Course Description

A. COVER PAGE

1. SCHOOL/DISTRICT INFORMATION

School: Richmond High School, De Anza High School, Hercules High School, and Pinole Valley High School

District: West Contra Costa Unified School District: City Richmond, CA

School/District Web Site: http://www.wccusd.net

School Course List Contact: Jennifer Bender, Position: Vice Principal, Richmond High School; *(as well as Ryan Kolb, Vice Principal, Pinole Valley High School; and Robert Evans, Principal, De Anza High School) jbender@wccusd.net 510.235.0316*

Teacher Contact: Denise Melis, Science Teacher, Biology, Physiology, Biomedical Science, Richmond High School dmelis@wccusd.net 510.235.0316 also: Steven Thomas, De Anza High School – Biology, Physiology Teacher sthomas@wccusd.net and Dan O'Shea at Pinole Valley High School – Biology, Physiology teacher doshea@wccusd.net

District Course List Contact: Antoinette Henry-Evans

Title/ Position: Senior Director, Curriculum and Instruction

Phone: 510.231.1128 Email address: ahenry-evans@wccusd.net

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2. Course Description: Biomedical Science: Applied Human Anatomy and Physiology

Biomedical Science is the application of human anatomy and physiology to medical use, be it research, health monitoring or treatment. As 21st century medicine and healthcare become increasingly more sophisticated, the demand grows not only for health care professionals, but also for highly skilled biomedical scientists and biomedical technicians capable of performing and analyzing a battery of technical procedures to screen, maintain and improve human health.

The Biomedical Science course is structured to engage students in learning the principles, concepts, and practices of human anatomy and physiology through biomedical applications. Students are involved in problem solving, analytical thinking and conceptual development. Students use knowledge of the human body, medicine, health, and bioscience in investigative labs and projects. Topics include range from case studies related to a particular system of the body to metabolic disorders, biomedical testing, blood typing, identification of infectious microorganism. etc. Students explore anatomical and physiological mechanisms underlying normal human function. Students also investigate homeostatic imbalances that cause disease. In learning about diabetes, for example, students gain an in-depth understanding of the endocrine system, pancreas, metabolism of sugar, and biochemical effects of glucose.

Lab work covers techniques in histology, anatomy and physiology, and related biomedical sciences. Students engage in research, read and write analytical essays, exhibit their work to medical professionals and biomedical scientists, and examine social and political consequences of biomedical science and biomedical technology change.

In addition, students collect and categorize data, produce graphic representations, maintain a biomedical scientist notebook, complete a portfolio, and regularly make oral presentations.

Transcript Title(s) / Abbreviation(s) Biomedical Science (P)

Transcript Course Code(s) / Number(s)

Seeking "Honors" Distinction [ ] Yes [x] No

Subject Area [X] **Laboratory Science – Biological**

Grade Level(s) for which this course is designed [ ] 9 [x] 10 [x] 11 [x] 12

Unit Value [ ] **0.5 (half year or semester equivalent)** [x] **1.0 (one year equivalent)**

3. Previously Approved Courses

Complete outlines are not needed for courses that were previously approved by U.C.
Was this course previously approved? ___Yes X No
If yes, select all that apply.

__A course reinstated after removal within 3 years.
Year removed from list_____
Same course title? ___Yes ____No
If no, previous course title: _____

___An identical course approved at another school in same district?
Which school? _____
Same course title? ____Yes _____No
If no, course title at other school? _____

___Approved International Baccalaureate (IB) course?
___Approved CDE Agricultural Education course?
___Approved P.A.S.S./Cyber High course
___Approved UCCP/UCI course
___Approved ROP/C course. Name of ROP/C Organization: _____
___Approved A.V.I.C. course
___Approved C.A.R.T. course
___Approved Project Lead the Way course
___Approved Expository Reading and Writing courses

Other. Explain: _____

Advanced Placement Course N/A
If Advanced Placement, has it been authorized by the College Board through the AP Audit process? Yes No
If not, please explain why:_____
If in progress, date submitted to AP:_____

Is this course a resubmission? __X_Yes _ No If yes, date(s) of previous submission? September, 2011 *(rejected since it did not list Algebra as a required pre-requisite, but instead listed a college preparatory math course as a recommended co-requisite. This has been corrected. Some other suggested enhancements were also made.)*

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Title of previous submission? Biomedical Science_____
----**Is this an Internet-based course?** ___Yes X No
If yes, who is the provider? PASS/Cyber High Other:_____
Is this course modeled after an UC-approved course from another school outside your district? __Yes _X No (However, courses with very similar titles have been approved)
If so, which school(s)? : *(NOTE: We did review multiple high school and college/university classes related to biomedical science.)*
Is this course classified as a Career Technical Education? (x) Yes __ No
Name of Industry Sector: Health Science and Medical Technology
Name of Career Pathway/s: Primarily Therapeutic and Diagnostic, but with aspects of biotechnology research and development.

4. Catalog Description

Brief Course Description: Biomedical Science is the application of human biology, anatomy and physiology-based science to medical use, including research, laboratory experimentation and testing, health monitoring, and treatment. As 21st century medicine and healthcare become increasingly more sophisticated, the demand grows for highly skilled health care professionals as well as biomedical scientists and biomedical technicians capable of performing and analyzing a battery of technical procedures to screen, maintain and improve human health. Biomedical Science is an applied Anatomy and Physiology course that provides an introduction to essential concepts, principles and practices of biomedicine. The course engages students in learning through applications and emphasizes problem solving, analytical thinking and concept development. Students complete a series of laboratory experiments and projects, as well as in-depth case studies related to human disease and its treatment.

Pre-Requisites: Biology or other laboratory science course (required); Algebra or other (higher-level) college preparatory math required.
Co-Requisites: Enrollment in Health Academy program of study (Health Academy English, Health Academy History; enrollment in a college preparatory mathematics course (Geometry, Advanced Algebra, or higher) (required)

5. Optional Background Information

Context for Course: is offered as one in a sequence of laboratory science courses for students enrolled in a multi-year Health Academy//Health and Bioscience Academy program. Biomedical Science students are also enrolled in Health and Bioscience Academy English, Academy Social Studies, Mathematics, and, typically, an additional Academy science course --- all of which are flavored with the theme of health and medicine. They have already taken college preparatory courses in Biology and Algebra (or higher). Each Health and Bioscience Academy partners with local colleges and universities as well as with health/medicine professionals and scientists who serve as consultants for student projects.

History of Course Development: Health and Bioscience Academy teachers have worked to increase the academic rigor and biomedical-content of the Academy program of study and have involved postsecondary faculty and medical/biomedical professionals in the curriculum redesign work. Teachers also reviewed multiple college preparatory and University-level science courses to inform course enhancement. Biomedical Science has evolved into a challenging laboratory science course with course content and methodologies designed to capture the interest of students, prepare them for success in advanced studies in health and bioscience related majors and fields, and to assure college and career readiness.

6. Texts and Supplemental Instructional Materials

Primary Texts:

The Human Body in Health and Disease, Gary A. Thibodeau and Kevin T. Patton, Mosby Elsevier Publishing, 2010 (5th edition)

Secondary Texts:

The Human Body: An Introduction for the Biomedical and Health Science, Gillian Pocock and Christopher D. Richards, Oxford University Press, 2009

Human Biology: Concepts and Current Issues, Michael D. Johnson, Addison Wesley Longman, Inc., 2001

The Human Body in Health and Disease, Frederic H. Martini, Edwin F. Bartholomew, Kathleen Welch, Edwin Bartholomew, 2007

The Human Body in Health and Illness, Barbara Herlihy, Elsevier, 2011 (4th edition)

Case Studies in Biomedical Research Ethics, Timothy F. Murphy, The MIT Press, 2003.

Students will also read at least one biomedical science related book from a list provided by the teacher. Students can borrow a copy from the classroom library, school library, public library, or purchase a copy from a used bookstore. Sample titles include; The Spirit Catches You and Your Fall Down by Anne Fadiman; Stiff: The Curious Lives of Human Cadavers by Mary Roach; When the Air Hits Your Brain by Frank Vertosick; The Doctor Stories by William Carlos Williams; Gifted Hands by Ben Carson; Bitten: True Medical Stories of Bites and Stings by Pamela Nagami; First, Do No Harm by Lawrence Gold, M.D.; A Nurse's Story by Tilda Shalof; Yellow Death: A True Story of Medical Sleuthing by Suzanne Jumain

Supplemental Instructional Materials:

- Books, chapters articles and reports (both required and recommended readings as well as online articles)
- DVDs/Recordings/Podcasts
- Webinars, other online resources, virtual labs, animations, and simulations .
- Software (e.g., simulators, control, computational, educational software)
- Science Kits
- Laboratory resources
- MIT Open Courseware, etc.
- Biomedical Science/Human Body/Anatomy & Physiology/Medical -related Web sites

COURSE CONTENT

A. Course Purpose: Goals and Objectives

- Students will acquire an enhanced understanding of human biology, anatomy and physiology and their applications in biomedical science and the role of health professionals and biomedical scientists in today's society.
- Students will understand and discuss current and emerging opportunities and challenges in the broad field of health care and biomedical science.
- Students will understand complementary relationships among human biology, anatomy and physiology/biomedical science (and other sciences), mathematics, and technology

- Students will demonstrate ability to do research, to solve problems and think critically by completing challenging group and individual projects
- Students will understand how principles and concepts underlying a scientific problem can lead to design and production of viable solution (scientific method)
- Students will apply tools and technologies employed by health care professionals and biomedical scientists in the completion of laboratory learning experiences.
- Students will develop conceptual knowledge as well as quantitative and analytical skills necessary to solving applied anatomy and physiology/biomedical science problems.
- Students will demonstrate competencies in written and oral presentations of applied anatomy/physiology biomedical science concepts and applications
- Students will design, construct, and present a scientific poster on a current topic in biomedical science
- Students will describe issues associated with the ethical dimensions of applied anatomy and physiology/biomedical research and practice including animal welfare, scientific misconduct, and how science and the public need to interact in considering the broader implications of emerging technologies (e.g., embryonic stem cells and cloning)

