1-1) Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic	How the body maintains its internal environment through homeostasis. Body Tissues ● Epithelial ● Connective ● Muscle ● Nervous Body tissues combine to form membranes. Each of the four body tissue types has a specific role in the body.	Identify the organ systems of the human body and the major components of each system. Explain the concept of homeostasis. Use anatomical terms to describe body sections, body regions, and relative positions. Identify the major body cavities and their subdivisions. Identify the body's four basic types of tissues and describe their roles. Describe the characteristics and functions of epithelial cells and describe the relationship between form and function for each type of epithelium. Compare the structures and functions of the various types of connective tissues. Explain how epithelial and connective tissues combine to form four types of tissue membranes, and specify the functions of each. Describe the three types of muscle tissue and the special structural features of each. Discuss the basic structure and role of neural tissue.	<u>Textbook Chapter:</u> Chapters: 1 – An Introduction to Anatomy & Physiology. 4 - The Tissue Level of Organization	<u>Summative Assessment:</u> Quizzes Tests Performance Assessments Laboratory Investigations

material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)				
Resources: Essential Materials, Supplementary Materials, Links to Best Practices Martini, Frederic H. and Edwin F. Bartholomew et al, Essentials of Anatomy and Physiology 6th ed., Boston, MA: Pearson 2013			**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings	

UNIT 2: THE SKELETAL SYSTEM

Targeted State Standards (NJSLS-S/NGSS): HS-LS1.A, HS -LS1.B

Unit Objectives/Enduring Understandings:

- Describe the primary functions of the skeletal system (this includes comparing individual bones as well as both the axial and appendicular skeletons)
- Explain the functional relationships between the skeletal system and other body systems

Essential Questions:

- How does the skeletal system work together with muscles and nerves to achieve motion? What role do tendons plan in the collaborative efforts of the skeletal and muscular system? What is the significance of the role of ligaments and tendons in bone articulation? What are the major joints and how are they held together?

Optional Unit Assessment:

- See laboratory investigations and tests.
- ***Problem Based Pathology Research***: Students to be presented with an "unknown" pathology that they will have to diagnose based on their understanding of the system(s) affected.

	Core Content		**Instructional Actions**	
Disciplinary Core Ideas	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
LS1.A: Structure and Function Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) Multicellular organisms have a hierarchical structural	Primary functions of the skeletal system ● Support, storage, blood cell production, protection, movement Bone classification ● Shape ● Structure/composition ● Microscopic features ● Macroscopic features ● Growth/formation/repair Mineral storage Skeletal tissue Skeletal division:	Identify major bones in the body and their functions Classify each bone Explain how the skeleton allows for movement and flexibility of the human body Identify differences between the male and female skeleton Describe the three major categories of joints and type of movement of each Explain how the structure and organization of bone relates to its function in the body	<u>Laboratory Investigations:</u> (optional, but not limited to the following) -Skeletal Model Identification -Chicken Bone Dissection Lab -Dissection of Fetal Pig -Coloring Pages of Bones - Career Report related to the system. <u>Textbook Chapter:</u> Chapter 6 – The Skeletal System	<u>Formative Assessments:</u> Class Discussions Worksheets/Drafts with teacher feedback Pre-Assessments Exit tickets Informal polling <u>Summative Assessment:</u> Quizzes Tests Performance Assessments

organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism,	Axial Skeleton ● Skull ● Vertebral column ● Thoracic cage Appendicular Skeleton ● Pectoral Girdle and Upper Limb Bones ● Pelvic Girdle and Lower Limb Bones Joints ● Categorization ● Movement ● Location Aging and Bones Connection to other body systems	Explain how certain diseases and disorders inhibit bone function. Discuss the interdependent nature of the skeletal system and the muscular systems		Laboratory Investigations

composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)				
Resources: Essential Materials, Supplementary Materials, Links to Best Practices Martini, Frederic H. and Edwin F. Bartholomew et al, Essentials of Anatomy and Physiology 6th ed, Boston, MA: Pearson 2013			**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings	

UNIT 3: THE MUSCULAR SYSTEM

Targeted State Standards (NJSLS-S/NGSS): HS-LS1.A, HS -LS1.B

Unit Objectives/Enduring Understandings:

- Understand the relationship between structure and function of muscle
- Understand the interdependence of the muscular and skeletal systems
- Understand how muscles control the movement in the human body

Essential Questions:

- How does the muscular system work together with the skeletal system to allow for movement? What role do tendons plan in the collaborative efforts of the skeletal and muscular system? Does connective tissue have a significant role in the overall function of the human body? How does ATP provide energy for muscle contraction? How do nerve impulses translate into action potential? What effect does aerobic and strength training have on different muscle sets? What are the overall long term and short term effects of anabolic steroids and "nutritional performance enhancers" on the body? What do striations of skeletal muscles tell us?

Optional Unit Assessment:

- See laboratory investigations and tests.
- ***Problem Based Pathology Research***: Students to be presented with an "unknown" pathology that they will have to diagnose based on their understanding of the system(s) affected.

	Core Content		Instructional Actions	
Disciplinary Core Ideas	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
LS1.A: Structure and Function Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which	-Primary Functions of the Skeletal Muscle ● Produce movement, maintain posture/position, support of soft tissues, guard entrances/exits, maintain body temperature -Components ● Muscle tissue, connective tissues, blood vessels, nerves	-Identify major muscles in the body and their functions -Classify and name muscles -Discuss the interdependent nature of the skeletal and muscular systems -Recognize how the structure and organization of muscle tissue allows for movement	<u>Laboratory Investigations:</u> (optional, but not limited to the following) -Chicken Bone Dissection Lab (Muscle connection) -Dissection of Fetal Pig -Muscle Building on "Maniken" -Coloring Pages of Muscles. - Career Report related to the system. <u>Textbook Chapter:</u> Chapter 7 – The Muscular System	<u>Formative Assessments:</u> Class Discussions Worksheets/Drafts with teacher feedback Pre-Assessments Exit tickets Informal polling

carry out most of the work of cells. (HS-LS1-1) Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each	-Features of Muscle Fibers -Communication between Nervous System and Skeletal Muscles -Muscle Tension ● Elongation and Contraction -ATP -Performance ● Fiber type ● Physical Conditioning/Exercise -Cardiac Muscle ● Structure and Function -Smooth Muscle ● Structure and Function -Naming -Axial Muscles ● Head and Neck ● Vertebral Column ● Trunk -Appendicular Muscles ● Shoulders ● Upper Limbs ● Pelvic Girdle ● Lower Limbs -Aging and Muscles -Connection to other body systems	-Explain the physiological process of muscle contraction in skeletal and smooth muscle -Recognize the different neurological pathways which control muscle function -Identify the locations of different types of muscles in the body -Identify the major muscles in the body and the specific movements they control -Recognize how particular muscles work in concert with one another to produce movements -Explain how muscles grow and repair tissue damage -Explain how certain diseases and disorders inhibit muscle function		<u>Summative Assessment:</u> Quizzes Tests Performance Assessments Laboratory Investigations

chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)				
Resources: Essential Materials, Supplementary Materials, Links to Best Practices Martini, Frederic H. and Edwin F. Bartholomew et al, Essentials of Anatomy and Physiology 6th ed, Boston, MA: Pearson 2013			**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings	

UNIT 4: THE CARDIOVASCULAR SYSTEM

Targeted State Standards (NJSLS-S/NGSS): HS-LS1.A, HS -LS1.B

Unit Objectives/Enduring Understandings:

- Describe the significance of the four-chambered heart structure.
- Explain how a heart beat is generated, regulated and changed.
- Understand the structure and roles of vessels in the human body, and explain the circulation pathway for blood.
- Discuss the interdependence of the cardiovascular and respiratory systems.
- Identify factors which put people at risk for cardiovascular disease and related disorders.

Essential Questions:

- How is blood moved through the body?
- What factors affect cardiovascular health?

Optional Unit Assessment:

- See laboratory investigations and tests.
- ***Problem Based Pathology Research***: Students to be presented with an "unknown" pathology that they will have to diagnose based on their understanding of the system(s) affected.