Expected Outcomes	Standards
❑ Biological/Life Science Standards: *Physiology*: 9. Students will understand that as a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. a) Students will know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide. B) Students will know how the nervous system mediates communication between different parts of the body and the body's interactions with the environment. c) Students will know how feedback loops in the nervous and endocrine systems regulate conditions in the body. D) Students will know the functions of the nervous system and the role of neurons in transmitting electrochemical impulses. E) Students will know the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response; F) Students will know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts. G) Students will know the homeostatic role of the kidneys in the removal of nitrogenous wastes and the role of the liver in blood detoxification and glucose balance. H) Students will know the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca+2, and ATP. I) Students will know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms. *Physiology*: 10. Students will understand that organisms have a variety of mechanisms to combat disease. A. Students will know the role of skin in providing defenses against infection. B. Students will know the role of antibodies in the body's response to infection. C. Students will know how vaccination protects an individual from infectious diseases. D. Students will know important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections. E. Students will know why an individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign. F. Students know the roles of phagocytes, B-lymphocytes, and T-lymphocytes in	Biological Science Standards: 9.& 10: Physiology – 9a, 9b, 9c, 9d, 9e, 9f, 9g, 9h, 9i, 10a, 10b, 10c, 10d, 10e, 10f 1: Cell Biology: 1.a, 1.b, 1.c, 1.d, 1.e, 1.g, 1.h, 1.i, 1.j 2.3.4.5 – Genetics: 2.a, 2.b, 2.c, 2.d, 2.e, 2f, 2.g, 3.a, 3.b, 4.a, 4.d, 4.e, 5.a, 5.b, 5.c, 5.e

the immune system. *Also included:* Cell Biology: 1: Students will understand basic cell biology and how fundamental life processes depend on a variety of chemical reactions that occur in specialized areas of the organism's cells (especially as this is related to human cells and human bodies.) Genetics: 2: Students will understand how mutation and sexual reproduction lead to genetic variation in a population (meiosis, chromosomes, alleles, DNA sequences, etc.) Genetics: 3: Students will understand how a multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. (genetic crosses, Mendel's laws of segregation and independent assortment, pedigree diagrams, genetic combinations, chromosome maps, etc.) Genetics: 4: Students will understand that genes are a set of instructions encoded in the DNA sequence of each organism that specific the sequence of amino acids in proteins characteristic of that organism. (DNA, RNA, specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves, proteins, amino acid sequences, etc.) Genetics: 5: Students will understand that the genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. (principles of biotechnology/genetic engineering)	
❑ Health Science and Medical Technology Foundation Standards: 1.0 Academics (academic content needed for college and career readiness) 1.2 (1.a) Students know cells function similarly in all living organisms. 1.2 (5.a) Students know plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism. 1.2 (5.b) Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system. (5.c) Students know how bones and muscles work together to provide a structural framework for movement. (5.d) Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy. (5.e) Students know the function of the umbilicus and placenta during pregnancy. (5.g) Students know how to relate the structures of the eye and ear to their functions.	Health Science and Medical Technology Foundation Standards 1.0, 1.2 (1.a), (5.a), (5.b), (5.c),(5.d), (5e), (5g)
❑ Health Science and Medical Technology Foundation Standards: Specific applications of Biology Students know cells are enclosed within semipermeable membranes that regulate their interactions with their surroundings; students know enzymes are proteins that catalyze biochemical reactions altering eh reaction equilibrium and the activities of enzymes depend on temperature, ionic conditions, and the pH of surroundings. * Students know how prokaryotic cells, eukaryotic cells, and viruses differ in complexity and structure. * Students know the flow of information from transcription of RNA in the nucleus to translation of proteins on ribosomes in the cytoplasm. * Students know the role of endoplasmic reticulum and Golgi apparatus in the secretion of proteins.	Biology Standards Health Career Standards
❑ Students will be acquainted with the major fields of biomedical science. Students will examine both historic and modern developments in the fields of health, medicine, and bioscience. Students will understand how advances in bioscience impact human society, and how human society may determine which new bioscience technologies are developed. Students will understand that bio-scientists have a moral obligation to the public. Students will be familiar with the education requirements of careers in health, medicine, and biotechnology.	History/Social Science: 10.0, 10.3, 10.3.5,
❑ Students understand that biomedical science involves solving problems by applying	* Reinforce multiple

knowledge of the human body in health and disease, principles of bioscience (& other sciences), mathematics, & technology. Students demonstrate effective use of biomedical principles & practices in planning & development of biomedical science projects. Students identify underlying concepts & relationships, analyze different perspectives, synthesize existing ideas, create new ideas, & use knowledge & skills to solve problems. Students frequently apply a biomedical scientific inquiry process. Students assume role of biomedical scientists in a variety of laboratory exercises and observations Students use technology as a tool for collection, organization, manipulation, & presentation of data. ❑ Students understand & apply concepts & knowledge in biology, chemistry, anatomy, physiology, mathematics & technology in design and implementation of Biomedical Science projects.	Biology, Health, and Health Careers Standards * Reinforce Geometry Standards: 4.0, 5.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 15.0, 16.0, 20.0, 22.0 * Reinforce Chemistry Standards C1a, b, c, d, e; C2a, b, c, d, e
❑ Students will understand and demonstrate communication skills necessary in the field of biomedical science. They will employ an individual and team approach while completing biomedical science labs and projects or when solving biomedical science problems. They will demonstrate their ability to plan and to analyze their biomedical science projects in written and verbal form and complete a series of reports that include scientific analysis, scientific data, & application of biomedical science standards	* Reinforce Biological science Standards * Reinforce Health Careers Standards * Reinforce Language Arts Standards
❑ Students will understand measuring systems, methods of dimensioning, application of tolerances, & how measuring instruments are used in biomedical science, & related fields by completing a series of science labs and projects as well as computer-generated and hand-drawn graphic representations and models of important body systems and biomedical scientific concepts.	* Reinforce multiple biological science standards. * Reinforce health careers standards. * Reinforce Algebra 1: 5.0, 7.0,,8.0,15.0,16.0,17.0, 24.1, 24.2, 24.3, 25.1 * Reinforce Geometry: 4.0, 5.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 15.0, 16.0, 20.0, 22.0

B. Course Outline.

Unit I: Introduction to Biomedical Science

□ Introduction/Overview of the Course: What is biomedical science?

□ Reviewing What we Already Know:

Models (organisms to systems to cells and molecules)

- The human body (hierarchical organization of the body, homeostasis, terms used in anatomical descriptions, human physiology, self-assessment of knowledge)
- Key Concepts in Chemistry (molecules as specific combinations of atoms; water and solutions; self-assessment of knowledge)
- Chemical Composition of the Body (Body water, major organic constituents of body)
- Scientific Method (Pearson's Animation on the scientific method: http://wps.aw.com/bc_johnson_humanbio_5/100/25619/6558552.cw/index.html)
- Reading Strategies: Getting Most from Science texts: Strategic reading, SQ3R, etc. http://www.mindtools.com/rdstratg.html http://www.isu.edu~kingkath/readstrt.html

□ Overview: Structure and Function of the Body

- Structural Levels of Organization; Anatomical Position; Anatomical Directions; Planes or Body Sections; Body Cavities; Body Regions; Balance of Body Functions; overall Physiology

Several overall learning goals introduced in Unit I:

- Establish professional relationships with practicing health care/biomedical professionals to serve as consultants and mentors
- Understand own interests, motivations & aptitudes
- Commit to lifelong learning
- Develop and demonstrate communication (reading, writing, speaking, listening) skills; critical/analytical thinking skills; and problem-solving skills
- Apply valid scientific methodology to observations and problem solving in biomedical labs.
- Demonstrate facility in using resource materials, technical equipment/instrumentation to determine experimental outcomes.
- Communicate concepts & lab results in clear, logical fashion, both verbally and in writing.
- Demonstrate cooperative planning & problem solving as well as cultural and teaming competencies, while working on individual, small group and large group projects.
- Demonstrate knowledge of the historical role of biomedical science in the development of our modern and future societies..

Interactive Lecture: Teacher PowerPoint explaining various disciplines of Biomedical Science; Review and practice of Cornell note-taking
Self-Assessment of Applications of Anatomy and Physiology/Biomedical Science Knowledge; College and Career Readiness (see Assessment section)
Learning Activity: Biomedical Science Forum featuring health care professionals and other medical and biomedical science professionals from local hospitals, industries and colleges
Blog/Learning Log/Journal Entry: You have worked hard to be able to be successful in high school and to be studying biomedical science. Discuss your hopes, dreams, fears, and expectations for this year. What are your academic goals for this year? What are your college and career readiness goals for the year? What, specifically, will you do to assure you achieve your goals?

Small group learning activity: K-W-L chart (See Assessment Section)

Unit II. Historical and Social Context for Biomedical Science

History of science, with emphasis on medicine, bioscience, and biotechnology and their impact on society * Early & different attempts to understand the natural world. * Science & technology in ancient world, e.g., China, Greece, Egypt, etc. * Pre-scientific & early-scientific revolution (medical practitioners and scientists systematically ask what works & why; work of da Vinci & others.) * Foundations for modern medical science and bioscience * Development of modern medical science and bioscience in the 19th, 20th, & early 21st centuries (Industrial revolution, 2nd industrial revolution, information revolution) * Key figures, discoveries, & inventions in past four centuries. * Major theories that changed humans' view of their place in the world, e.g., Copernican revolution & Darwin's Theory of Evolution. * Social, religious, & economic conditions that supported or inhibited development of science & technology in various countries over the centuries. * Current events & challenges related to biomedical science, bioscience, and biotechnology their impact on society.

Assignment: Student-Researched & Facilitated Presentations (see assignment section)

Interactive Lecture: Teacher PowerPoint presentation on nature of science; benefits of science

(particularly biomedical science and biomedical technology); unintended negative effects * Sources of motivation to understand the natural world and, in particular, the human body * Basis in rational inquiry of observable or hypothesized entities. * Development of theories to guide scientific exploration. * Major changes in scientific knowledge stemming from new discoveries, new evidence, or theories that better account for anomalies or discrepancies. * Need to test theories, elimination of alternative explanations of a phenomenon, & multiple replications of results. * Tentativeness of scientific knowledge *(Theories are the best we know from the available evidence until contradictory evidence is found.)*

Benefits of biomedical science and biomedical technology: * Major advances in medicine and health care in the 19th and 20th century, e.g., communications, transportation. * Continuous progress in personal & public health, increasing longevity. * Key discoveries & inventions & their beneficial uses, e.g., radium & the X-ray.

Unintended negative effects from uses of biomedical science and biomedical technology: * How government, industry, &/or individuals may be responsible for negative effects (discuss examples here in California, the United States, & elsewhere). * Damage to environment, ecosystems, and human health from pesticides, dumping of toxic wastes, & industrial reliance on soft coal for energy. * Some sources of damage or pollution, e.g., human ignorance, overuse or abuse of natural resources * Unanticipated ethical dilemmas, e.g., genetic cloning, contraceptives.

How science and technology address negative effects from uses of science & technology/ biomedical science: * Examples of products & systems that address negative effects * Costs & benefits of government regulations. * How to balance risk-taking & creative entrepreneurial or academic activity with social, personal, & ethical concerns

QUIZ on essential ideas and concepts from Units I and II (includes short essays)

Unit III: Laboratory Procedures, Technology, and Safety //Biomedical Ethical Framework
Students will receive instruction in and participate in hands-on learning activities related to basic laboratory procedures such as preparation of reagents and culture media; preparation and execution of protocols; quality assurance; basic anatomy, physiology, human biology, and biomedical lab techniques and processes; safety; recording and reporting of experimental data; sterility; microbiology; analytical spectrophotometry,; chromatography; and electrophoresis. Students will also review use of a professional microscope, pipetting, and dissection techniques.

Quiz for Mastery on Laboratory Procedures and Technology

Biomedical College and Career Readiness Building: *Medical-Legal Responsibilities, Ethics, and Confidentiality*: (see key assignments

Biomedical Science Career Profile: (see Key Assignments)

Learning Activity: See Building College and Career Knowledge and Skills in Assignment Section
Historical Perspective of Biomedical Imaging: from MRI to fMRI

Learning Activity: Introduction of the Course Portfolio and Portfolio Requirements. Students develop and submit initial portfolio work samples as evidence of growth toward mastery.

Unit IV: The Chemistry of Living Things/The Chemical Constitution of the Body
Topics include:

- Levels of Chemical Organization:
- All matter consists of elements (chemical elements)
  (Atoms are the smallest functional units of an element; isotopes have a different number of neutrons) (structure of atoms, atomic number and mass number, atomic mass)
- Atoms combine to form ions, molecules, and compounds; Chemical Bonding (Energy fuels life's activities, electrons have potential energy, chemical bonds link atoms to form molecules, living organisms contain only certain elements. Health watch topic: free radicals & antioxidants)
- Life depends on water (water is the biological solvent; water helps regulate body temperature; distribution of body water and the distinction between the intracellular and extracellular fluids)
- The importance of hydrogen ions (acids donate hydrogen ions, bases accept them; ph scale expresses hydrogen ion concentration; buffers minimize changes in pH)
- Chemical Reactions (energy transfer in chemical reactions, types of chemical reactions)
- Inorganic Chemistry (water; acids, bases, and salts) Organic Molecules of living organisms (carbon as the common building block of organic molecules; macromolecules are synthesized and broken down within the cell)
- Organic Chemistry (carbohydrates, lipids, proteins, nucleic acids) Carbohydrates; lipids; amino acids and proteins and their functions; structure and functions of nucleotides and nucleic acids
- Organic Compounds *(carbon, carbohydrates, lipids, proteins, nucleic acids)*
- Clinical Connections: Harmful and beneficial effects of radiation; free radicals and effects on health; fatty acids in health and disease; DNA fingerprinting

Learning activities include use of web animations and research; developing models of carbon molecules; building a polymer; and creating an informational poster on carbon chemistry. Students will also complete a concept map of Chapter 2 in Thibodeau and Patton.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 2, pp. 24-34.
Each student completes a concept map of each chapter/unit and responds to select chapter/ unit questions. Each student uses concepts and knowledge from the chapter in class discussions and on work done on unit learning activities, labs, and essays.

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Unit V: The Organization and Basic Functions of Cells, Tissues, and Membranes

□ Introducing Cells
- The cell as the basic unit of life; cell parts and organelles overview; the structure and function of the cellular organelles; cell division; programmed cell death; energy metabolism in cells (including protein synthesis and aspects of biochemistry); cell motility

□ The functions of the plasma membrane
- Permeability of cell membranes to ions and uncharged molecules; active transport; the resting membrane potential; regulation of ion channel activity; secretion, exocytosis and endocytosis

□ Cells and Tissues
- Histological features of the main tissue types; Epidermal Tissue, Connective Tissue, Muscle Tissue, Nervous Tissue, Tissue Repair; cell-cell adhesion; specialized cell attachments

□ Principles of Cell Signaling/Communication within the Cell; Intracellular Communication; Cells use diffusible chemical signals for paracrine, endocrine and synaptic signaling; Chemical signals are detected by specific receptor molecules)

□ Genetics (Cell Life Cycle and Basic Heredity; The Genome (DNA, Genes and chromosomes); Genotype vs. Phenotype; The Genetic Basis of Disease

Learning Activities include:
Reciprocal Reading Activity: Strategies for Reading Science and Medical-related texts
Interactive Lecture: PowerPoint Presentation by Teacher; Guided practice in Cornell Note-taking
Video: Inner Life of a Cell
Lab Activity: Building a specific cell
Cancer Computer activity: http://science.education.nih.gov/supplements/nih1/cancer/default.htm
Lab: DNA Fingerprinting Lab

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 3, pp. 40-69.
Students will complete a variety of learning activities designed to deepen their understanding of the text, including concept maps.
Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 2, pp. 24-34.
Each student completes a concept map of each chapter/unit and responds to select chapter/ unit questions. Each student uses concepts and knowledge from the chapter in class discussions and on work done on unit learning activities, labs, and essays.

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Unit VI: Nerve Cells and Muscle Cells

□ Nerve Cells and Their Connections: Structure of nerve cells; Primary function of a nerve cell is to transmit information coded as a sequence of action potentials; Chemical synapses

□ Muscle Cells: Structure of skeletal muscle; How does a skeletal muscle contract?; Activation and mechanical properties of skeletal muscle; Neuromuscular transmission; Smooth muscle; Pharmacology of smooth muscle; Cardiac muscle

Biomedical College and Career Readiness Knowledge and Skill Building: Medical Terminology Associated with Applied Anatomy and Physiology, Body Systems, Diseases and Medical Conditions, Biomedical Procedures and Processes, etc. (See Key Assignment Section)

TEXT: The Human Body in Health And Disease, pp. 220 – 269
Students will complete concept maps of each chapter/unit and respond to select chapter/unit

questions. Students will use concepts, vocabulary, and knowledge from the text in unit and course assignments, labs, discussions, projects, and essays.

Benchmark Exam on essential Biomedical Concepts and Principles – multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate knowledge and understanding of key biomedical science concepts. Opportunities provided for relearning/retesting.

Unit VII: Organ Systems of the Body: From Cells to Organ Systems

- Overview of Organ Systems (Integumentary, Skeletal, Muscular, Nervous, Endocrine, Cardiovascular, Lymphatic and Immune Systems, Respiratory System, Digestive System, Urinary System, Reproductive Systems
- Integration of Body Organ System Functions)
- Organ Replacement (Artificial Organs, Organ Transplants)

Text: Thibodeau & Patton, The Human Body in Health and Disease, Chapter 4, pp. 78-94
Students will participate in a variety of learning activities related to deepening their understanding of the text. These include individual concept maps of the Chapter.

Benchmark Exam on essential Biomedical Concepts and Principles – multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate knowledge and understanding of key biomedical science concepts. Opportunities provided for relearning/retesting.

Resources: http://web.jjay.cuny.edu/~acarpi/NSC/14-anatomy.htm
Inner Body: Includes anatomy of various human systems (interactive)
http://www.innerbody.com/htm/body.html
Anatomy Arcade has games and animations related to the following body systems: skeletal, articular, muscular, circulatory, respiratory, nervous, digestive, and endocrine. There are also links to recommended youtube videos, including human anatomy lectures.
(http://www.anatomyarcade.com)

Unit VIII: MECHANISMS OF DISEASE

Topics include:

- Studying Disease; Disease Terminology, Patterns of Disease
- Pathophysiology; Mechanisms of Disease, Risk Factors
- Pathogenic Organisms and Particles; Viruses, Prions, Bacteria, Fungi, Protozoa, Pathogenic Animals
- Prevention and Control; Tumors and Cancer; Neoplasm, Causes of Cancer, Pathogenesis of Cancer
- Inflammation; Inflammatory Response, Inflammatory Disease

Learning Activity: M.S. & Gut Bacteria. (see key assignments)

Learning Activities: Gum Disease and Heart Disease from NPR – Talk of the Nation
The Ecology of Your Skin: Bacteria That Live on the Skin.
MedMyst: Medical Mysteries on the Web (see key assignments under Mechanisms of Disease)

Text: Thibodeau & Patton, The Human Body in Health and Disease, Chapter 5, pp. 102-126

Students will participate in a variety of learning activities designed to deepen their understanding of the text. These include a concept map of the chapter.

Benchmark Exam on essential Biomedical Concepts and Principles – multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate knowledge and understanding of key biomedical science concepts. Opportunities provided for relearning/retesting.

Unit IX: Integumentary System and Body Membranes

Topics include:

- Classification of Body Mechanisms
  Epithelial Membrane, Connector Tissue Membrane
- The Skin: Structure of the Skin (Epidermis; Accessory Structures of the Skin/Appendages of the Skin (Anatomy of Hair, Skin Glands, Nails); Function of the Skin
- Disorders of the Skin (Psoriasis, Acne, Sun Damage, etc.) Skin Lesions, burns, skin infections, muscular and inflammatory skin disorders, skin cancer
- Homeostatic Inbalances

Learning Activities from the Sciencenetlinks Skin Deep Project:
SCI: Skin Cancer Investigation http://www.sciencenetlinks.com/skindeep/
The Science Inside Skin (.pdf "book")
The Ecology of Your Skin 1: Bacteria That Live on the Skin
The Ecology of Your Skin 2: The Microbial World is an Olfactory World
The Ecology of Your Skin: The Body Food Connection
Extended Learning: A series of lessons related to Skin Cancer: types, prevention, and detection.
Extended Learning: A lesson/exploration on the factors that control variation in human skin color and the implications
For human society. http://www.sciencenetlinks.com/lessons.php?DocID=459

Health Careers Profile: Class Activity: Skype interview with a Dermatologist.

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 6, pp. 132-152
"You and Your Skin": http://www.sciencenetlinks.com/skindeep/yourskin/yourskin.html
(interactive "text" that describes the function, care, anatomy, and protection of your skin. There is also a Skin Assessment that helps students check for their understanding.
Students will complete concept map of chapter and respond to select questions. Students will use concepts, vocabulary, and knowledge in unit related assignments.

Unit X: The Musculoskeletal System

- Anatomy of the skeleton, including the axial skeleton
- Physiology of bone (structure and functions of bone, histology of bone tissue, blood and nerve supply of bone, bone formation, bone's role in calcium homeostatis, exercise and

bone tissue, aging and bone tissue)
- Skull Anatomy
- Investigation of a Hand http://www.gwc.maricopa.edu/class/bio201/hand/anhand.htm
- Disorders of the skeleton
- Joints (classifications – fibrous, cartilaginous, synovial; types of movement; range of motion; aging; antroplasty)
- Skeletal muscles; Disorders of skeletal muscle

Learning activities include:
- Tutorial on Skull Anatomy (http://www.gwc.maricopa.edu/class/bio201/skull/skulltt.htm
- Muscular System Tutorials: (http://www.gwc.maricopa.edu/class/bio201/muscle/mustut.htm)
- Muscle Lab Contraction exercise http://www.brookscole.com/chemistry_d/templates/student_resources/animations/muscles/muscles.html
- Demonstration: Lactic Acid Build Up
- Demonstration: Bone Anatomy
- Discussion on Osteoporosis
- Lab: Bone Forensics
- Lab: Anatomy and Muscle Histology Microscope Labs
- Exploration: Directions in Science: Helping Bones Heal Faster
- Applications: Diseases and Disorders of the Skeletal System
  - Stabilizing a Joint
  - Treating a Sprained Ankle
  - Sprains – mean damage to ligaments
  - Bursitis and tendinitis are caused by inflammation
  - Arthritis is inflammation of joints
  - *Case Study*: Will Onions Prevent Osteoporosis?
- Extended Learning activity: comparative anatomy of skeletons http://www.eSkeletons.org/
-

Health Careers Research and Poster Presentation on a Disease or Condition of the Skeletal/Bones and/or Muscular Systems: (see key assignments)

Biomedical Career Building: Speaker and Learning Activities related to Cultural Diversity in Health Care (see assignment section)
Health Career Profile: Skype Visit from an Orthopedic Doctor or Specialist

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: The Skeletal System: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 7, pp. 162-205

The Muscular System: Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 8, pp. 206 -233.

http://academic.pgcc.edu/~aimholtz/AandP/AandPLinks/ANPlinks.htm (skeletal views)
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

Unit XI: Nervous System – Organization, Integration and Control

Organization of the Nervous System (cells of the CNS, organization of the brain and spinal cord, structure of peripheral nerve trunks, central ventricles and the cerebrospinal fluid, cerebral circulation)

- Principal parts of the nervous system:
- Central Nervous system (CNS) and peripheral nervous system (PNS);
- Neurons as the communication cells of the nervous system (sensory neurons, interneurons, motor neurons); cell body; dendrites/ axon
- Neuroglial cells, myelin sheath; Neurons as initiators of action potentials
- Transfer of information from a neuron to its target (neurotransmitter)
- PNS relays information between tissues and the CNS (brain and spinal cord)
- The Brain & Cranial Nerves - Brain processes and acts on information; Brain organization, protection, and blood supply; cerebrospinal fluid, brain stem, cerebellum, diencephalon, cerebrum, functional organization of the cerebral cortex, cranial nerves
- Memory involves storing and retrieving information
- Psychoactive drugs effect higher brain functions
- Some Aspects of Higher Nervous Function
- Disorders of the nervous system (head trauma,/brain injuries, spinal cord injury, rabies, Alzheimer's)

Activity: Improving Your Memory
Health Watch Scenario: Cocaine
Health Watch Scenario: Cell Phones and Brain Tumors: Is there a Connection?
Applying What You Know: ** Why do you suppose treatment for rabies must be begun even before symptoms have appeared in order for the treatment to be successful? * Explain in terms of brain anatomy & functions, how it would be possible for a person to remember whole events in the distant past and not be able to recall what they had for breakfast. * What do you suppose would happen to a person's behavior and emotional expression if the neural connections between the limbic system and the cerebral cortex were severed?*

Case Study: Evidence That the Human Brain May Regenerate (in class handout) *Queries: How do these findings affect the hypotheses that the adult human brain does not produce new nerve cells? Which do you think would be most affected by the ease of the hippocampi, short-term memory or long term memory? Explain.*

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

TEXT: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 9, pp. 234-279
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XII: Physiology of Motor Systems//Sensory and Integrative Systems

- Hierarchical nature of motor control systems;
- Organization of the spinal cord; reflex action and reflex arcs;
- Role of the muscle spindle in voluntary motor activity;
- Effects of damage to the spinal cord;
- Descending pathways involved in motor control; Goal-directed movements;
- Role of the cerebellum in motor control; Roles of the Basal ganglia; Dendrites
- Modalities of Movement by the Cerebellum
- Sensory and Integrative Systems
  - Sensory modalities, process of sensation (tactile (touch/pressure/vibration/itch/tickle), thermal, pain, proprioceptive (muscle spindle, tendon organs, joint kinesthetic receptor)
  - Integrative Features of the Cerebrum (wakefulness and sleep, learning and memory)
- Clinical connections: phantom limb sensation; analgesia: relief from pain, paralysis, disorders of the basal ganglia, amnesia, etc.

Text: Thibodeau and Patton, *Human Body in Health and Disease,* pp. 196-201
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs. Benchmark Quiz on essential Concepts

UNIT XIII: Autonomic Nervous System

- Organization of the autonomic nervous system,
- Comparison of sumatic and autonomic nervous system'
- Anatomy and physiology of autonomic motor pathways
- Chemical transmission in the autonomic nervous system
- Integration and Control of Autonomic Functions
- Homeostasis and the Nervous System: Disorders: Homeostasis Inbalance

Learning Activities include:

- Central nervous control of autonomic activity
- Demonstration: Rope Neuron Demonstration
- Understanding Brain Functions Activity
- Lab: Sheep Brain Dissection (see Lab Activities)
- Learning Activity: Build a Brain Activity

Text: Thibodeau and Patton, Human Body in Health and Disease pp. 214-222
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs. Benchmark quiz on essential chapter concepts

Resources: On line Nervous Tissues lab: students identify a "typical" multipolar neuron; microscopic sections of ganglia and are able to distinguish between craniospinal ganglia and autonomic ganglia; supporting cells of nervous tissue; different regions of the spinal cord; microscopic sections of peripheral nerves; the axon, myelin sheath, and Schwasnn cells; choroid plexus; various layers and components of the cerebellum.

http://education.vetmed.vt.edu/Curriculum/VM8054/Lab9/lab9.htm
Review and Master elements of the Nervous System using
http://www.innerbody.com/image/nervov.html

UNIT XIV: Sensory Mechanisms/The Senses

Topics include:

- Receptors receive and convert stimuli
- Somatic sensations arise from receptors located throughout the body
- Taste and smell depend on chemoreceptors
  Olfaction: Sense of Smell (anatomy and physiology of olfaction, odor thresholds and adaption, olfactory pathway)
  Gustation: Sense of Taste (anatomy of taste buds and papillac, physiology of gustation, taste thresholds and adaptation, gustation pathway)
- Hearing: Mechanoreceptors detect sound waves; Hearing & Equilibrium: inner ear's essential role in balance, physiology of equilibrium; Anatomy of Ear: external (outer) ear, middle ear, internal (inner) ear (nature of sound waves, physiology of hearing, auditory pathway)
- Vision: Detecting and Interpreting Visual Stimuli; Accessory Structures of the Eye (eyelids, eyelashes, eyebrows, extrinsic eye muscles, etc.); Anatomy of an Eyeball; Image Formation, Convergence, Physiology of Vision, the Visual Pathway
- Disorders of sensory mechanisms
  Disorders of the eyes: Retinal detachment: Retina Separates from choroid; Glaucoma: Pressure inside the eye rises; Cataracts: The lens become opaque; Color blindness: inability to distinguish the full range of colors
  Disorders of the ears: Otitis media: Inflammation of the middle ear; Meniere's syndrome inner ear condition impairs hearing and balance

Applying Knowledge: ** What might be the benefit of slowly adapting or nonadapting taste receptors for bitterness? * With her/his eyes closed, would an astronaut in outer space be able to detect lateral movement of the head (would the semicircular canals be functioning normally? Explain? * Why do you suppose that you are not normally aware of the blind spot in each eye? * What would be a possible explanation for why dogs are completely colorblind (they only see black and white)?*

Medical Scenario: Humans Respond to Silent Olfactory Sensory Signals
Queries: What might be the ultimate purpose, or evolutionary advantage, of olfactory sexual cues? If you could do research in this area, what would you like to do? What specific question would you choose to address?

- Cow Eye Dissection (see Lab Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

TEXT: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 10, pp. 280-307
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XV: Endocrine System

Key Concepts/topics include:

- The endocrine system regulates body functions with hormones
- Hormones are classified as steroid or non-steroid
- The hypothalamus and the pituitary gland
- Pancreas secretes glucagon, insulin, and somatostactin
- Adrenal glands comprise the cortex and medulla
- Thyroid and parathyroid glands
- Testes and ovaries produce sex hormones
- Other glands and organs also secrete hormones
- Other chemical messengers
- Medical disorders of the endocrine system:
  Hypothyroidlism: Underactive thyroid gland

Learning Activities include:

- Tutorial on the Thyroid Gland
  http://www.gwc.maricopa.edu/class/bio202/thyro/thyroid.htm
- Video: George's Diet
- PowerPoint: An Overview of Diets (from a student perspective)
- Case History: See Key Assignments

Building Biomedical College and Career Knowledge and Skills: (See Key Assignments)

Benchmark Exam on essential multiple choice & short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There are opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 11, pp. 308-331. Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

http://www.io.og/~thyroid/English/Guides.html thyroid conditions

UNIT XVI: The Heart and Circulation

General Characteristics of the Heart:

- Coverings of the Heart – Heart Wall, Epicardium, Myocardium
- Heart Chambers: left and right Atria, Ventricles
- Heart Valves: Atrioventricular (AV) Values, Semilunar (SL) Valves
- Blood Flow Through the Heart; Supply of Blood to the Heart

Heart Physiology

- Cardiac Cycle; Heart Sounds; Heart Conduction System
- Electrocardiogram (ECG); Cardiac Output; Regulation of Heart Activity

Learning Activities:

- Sheep Heart Dissection (see Lab Assignments)
- Heart Anatomy Self-Test Interior View

http://www.gwc.maricopa.edu/class/bio202/cyberheart/hartinit_.htm

- Heart Anatomy Self-Test Posterior View
  http://www.gwc.maricopa.edu/class/bio202/cyberheart/hartbak.htm
- Sheep Heart Dissection http://bio.rutgers.edu/~gb102/lab_10/1004am-sheep.html
  Anterior View of Sheep Heart
  http://www.gwc.maricopa.edu/class/bio202/cyberheart/anthrt.htm
- Heart Activity Explorations on the Web
- The Electrocardiogram

Other Web Resources:
American Heart Association http://www.heart.org/HEARTORG/
NOVA Online – Companion Website for the "Cut to the Heart" NOVA television program includes resources on Pioneers of Heart Surgery, Treating a Sick Heart, Troubled Hearts (diseased hearts), Map of the Human Heart (Hot Science)
http://www.pbs.org/wgbh/nova/heart
The Heart: An Online Exploration
Animation of Route of Blood in Heart, in conjunction with Wiggers Diagram
http://library.med.utah.edu/kw/pharm/hyper_heart1.html
Virtual Heart – Interactive site with basic heart tutorials
http://thevirtualheart.org/anatomyindex.html

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 13, pp. 372-387
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XVII: Circulation and the Properties of Blood

- Circulation; Properties of Blood;
- Components and functions of blood (transportation, regulation, defense; plasma, red cells, white cells, platelets; plasma proteins, albumins, globulins, clotting proteins; red blood cells (RBCs), erythrocytes, hemoglobin; hematocrit; stem cells; RBCs (erythrocytes), macrophages, phagocytosis; erythropoietin; WBCs (Leukocytes, granular leukocytes, agranular leukocytes); neutrophils, eosinophils, basophils
- Hemostasis: stopping blood loss (vascular spasm; formation of platelet plug;
- Blood types determine blood compatibility (antigen, antibody, ABO blood typing; Rh blood typing; Rh Factor and pregnancy)
- Blood disorders (Carbon monoxide poisoning; anemia: reduction in blood's oxygen-carrying capacity (iron-deficiency (iron-deficiency anemia; aplastic anemia; hemorrhagic anemia; pernicious anemia; sickle cell anemia

Applying Knowledge Key Learning Activities (see Key Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Blood: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 12, pp. 340-371
Text: Circulation: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 14, pp. 394-419 Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XVIII: Lymphatic System and Immunity: Defense against Infection, Information, and Immunity

- The Lymphatic System: *Lymph and Lymphaic Vessels, Lymphedema, Lymph Nodes, Lymphoma, Thymus, Tonsils, Spleen*
- The Immune System: Immunity – body's ability to resist disease;
  Natural immunity – at birth, inherited and permanent (unbroken skin, mucus and tears, blood phagocytes, local inflammation
  Acquired immunity – body's reaction to invaders
  a. Passive acquired immunity – from injecting antibodies, only lasts a few weeks
  b. Active acquired immunity – lasts longer
     i. Natural acquired immunity – result of recovering from disease, body manufactures own antibodies and person doesn't get the disease again
     ii. Artificial acquired immunity – from being vaccinated
  Immunization – antigen injected into a person to stimulate production of antibodies
  Function of the Immune System, Nonspecific Immunity, Specific Immunity
- Immune System Molecules: *Antibodies, Compliment Proteins*
- Immune System Cells: *Phagocytes, Lymphocytes*
- Hypersensitivity of the Immune System: *Allergy, Autoimmunity, Isoimmunity*

Learning Objectives: Students will be able to describe the structure of the lymphatic system, analyze the function of the lymphatic system, analyze the characteristics and treatment of common lymphatic disorders, and apply standard medical precautions.
Learning Activities include:

- Immunology Tutorial http://www.biology.arizona.edu/immunology/immunology.html
- Common Cold activity (from Science Kit)
- *Outbreak*! And/or *Contagion* Clip and Discussion
- Lymphatic System Chart – explain structure and analyze function of lymph, lymph vessels, lymph nodes, tonsils, spleen, and thymus
  See also Key Assignments

Biomedical Career Profile: (see Key Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 15, pp. 420-451
National HOSA Handbook: Section B http://www.hosa.org Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XVIX: Respiration/ Respiratory System

Topics include:

- Structural Plan; Respiratory Tracts; Respiratory Mucosa
- Nose
- Pharynx; Larynx
- Disorders of the Upper Respiratory Tract (upper respiratory infection, anatomical disorders)
- Trachea; Bronchi, Bronchioles, and Alveoli (respiratory distress); Lungs and Pleura
- Respiration (mechanics of breathing, exchange of gases in lungs and in tissues)
- Blood Transportation of Gases (Transport of oxygen and carbon dioxide; volumes of air exchanged in pulmonary ventilation
- Regulation of Respiration (cerebral cortex, receptors influencing respiration)
- Breathing Patterns
- Disorders of the Lower Respiratory Tract (lower respiratory infection, restricted pulmonary disorders, obstructive pulmonary disorders, lung cancer)

Learning Activities: Respiratory Case Study (see key assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 16, pp. 452-485
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XX: Digestive System

Topics include:

- Alimentary canal
- Mouth; Teeth; Disorders of the Mouth and Teeth; Salivary Glands;
- Pharynx; Wall of the Digestive Tract; Esophagus
- Stomach (Disorders of the Stomach)
- Small Intestine (Disorders of the Small Intestine)
- Liver & Gallbladder (Disorders of the Liver and Gallbladder)
- Pancreas; Colon (large intestine); Appendix and Appendicitis; Peritoneum
- Rectum, Peretonitis, Anus
- Digestion (Enzymes & Chemical Digestion; Carbohydrate Digestion; Protein Digestion, Fat Digestion)
- Absorption

- Nutrition and Metabolism (metabolic functions of the liver, nutrient metabolism, vitamins and minerals, metabolic rates, metabolic and eating disorders, body temperature (normal and abnormal))

Learning Activities

- Peristalsis Demonstration, multiple labs, on-line simulations, etc. (See Digestive Learning Activities in Key Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Digestion: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 17, pp. 486-523; Nutrition and Metabolism: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 18 pp. 524-541 Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XXI: Urinary System/Excretory System - Kidney and Urinary Tract

- Kidneys (anatomy and histology of the kidneys, including histology of the nephron)
- Formation of Urine (production of dilute and concentrated urine
- Urine transportation, storage, and elimination; waste management in other body systems
- Ureters; Urinary Bladder; Urethra
- Micturition
- Renal and Urinary Disorders (overview of rental physiology and glomerular filtration) Obstructive Disorders, Urinary Tract Infections, Glomerular Disorders, Kidney Failure Homeostasis and the urinary system

Learning Activities include:

- HIV Patient Role Playing Activity
- Video: Ben's Hens
- Lab: Simulated Urinalysis activity
- Health Disease Pamphlet Assignment

Applications of Knowledge (See Key Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.
Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 19, pp. 542 – 567
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

Unit XXII: Homeostasis

Topics include:

- Defining Homeostasis; Understanding its important role in human wellness

- Homeostasis-gas exchange. The heart and lungs
- Homeostasis-fluid volumes and blood pressure. Blood vessels and blood
- Homeostatis-fluids, electrolyte and acid/base; kidneys and renal physiology
    - Fluid and Electrolyte Balance (Body Fluids/Compartments; Mechanisms that maintain fluid balance (regulation of fluid intake, importance of electrolytes in body fluids; capillary blood pressure and blood proteins); fluid inbalances; electrolyte inbalances
    - Ph of Body Fluids; Mechanisms that control pH of Body fluids; pH inbalances
- Accessing and metabolizing energy: Digestive Physiology (see also unit on Digestive system)
  Nutrition and Metabolism (Metabolic functions of the Liver; Nutrient Metabolism; Vitamins and Minerals; Metabolic Rates; Metabolic and Eating Disorders; Body Temperature)
- Homeostatis: Energy balance. Blood Glucose and energy utilization.

Learning Activity: Homeostatis in Systems: *(See Key Assignments); Homeostatis Labs*

Extended Learning: * Students research a negative feedback mechanism that a nonhuman organism may use to maintain a relatively stable internal environment. (See Key Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapter 20-21 pp. 568-601
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

Unit XXIII: Reproduction and Inheritance; Growth and Development; Genetics & Genetic Diseases

□ Physiology of Reproduction
- Common Structural and Functional Characteristics
- Male Reproduction System; Disorders of the Male Reproductive System
- Female Reproductive System; Disorders of the Female Reproductive System
- Sexually Transmitted Diseases
- Effects of Aging

□ Sexual Reproduction: Fertilization and Pregnancy
□ Genetic Basis of Inheritance
- Chromosomes and Genes; Gene Expression (hereditary traits, sex-lined traits, genetic mutations)

□ Genetic Diseases: Mechanisms of Genetic Disease, Single-Gene Disorder, Chromosomal Disorder
□ Prevention & Treatment of Genetic Disease: Genetic Counseling, Pedigree, Treating Genetic Disease
□ Growth and Development

- Prenatal Period (fertilization to implantation; periods of development)
- Birth or Parturition; Disorders of Pregnancy
- Postnatal Period (Infancy, Childhood, Adolescence, Adulthood)
- Effects of Aging

□ Genetics & Genetic Diseases: Genetics and Human Disease; Chromosomes and Genes; Gene Expression; Genetic Diseases; Prevention and Treatment of Genetic Diseases

Learning Activities include:

- Labs related to Genetics, DNA extraction, DNA analysis (See Lab Assignments)
- Journal/log/blog Topics: If you could select the traits of your future children by manipulation of their chromosomes/genes would you? Why or why not? If you did, would that be fair to the child? * Genetic screening is used to identify genes causing diseases in humans. While the presence of these genes may increase the risk for a number of diseases, they don't provide absolute certainly that one will contact the disease. If your family had a history of a genetic disease would you tested? Why or why not? What factors would weigh in your decision?
- Teacher Interactive Presentation of key concepts
- Speaker (or Skype Expert-Visit) on Genetic Counseling as a Career
- Assignment and Classroom Presentation: Genetics Debate
- Visit to Tech Museum in San Jose, including *Genetics: Technology With a Twist* exhibit. Students explore new advances in the field of genetics. Students play role of genetic counselor, scientist, or policymaker. Students "virtually" insert DNA into bacteria to learn how medicines like insulin are made. Students listen as patients struggle with decisions about new genetic treatments. Students join the discussion on ethical issues surrounding the new genetic technologies. (or other appropriate science museum/exhibit)
- Film: *Lorenzo's Oil*
- Case Study (see Key Assignments)

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Thibodeau & Patton, *The Human Body in Health and Disease*, Chapters 22-24, pp. 602-678
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XXIV: Integrative Aspects of Physiology and Pharmacology *(extended learning unit)*

□ Nutritional Needs of the Body
□ Energy balance and exercise
□ Regulation of Body Temperature
□ Body Fluid and acid-base balance
□ Uptake, distribution, and elimination of drugs

Extended Learning Activity: Acidosis/Alkalosis Tutorial
http://www.biology.arizona.edu/biochemistry/problem_sets/medph/medph.html

Research & Essay: (See Key Assignments)

Biomedical Career Profile: (See Key Assignments)
Text: Pocock & Richards, *The Human Body: An Introduction for the Biomedical and Health Sciences*, Chapters 31-35 Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XXV: A Special Exploratory and Action Unit: A Biomedical Science Approach to Diabetes
FACT: "If you have diabetes there are many systems of the body affected: digestive, circulatory, urinary, endocrine, sensory, nervous, etc.

FACT: African Americans and Hispanics are more likely than whites and Asians to be diagnosed with diabetes. (NOTE: Filipinos and Native Hawaiians also have higher incidents of diabetes.) 9.8% of Whites, 14.7% of Blacks, 10.4% of Hispanic/Latino; 16.55 American Indians and Alaska Natives (NOTE: 29.3% among American Indian adults in southern Arizona)

FACT: According to the Center for Disease Control, 1 in 3 children born in 2000 will develop diabetes in their lifetime.

Learning Activities: See Key Assignments (Diabetes Learning Activities)

Resources: American Diabetes Association http://www.diabetes.org
Diabetes Curriculum (one among many sources):
http://www.southcentraltxahec.org/html/diabetes/DiabetesCurriculum.pdf
(teaching about preventing Type II Diabetes)
Centers for Disease Control (CDC) Science Ambassador Lesson Plans: Diabetes: A national Epidemic
http://www.cdc.gov/excite/ScienceAmbassador/ambassador_pgm/lessonplans/Diabestes%20National%20epidemic.pdf
http://www.cdc.ogv/diabetes/faq/basics.htm
http://www.nim.nih.gov/medlineplus/tutorials/diabetesintroduction/htm/index.htm
http://www.howstuffworks.com/diabetes.htm
http://www.kent.k12.wa.us/staff/Linda.Jancola/6Trait/what.htm (6-Trait writing rubric to support effective writing)
http://www.cdc.gov/diabetes/ndep OR www.ndep.nih.gov (National Diabetes Education Program)
Diabetes Animation www.nhhe.com/biosci/genbio/animation_quizzes/graphics/mm5s8c.ram

UNIT XXVI: Introduction to Microbiology (*plus* A taste of future learning: preparing for Advanced Biomedical Science) *(extended learning unit)*

- What is Microbiology, History of Microbiology, Microbiology as a Career
- Microbiology in the context of answering the question: What is Disease? (disease causing organisms, pathogens, spread of infection, portals of entry and exit)
- Basic Groups of Microbes (bacteria, fungi, protozoa, microscopic algae, viruses, various parasitic worms)
- Cellular Organization: Prokaryolic and Eukaryotic Cells

- Classification: The Three Domain Systems
- The Prokaryotic Cell: Bacteria
  - Sizes, Shapes, and Arrangements of Bacteria
  - Cell Structure of the Domain Bacteria: An Overview (cytoplasmic membrane, peptidogiycan cell wall, gram-positive cell wall, gram-negative cell wall, acid-fast cell wall)
  - Structures within the Cytoplasm
  - Structures outside the cell wall
- Horizontal Gene Transfer
- Introduction to Microbiology Techniques
  - Microscope Investigation and Comparison of the Sizes and Shapes of Different Bacteria
  - Lab: Aseptic Technique and Transfer of Microorganisms
  - Lab: Obtaining Pure Cultures from a Mixed Population

Additional learning activity: Microbiologists as Guest Speaker or Skype Speaker

Benchmark Exam on essential multiple choice and short essay questions. Students must achieve at 90% or above mastery on essential course benchmarks. Students must demonstrate mastery of essential standards, including demonstrating knowledge and understanding of key science concepts and applications. NOTE: There will be opportunities for relearning and retesting.

Text: Herlihy, *The Human Body in Health and Illness*, Chapter 5, pp. 64 -75
Students will complete a concept map of each chapter, respond to select questions related to each chapter, and use concepts and information from the text in learning activities, essays, and labs.

UNIT XXVII: Biowork: Careers in Biomedical Science; Building your College and Career Portfolio

- Careers in biomedical science,
- Careers related to Lab techniques and safety
- Careers related to Quality
- Careers related to Measuring process variables
- Careers related to Transforming matter (biochemistry)
- Careers related to Sterile processes (microbiology)
- Careers related to Growing living cells (cell biology)
- Preparing a professional resume
- Practicing Interview Skills
- Gaining biomedical experience

Biomedical Science Career Search: See Key Assignments (College and Career Building)

Biomedical Science College and Career Knowledge and Skill Building:
MOCK INTERVIEWS: (See Key Assignments)
Learning activity: Work on Biomedical Science Portfolio

Unit XXVIII: The Future of Biomedical Science

◊ BIOMEDICAL SCIENCE FORUM: Panel of Speakers on Emerging Trends in Biomedical Science; Students prepare interview questions, take notes, write reflective blog/journal entry on ideas shared by speakers.

ESSAY ASSIGNMENT: (see key assignments)

BIOMEDICAL SCIENCE POSTER ASSIGNMENT: (See key assignments)

Work to Finalize Student Portfolio (including samples of exemplary lab/project reports, one or more research papers, one or more essays, artifacts from or pictures of student projects with summary pieces that describe standards met; one or more entries from the bioscience notebook/learning log/blog; other evidence of Biomedical Science learning/accomplishments. Students might also include a resume, letters of recommendation, etc.)

- Review for Final Exam and preparation for Biomedical Science Student Portfolio Presentations

FINAL EXAM AND PORTFOLIO EXHIBITION:

Final Exam: Exam includes key concepts from all units, with greater emphasis on second semester units; Includes multiple choice, short answer, and essay questions.

Public Exhibition of Student Work * Determining Exhibition criteria and options * Designing and Implementing a Public Exhibition of Student Biomedical Science work

Students analyze own work & determine what pieces best represent their growth & accomplishments. Students create a portfolio (DVD, Web site or other media). Students defend & explain choices. Students work with faculty & Biomedical Science professionals to determine criteria, exhibition & judging.

C. Key Biomedical Laboratory Activities. *(Note: In addition to the following, there are several lab investigations/demos embedded in larger key assignment units/ projects and/or used to deepen understanding of important concepts. Some Key Laboratory Learning Activities are also embedded in the Course Outline.)*

HUMAN BIOLOGY CELL LAB: Students will view both plant & animal cells, complete accurate drawings of each, & identify, label, & describe centrioles, lysosomes, chloroplasts, mitochondrion, Endoplasmic reticulum (ER), Smooth E.R., cell membrane, nucleus, gogli body, etc.

CELL AND TISSUE LAB: Students will examine red blood cells, bone cells, connective tissue cells. Students will view red blood cells. Using both a lab microscope (400 X) & an electronic microscope (3000X). Students will complete laboratory drawings of microscope slides viewed. Students will view and draw slides of cheek cells, muscle cells, and nerve cells. Students will also view 3 types of muscle cells – skeletal, smooth, and cardiac – as well as blood, cartilage, and bone tissue. Students will be able to distinguish between various types of body cells & body tissue.

BASIC CHEMISTRY OF LIFE/BIOCHEMISTRY LABS:

HOW MANY MOLECULES OF CARBON ARE POSSIBLE? Carbon is synonymous with life. Its central role is due to the fact that it has four bonding sites that allow for the building of long,

complex chains of molecules. Moreover, carbon bonds can be formed and broken with a modest amount of energy, allowing for the dynamic organic chemistry that goes on in our cells. Using molecular model kits, students will construct models of different assigned carbon molecules. They will also draw each model and label the drawings. In the course of completing the lab, they will make predictions and be able to explain the difference between branched chains and straight chains. Students will also complete a similar carbon molecule building exercise in the Academy's computer lab. *POLYMER ACTIVITY*: Working in pairs, students will create a polymer and complete a series of experiments related to the polymer. *BIOCHEMISTRY POSTER:* Students will create an informational poster that describes the unique properties of one important biochemical element and its role in the human body. Posters will include: number and mass; family in the periodic table; general properties (states of matter, appearance, forms); role in the human body, etc. (more detailed instructions in class). These might include: oxygen, hydrogen, carbon, nitrogen, calcium, phosphorus, potassium, sulfur, sodium, chlorine, magnesium, iron, fluorine, zinc, copper, iodine, selenium, chromium, manganese, molybdenum, cobalt	symbol, atomi
HEMATOLOGY: BLOOD AND BLOODTYPING LAB Red blood cells carry proteins on the erythrocyte (red blood cell or RBC) surface; this lab exercise focuses on proteins B, & D (Rhesus), which can function as antigens (agglutinogens P). Each student will follow laboratory procedures to determine their ABO blood type and whether or not they are Rh positive or Rh negative. Students will also respond to the following questions: * What antigens are present on a person's red blood cells if that person is (a) type B+, (b) type O-, & (c) type AB+. * Explain the danger of giving a person with type B a blood transfusion with type A blood. * In a paternity suit, a woman (type O) accuses a man (type A) of being the father of her baby (type O). Will the blood types prove or disprove her claim? Explain. Part II: Hemoglobin Estimation Using the Tallquist Method: A mature erythrocyte is mainly a package of the molecule hemoglobin. This molecule gives the erythrocyte its oxygen-carrying power. If the concentration of hemoglobin in grams (g) per 100 milliliters (ml) is normal, the blood should have normal oxygen-carrying ability. Male values usually range from 13-18 g/100 ml, whereas female values normally are 12-16 g/100 ml. A departure from these norms, such as a deficiency, indicates that the oxygen-carrying capability is not normal. The amount of hemoglobin present in red blood cells is a good indicator of oxygen-carrying capacity of the blood. A simple method of measuring the amount of hemoglobin in blood is to compare a small piece of Tallquist paper that has been saturated with a sample of blood w. a Tallquist color chart. Part III: Hematocrit: Blood looks like a homogeneous red fluid. Closer analysis, however, reveals that blood is composed of two basic parts: 1) formed elements (cells) & 2) plasma. Cells are the fraction, consisting of three major types: erythrocytes (red blood cells), leukocytes (white blood cells), & thrombocytes (platelets). Plasma generally constitutes a little more than half an adult human's 4-6 liters of blood. This fraction is 90% to 92% water, with various solutes dissolved or suspended within it. The percentage of erythrocytes found in a set volume of blood is known as the hematocrit or packed cell column (PVC). The adult male hematocrit normally averages 45%, with ranges from 42% to 52%. Adult female hematocrit normally averages 42% & ranges from 37% to 48%. A low reading indicates possible anemia. Slightly higher levels may indicate a healthy adaptation. In this lab exercise, each student follows lab procedures to calculate the hematocrit	denser

of a sample of blood. Questions include: * Were your hemoglobin & hematocrit readings within normal limits? If not, give at least one reason why your hemoglobin &/or hematocrit levels deviate from the normal range. * Give at least three reasons why normal hemoglobin & hematocrit values differ between males and females. See also Animated Blood Typing at http://waynesword.palomar.edu/aniblood.htm to explore Rh Blood Factor Explanation, Determining ABO Blood Type, Blood Agglutination by Antibodies, ABO Donor-Recipient Compatibility	
LAB INIVESTIGATION: BLOOD LABORATORY After studying chapters in the text dealing with various constituents of blood, their functional characteristics, & regulatory factors that determine their numbers of concentrations, students will use the McGill Physiology Virtual Lab to conduct a series of simulated & hands-on blood tests involving the use of blood kits, pipettes, centrifuge tubes, centrifuges, spectrophotometers, micro-centrifuge tubes/Eppendorf tubes, and hemocytometers. These include measurement of erythrocyte (RBC) fragility; Erythrocyte sedimentation rate (ESR); hemostatic tests; & blood cell indices. Students will learn more about the use of various kinds of equipment, techniques, and procedures as well as grids to test and count blood cells/ as well as other blood testing techniques. http://medicine.mcgill.ca/physio/viab/bloodlab/viabmenublood.htm	
NERVOUS SYSTEM LAB The human nervous system is composed of the brain & spinal cord (Central Nervous System, CNS) & erves which branch out from the CNS, Peripheral Nervous System (PNS). Sensory Neurons of the PNS carry information to the CNS. Signals from the brain are carried to motor neurons (PNS), which carry out responses by muscles. In this lab, students will compare the rate at which sensory neurons, working through the brain, can elicit responses via motor neurons. Students will also map the density of sensory neurons on the skin. http://www.sciencegeek.net/Biology/biopdfs/Lab_NervousSystem.pdf	
NERVOUS SYSTEM LAB: Students begin by taking a Tour of the Brain at http://www.alz.org/alzheimers_disease_4719.asp & complete a note taking exercise related to the tour. Students then complete a series of laboratory learning activities related to the Brain and nerves: Stations include: Neuroanatomy & Function Activities (Cerebellum: function = balance and coordination); lab activities: Knee flexion; hip extension; Parietal Lobe (part of the cerebral cortex) (Function=Sensory process=touch); lab activity: cutaneous (skin) Sensations * Temporal Lobe (part of the cerebral cortex) (function=auditory perception and speech) Activity: tongue twisters Which tongue twister is most difficult? Why? * Occipital Lobe (Function=Vision) lab activities: Depth Perception: Why do you need two eyes?; How does closing one eye affect the ability to judge distances? * Frontal Lobe (Function = Decision making, problem solving, and planning) If you were asked to design a test to stimulate the frontal lobe, what would you do? • Brain Stem: (Function = vital center) (respiration, regulation of heart rhythms) Why didn't we test this in the lab? Testing your Cranial: Olfactory Nerve (identification of samples); Optic Nerve (optical illusions) Oculomotor Nerve, Trochlear Nerve, Abducens Nerve (following finger with eye); Trigeminal Nerve; Facial Nerve; Vestibulococlear Nerve; Glossopharyngeal Nerve & Vagus Nerve; Spinal Accessory Nerve; Hypoglossal Nerve	

Alternate Nervous System Lab: Special Senses: Includes investigations into the behavior of the human Nervous system and the special senses. Activities involve: working with a partner to map touch receptors; vision: Using eye charts to test vision; test the age of your eyes; find your blind spot; observe the Shimmering (or seeming to move) image; find the hole in your hand; circles or ovals; reading a (misspelled) message. http://schoonerchantal.com/bio10abnervous.pdf	
LAB on BODY MEASUREMENT: Working with a partner, each student will use a meter stick or measuring tape to measure the length of his/her right foot (heel to the end of the longest toe) in centimeters, to the nearest 0.1 cm. • Using a meter stick or measuring tape, each student measures her/his height in centimeters. The easiest way to do this is for a student to stand with heels & back against a wall & have her/his partner use a pencil to mark the height on the designated chart paper on the designated wall & then use the meter stick or measuring tape to determine the height by measuring the distance from the floor • Each student uses an accurate scale to determine her/his weight. Report your weight in kilograms. (If, for example, you weight 154 pounds, you would divide 154 by 2.2 to get 70 kg.) • Each student measures her/his resting pulse. (To do this, a student might grip her/his wrist between the thumb & forefinger & feel for the pulse. After the student can do this successfully three times, he/she should count the number of pulses, he/she can feel in 30 seconds. Each student should determine her/his resting pulse at least3 different times & be prepared to share her/his average resting pulse. • Student pairs spend ten minutes walking quickly up and down the stairs or engaged in another moderately rigorous exercise activity. Students measure pulse again (using same procedure used to determine resting pulse.) • Students develop a formal data table with explanatory row & column headings & enter all of the personal body measure values they have gathered. They indicate the units of measure that correspond to each value in the row Or column heading, as appropriate. They each provide a descriptive title for their chart. *As students learn more about body mass, pulse, and other important indicators of human health, they will use the information from this chart in a variety of assignments.*	
VIRTUAL LAB: IMPACT OF EXERCISE ON CARDIOVASCULAR & RESPIRATORY SYSTEMS Using McGill Physiology Virtual Lab (http://www.medicine.mcgill.ca/physio/viab/exercise/vlabmenuexercise.htm), students will Complete a lab about the way the cardiovascular system & respiratory system & body respond to exercise. During the laboratory, students will measure their heart rate and ventilator response during exercise in order to predict their maximal oxygen consumption. Energy expenditure and cardiovascular variables, before and during exercise, will be plotted. The exercise protocol will involve a two-step wooden box (as detailed in a modified aerobic fitness test); it is a series of 3-minute stepping stages (at increasing cadences) where the heart rate at the end of each stepping stage is recorded.	
DIGESTIVE SYSTEM LAB ACTIVITIES ○ *Lab:* Investigating Digestive Processes (Ward's) (Lab Report – approximately 4 pages) ○ *Lab:* GI Anatomy Models: Torso, stomach, pancreas, duodenum, spleen *Dissection*: hands-on or virtual of excised GI tract and abdominal blood vessels Procedures: Identify the structures and blood vessels of the alimentary canal and related organs and	

correlate with functions. (Lab Report – approximately 4 pages)
Histology: materials: microscope slides, web histology sites. Students will identify the histological structures of selected GI organs and relate structure to function (drawings *of slides and lab report* – approximately 3 pages)

- *Lab Activity: Digestion of Proteins (Neo/SCI) (http://www2.piedmont.cc.nc.us/faculty/durrenr*
- *Lab Activity: Digestion of Carbohydrates (Neo/SCI)*
- *Lab Activity: Digestion of Fats (Neo/SCI)*

Students will learn the parts of the digestive system; demonstrate how complex food molecules break dow into smaller molecules with the aid of digestive enzymes; study the subunits that make up carbohydrates, proteins and fats; understand where digestion occurs for each nutrient; learn about the major nutrients ar their function within the human body. Students will chart their observations and findings and answer a seri of short essay questions related to the lab activities. Students complete formal lab reports (approximatel 4 pages)

Resources: http://webanatomy.net/anatomy/digestive_lab-pdf.pdf

LAB INVESTIGATION: *COW EYE DISSECTION*:

Students will view a video about cow eye dissection, complete additional research on the eye, complete an eye dissection lab, and write a two-page lab report describing observations, Procedures, process, etc. Lab reports will include drawings and a discussion of observations And findings. (virtual eye dissection lab available as an alternative)

Resources include:

- video plus additional information on eyes and on the Cow's Eye Dissection Lab from the Exploratorium http://www.exploratorium.edu/learning_studio/cow_eye.html
- Virtual Eye Dissection http://www.eschoolonline.com/company/examples/eye/eyedissect.
- Cow Eye Dissection Observation and Dissection protocols with pictures: http://www.hometrainingtools.com/eye-dissection-project/a/1379/

In writing their 1=2 page lab report, students will include:

- An Introduction in which they briefly describe the purpose of conducting the dissection. What specific knowledge and skill would a student gain doing this exercise.
- Methods: Students will briefly summarize the procedures used during observation and dissection. Students will describe steps taken, dissection techniques used, major structures examined, etc. Include lab drawings.
- (written) Discussion: Students reflect on their thinking while conducting the lab investigation. How did doing this lab increase her/his understanding of eye anatomy. Specifically, did the student run into any difficulties/challenges in completing the lab? Did the student see anything or learn anything he/she did not expect? What are the similarities & differences between cow eyes and human eyes? Did the student have questions about the anatomy of the eye that were addressed by doing the eye lab? Did the lab raise any new questions about the eye//eye anatomy & physiology?

a
dissection

LAB INVESTIGATION: SHEEP HEART DISSECTION:

Students describe appearance of external & internal structures of a sheep's heart. Students identify structures & functions of a sheep's heart. Students trace flow of blood through the heart. Students follow the lab Sheep Heart Lab Dissection protocol & complete a series of observations and dissection procedures. Students also complete related lab drawings & write a formal laboratory report that includes their observations, methods, findings, conclusions, discussion,

& reflection. Students practice demonstrating their knowledge of the sheep heart & of heart circulation in several on line sheep heart learning exercises. Students take a mastery quiz on sheep heart anatomy and heart circulation. Students locate, label & identify functions of: superior vena cava, inferior vena cava, right atrium, opening of coronary sinus, tricuspid, chordae tendinae, pulmonary semilunar value, pulmonary artery (trunk), right coronary artery, interventricular coronary artery, coronary sinus, left atrium, pulmonary veins, bicuspid or mitral value, left ventricle, semilunar valve of the aorta, aorta, brachiocephalic artery, carotid artery, subclavian artery. **Resources include: http://www.biologyjuntion.com/sheep_heart_dissection_lab_report.htm** Sheep Heart Dissection with pictures including observation of external and internal anatomy: http://www.hometrainingtools.com/heart-dissection-project/a/1318/ http://www.nku.edu/~dempseyd/HEART_1.htm (includes many sheep heart resources plus an animation of blood through the heart, a blood pressure measurement video, interactive heart labels, etc.) http://www.morgancc.edu/faculty/Smith,L/AnatomyReview/Labs/Heart%20Dissection.pdf (note: this is an advanced lab on the heart dissection with some excellent heart dissection directions and pictures. This lab also explores blood vessels and value action. It also includes a heart proficiency quiz. http://fsweb.bainbridge.edu/acunningham/BIOL2012/BIOL2112-HeartDissection.htm (includes human heart models/pictures as well as sheep heart dissection The Human Heart http://www.fl.edu/learn/heart/index.html (topics: development, structure, Vessels, blood, systems, monitoring, health, history, heart headlines, etc.)	
LAB INVESTIGATIONS: FETAL PIG DISSECTION – The dissection of the fetal pig will be spread out over multiple units and multiple weeks and will involve the following separate labs: ➢ **Fetal Pig Dissection External Anatomy Lab** ➢ **Fetal Pig Dissection Oral Cavity Lab** ➢ **Fetal Pig Dissection Digestive System Lab** ➢ **Fetal Pig Dissection Circulatory System Lab** ➢ **Fetal Pig Dissection Respiratory system Lab** ➢ **Fetal Pig Dissection Urogenital System Lab** ➢ **Fetal Pig Dissection Nervous System Lab** o Students identify important external structures of a fetal pig. o Students identify major structures associated with the pig's digestive, respiratory, circulatory, urogenital, and nervous systems. o Students complete formal lab observations and drawings and professional lab reports for each of the fetal pig dissection labs. Students are assessed both on their knowledge of the anatomy of the fetal pig and also on their understanding of the identification and function of the body systems involved in the dissection. In addition, students respond to a series of critical thinking questions related to the fetal pig dissection and the body systems involved. A few resources among many include:	

http://www.seattlecentral.edu/faculty/adavis/241_OCLWINTER/Lab_Handouts_PigLab_Draft.pdf Whitman College Virtual Fetal Pig Dissection http://www.whitman.edu/content/virtualpig/anatomical-references (also includes: excretory system and reproductive system, sexing your pig, anatomical references, as well as quizzes) http://faculty.clintoncc.suny.edu/faculty/michael.gregory/files/bio%2010%20laboratory/fetal%20pig.htm http://www.bio.davidson.edu/people/midorcas/PrinciplesofBiologyII/LabExercises/Fetalpig.Dissection.pdf	
INVESTIGATIVE ACTIVITY: DIALYSIS LAB Students engage in a dialysis activity & see how a membrane can be selectively permeable. Students use Benedicts solution & Lugol's solution (Iodine) to test for carbohydrates and sugars. Students analyze their results & make connections between the lab activity & learnings from class & the textbook. Students complete lab report detailing their work and findings. http://www.lessonplansinc.com/lessonplans/dialysis_lab.pdf **AND/OR KIDNEY DIALYSIS LAB (**from the University of Rochester) Students create a mini-model of a dialysis machine. They observe which substances diffuse from the bloodstream into the fluid in the dialysis machine They determine what substances should be added to the dialysis fluid to maintain homeostasis. Students also learn about & compare & contrast Hemodialysis and peritoneal dialysis http://lifesciences.envmed.rochester.edu/curriculum/SEPAClass/3.TEACHERKidneyDialysis7-23.-09.pdf	a professiona
LAB INVESTIGATION: IMMUNOLOGY Purpose to: * Demonstrate how the ELISA assay is used to diagnose exposure to a disease by testing for the presence of antibodies to the disease in a sample of simulated serum; * determine hemagglutinating antibody titer of 2 different sera * demonstrate complement mediated lysis & sequence of reactions necessary to cause lysis. Students increase their understanding of basic immunology concepts such as cell-mediated or humoral immunological responses; functions of the thymus, spleen, bone marrow, lymph nodes, mucosal associated with lymphoid tissue, and cells of the immune system.	
LABORATORY INVESTIGATION: SHEEP BRAIN DISSECTION Students watch a video on sheep brain dissection and then follow a sheep brain dissection lab protocol. Students will locate, label, and observe various structures of the Brain. Students complete a professional lab report on the sheep brain dissection. Resources include: Sheep Brain Dissection: The Anatomy of Memory (from the Exploratorium) http://www.exploratorium.edu/memory/braindissection/index.html (includes an excellent video of a dissection of a sheep brain.) Sheep Brain Tutorial: Neuroanatomy: Basic Anatomy of the Brain, Neurophysiology of the Brain, Parasaggital Views of the Brain, http://www.gwc.maricopa.edu/class/bio201/brain/brshpx.htm	
LABORATORY ACTIVITY: COMPARING BRAIN IMAGES. Using the Brain module that is part of the New Science of Addiction: Genetics and the Brain unit at http://gslc.genetics.utah.edu, students develop and then compare PET scan images showing activity in a drug-free brain and activity in the brain of a cocaine addict. Students write a brief essay in which they compare and contrast the images.	
LABORATORY ACTIVITY: EXPLORING THE SCIENCE OF ADDICTION: GENETICS AND THE BRAIN. Students log on to a module on addiction available at	

http://gslc.genetics.utah.edu/units/addiction, & navigate their way through the module to complete a web quest on addiction. Standards addressed include several related to the cell, the behavior of organisms, and science in personal and social perspectives. Students learn more about toxic substances, the ways in which the nervous system works, how electrical impulses carry information, how drugs mimic or block the molecules involved in transmitting nerve or hormone signals; cultural effects on behavior; and ways in which heredity, culture, and personal experience interact in shaping human behavior. In addition, students learn more about emerging health technologies related to genetics and emerging health care fields.	
SYNAPSE SIMULATION: Students participate in a "Jumpin' the Gap" Simulation in which the classroom functions as a giant synapse as students act out communication at the neural level by behaving as pre-synaptic vesicles, neurotransmitters, post-synaptic receptors, secondary messengers and re-uptake transporters. Students increase their understanding of the ways in which nerve cells communicate; how, when stimulated by an action potential, a neuron releases neurotransmitters into the synapse; how receptors on the outside of the receiving cell (post synaptic cell) fit synaptic neurotransmitters similar to a "lock and key" mechanism, etc.	
LABORATORY INVESTIGATION: EXTRACTING DNA/HEREDITY Students begin by exploring *DNA: The Instruction Manual for All Life*, from the Tech Museum of Innovation. (They should keep pressing the "next" button at the top of the page to work through the exhibit. Ask students to stop once they get to the "Finding a Sequence in a Genetic Haystack" page.. Written responses: What Is DNA? What are some things DNA determines? Where is DNA? What are the chromosomes made of? What makes up DNA? Students then participate in several lab activities, including Building a DNA molecule. Students further explore: DNA, gene, chromosome, inheritance, protein. Students illustrate chromosomes, build a DNA strand, explain how we inherit characteristics from our parents, describe transcription, describe translation, and describe the role proteins play in an organism. Finally, students complete a lab experiment based on a guide to How to Extract DNA From Anything* To assess students' knowledge of the content of this lab, students design posters that they can use to teach someone else about DNA. (Guidelines provided in class) * http://learn.genetics.utah.edu/content/labs/extration/howto/ Extended learning: DNA Extraction From Wheat Germ (Learn. Genetics, University of Utah) http://learn.genetics.utah.edu/archive/wheatgerm.index.html Extended Learning: What are Genetic Disorders? (Learn. Genetics, University of Utah) http://learn.genetics.utah.edu/content/disorders/whataregd/ (Besides information on a range of genetic disorders, this "visual" genetic library includes link to learning about Genetic Counseling as a career; includes biomedical scientist profile – defining what it means to be a good scientist, and includes information on newborn genetic screening. Alternative Assignment or Enrichment Assignment: DNA Extraction Biotechniques Virtual Lab http://learn.genetics.utah.edu/content/labs/extraction Detailed lesson plans for the lab are available at http://www.sciencenetlinks.com/lessons.php?BenchmarkID=5&DocID=98 Resources/Field Study: Tech Museum of Innovation: http://www.thetech.org/	

DNA: the Instruction Manual for Life http://www.thetech.org/exhibits/online/genome Online Understanding Genetics Exhibits (Tech Museum, Stanford School of Medicine) Zooming into DNA, What Color Eyes Will Your Children Have? http://www.thetechorg/genetics Features also genetics in the news, ethics and issues, ask a geneticist, at home activities, insider's view: A look at genetic research at the Stanford Human Genome Center.	
GENETICS: BLOOD TYPES INVESTIGATION Students learn about the inheritance of blood types and Rh Factors while attempting to Answer real questions received from people who had concerns about the blood types of Their parents or about the father of their child or grandchild. On line problem sets at: http://www.biology.arizona.edu/human_bio/problem_sets/blood_types/intro.html Students explore Human ABO markers, blood types and genotypes, how BO alleles are inherited by children, blood type and Rh Factor calculator, Rh factor, and blood type problem sets.	
GENE REGULATION LABORATORY EXERCISE: In this interactive exercise the student explores the various strategies employed by organisms (including human organisms) to regulate the transcription of genes. Two Strategies are explored in more depth: bacterial gene regulation, with focus on Rapid adaptation to environmental changes, and eukaryotic gene regulation, w. focus on complex, hard-wired programs dictating fixed patterns of **gene activity. In** the bacterial simulation, the student designs a regulatory mechanism for a sugar-utilizing enzyme, selecting elements from among activator and repressor proteins, and locating their binding sites on the DNA. The student then varies the level of sugar in the environment & assesses the success of the proposed regulatory mechanisms in optimizing use of the sugar. In the eukaryotic simulation, the user will have a broader choice of regulatory tools, including transcription factors, & the ability to locate regulatory genes at far distant sites. The challenge is to design a regulatory mechanism that permits the various mammalian globin genes to be expressed at different times during development. Resource: http://highered.mcgraw-hill.com/sites/0070272468/student_view0/laboratory_exercises.html	
DNA FORENSICS INVESTIGATION • Students learn about the Restriction Fragment Length Polymorphism (RFLP) method to characterize human DNA samples as applied in paternity analysis, etc. • Students explore this topic in more detail and interpret actual case results as Might be produced by the FBI Laboratory or a commercial paternity-testing facility. Resources include: http://www.biology.arizona.edu/human_bio/problem_sets/DNA_forensics_1/DNA_forensicss.html http://www.biology.arizona.edu/human_bio/problem_sets/DNA_forensics_2/DNA_forensics.html	
MICROBIOLOGY LAB: USING AN OIL IMMERSION MICROSCOPE TO COMPARE THE RELATIVE SIZES AND SHAPES OF MICROORGANISMS (extended learning lab) * Students review prokaryotic & eukaryotic Cells * Learn that Bacteria are unicellular prokaryotic microorganisms that divide by binary fission, a process by which one bacterium split into two. * Observe & identify 3 common shapes of bacteria: coccus, bacillus, & spiral. * Create a concept map related to the comparison of the sizes & shapes of different bacteria. * Examine yeasts, such as common baker's yeast Saccharomyces cerevisiae, a unicellular fungi & learn about	

the process of budding. *Use ocular micrometers to measure microorganisms & compare the size of a virus, a bacterium, & a human cell.* Learn the proper procedures for using an oil immersion microscope (Olympus CH-2 Microscope) & examine prepared slides of stephyloccus aureus, escherichia coli, trponema pallidum, and spirillum species. View on-line demonstration slides of the following Bacteria: micrococcus luteus, Neisseria gonorrhoeae, streptococcus pyogenes, and bacillus Megaterium. * Create laboratory drawings of several of the bacteria from each of the prepared slides & indicate their approximate size in micrometers. Describe their shape, form, and arrangement. As a result of completing this lab, students are able to describe basic shapes of bacteria, different arrangements of cocci, bacilli, spiral forms, and yeast. They also acquire experience the use of an oil immersion microscope.	in
MICROBIOLOGY LAB: ASEPTIC TECHNIQUE AND TRANSFER OF MICROORGANISMS In this lab, students learn and practice aseptic technique. Students also develop a detailed Concept map of the concepts, processes, and terminology involved in aseptic technique and transfer. In addition, students learn about forms of culture media, oxygen requirements for microbial temperature requirements, and colony morphology and pigmentation. Using a microscope, students observe the growth in colonies of Bacillus subtilis and Micrococcus luteus (& possibly Escherichia coli, and Mycobacterium phlei) & will chart their lab observations & findings. (form of colony, elevation, margin (edge), surface, optical characteristics, pigmentation, etc. After completing this lab, students are able to define: culture, sterile medium, inoculum, aseptic technique and colony. They are able to describe & define the types of growth that may be in a broth culture. In addition, they increase their knowledge of more advanced bioscience and microbiology techniques, concepts, and terminology. Resource: http://faculty.ccbcmd.edu/courses/bio141/labmanua/lab2/lab2.html	grow see
MICROBIOLOGY LAB: OBTAINING PURE CULTURES FROM A MIXED POPULATION This lab involves two major steps: 1) Diluting the mixture until various individual microorganisms become separated far enough apart on an agar surface that after incubation they form visible colonies from the other colonies of microorganisms on an isolation plate. 2) Aseptically "picking off" the isolated colony & transferring it to a new sterile medium. After incubation, all organisms in the new culture will be descendants of the same organism, that is a pure colony. Students learn & practice the streak plate method of isolation as well as the pour plate & spin plate method. Students learn about selective media, differential media, enrichment media, &combination selective media. Students observe isolated colonies on plates of Trypticase Soy agar, Columbia CAN agar, EMB agar **http://faculty.ccbcmd.edu/courses/bio141/labmanua/lab3/lab3.html**	& differential a

D. Additional Key Assignments *(Note: Some Assessments & additional key assignments are embedded in the course outline. Other reading, writing, speaking, listening, exhibition, and multimedia assignments are embedded in key lab investigations and major projects)*

TEAM REPORTS ON A CHOSEN BIOMEDICAL FIELD, HISTORICAL BIOSCIENTIST AND HER/HIS ACCOMPLISHMENTS, OR HISTORY/IMPACT OF A FORM OF BIOSCIENCE TECHNOLOGY: Each student team researches, plans, & delivers multimedia presentation on: * a

particular field of biomedical sciences; * historical biomedical scientist & her/his contributions; OR history & impact of a form of biomedical science technology. Students access internet & other sources, including email project consultants/ medical and scientific professionals, to research topic. Presentations include posters, Power Points, & other multimedia/written documentation. Students present to peers & guests (including biomedical professionals). Presentations evaluated using Academy scoring rubric.

BIOMEDICAL SCIENCES POSTER TALK: EVERYONE TEACHES, EVERYONE LEARNS: Individual Students or Pairs of Students are assigned/chose one key biomedical science concept and assume responsibility for teaching the concept to others. Presentations should include a poster/graphic representation of the concept and/or other multimedia. All presentations will involve a demonstration of the concept. Cornell Note-taking. Student-generated quizzes on essential concepts; Interactive Presentation Facilitated by Teacher to review and reinforce all essential biomedical science concepts.

WRITING PROFESSIONAL LAB REPORTS & PROJECT REPORTS: Student understanding of