	Core Content		**Instructional Actions**	
Disciplinary Core Ideas	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
LS1.A: Structure and Function Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)	- The anatomy of the heart. - Blood flow through the heart. - The cardiac cycle. - The major blood circulatory routes (systemic and pulmonary). - The anatomy of blood vessels. - Major arteries and veins of the human body.	- Describe the anatomy of the heart, including blood supply and pericardium structure, and trace the flow of blood through the heart, identifying the major blood vessels, chambers, and heart valves. **-** Define cardiac output, describe the factors that influence heart rate and stroke volume, and explain how adjustments in stroke volume and cardiac output	<u>Laboratory Investigations:</u> (optional, but not limited to the following) - HHMI Virtual Cardiology Lab or PBS The Mysterious Human Heart virtual activity. - Heart Dissection Lab - Blood Pressure Activity - CO_2/Heart Cycle Lab - Career Report related to the system. <u>Textbook Chapter:</u> Chapters:	<u>Formative Assessments:</u> Class Discussions Worksheets/Drafts with teacher feedback Pre-Assessments Exit tickets Informal polling

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular		are coordinated at different levels of physical activity. **-** Distinguish among the types of blood vessels based on their structure and function. **-** Describe the control mechanisms that interact to regulate blood flow and pressure in tissues. - Identify and describe the structure and function of arteries, arterioles, capillaries, venules and veins. **-** Identify the major arteries and veins of the pulmonary & systemic circuits. **-** Give examples of interactions between the cardiovascular system and the other organ systems.	12 – The Cardiovascular System: The Heart 13 – The Cardiovascular System: Blood Vessels & Circulation	<u>Summative Assessment:</u> Quizzes Tests Performance Assessments Laboratory Investigations

division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)				
Resources: Essential Materials, Supplementary Materials, Links to Best Practices Martini, Frederic H. and Edwin F. Bartholomew et al, Essentials of Anatomy and Physiology 6th ed, Boston, MA: Pearson 2013			**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings	

UNIT 5: THE RESPIRATORY SYSTEM

Targeted State Standards (NJSLS-S/NGSS): HS-LS1.A, HS -LS1.B

Unit Objectives/Enduring Understandings:

- Understand how the organization of the respiratory organs and tissues relates to their functions.
- Understand the interdependence of the cardiovascular and respiratory systems

Essential Questions:

What are the components of the respiratory system and how do they support proper functioning?
How does air get from outside the body distributed to cells throughout the body? How does this "dead end" path work?
What other body systems are needed to allow the respiratory system to function and how do they assist?

Optional Unit Assessment:

- See laboratory investigations and tests.
- ***Problem Based Pathology Research***: Students to be presented with an "unknown" pathology that they will have to diagnose based on their understanding of the system(s) affected.

	Core Content		**Instructional Actions**	
Disciplinary Core Ideas	**Concepts** *What students will know.*	**Skills** *What students will be able to do.*	**Activities/Strategies** Technology Implementation/ Interdisciplinary Connections	**Assessment Check Points**
LS1.A: Structure and Function Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)	- Respiratory organs and tissues - The path air follows through the respiratory system - Sound production occurs at the vocal cords - Specialized cells and glands help the system work - Ventilation requires pressure changes and muscle movement - Gas exchange requires diffusion	- Describe the primary functions of the respiratory system. - Explain how the respiratory exchange surfaces are protected from debris, pathogens, and other hazards. - Identify the structures that conduct air to the lungs and describe their functions. - Describe the functional anatomy of alveoli, and the superficial anatomy of the lungs.	<u>Laboratory Investigations and Class Activities:</u> (optional, but not limited to the following or equivalent) -Measuring Respiratory Function Activity -Anatomical Diagrams and models -Oral and/or PowerPoint presentations -Career Report related to the system. <u>Textbook Chapter:</u>	<u>Formative Assessments:</u> Class Discussions Worksheets/Drafts with teacher feedback Pre-Assessments Exit tickets Informal polling <u>Summative Assessment:</u>

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation	- Hemoglobin helps to transport oxygen in the blood - The nervous system and respiratory reflexes both work to control respiration rates.	- Describe the physical principles governing the movement of air into the lungs and the actions of the respiratory muscles. - Describe how oxygen and carbon dioxide ender and are transported in the blood. - List the factors that influence the rate of respiration, and describe the reflexes that regulate respiration.	Chapter 15 – The Respiratory System	Quizzes Tests Performance Assessments Laboratory Investigations

produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)				
Resources: Essential Materials, Supplementary Materials, Links to Best Practices Martini, Frederic H. and Edwin F. Bartholomew et al, Essentials of Anatomy and Physiology 6th ed, Boston, MA: Pearson 2013			**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings	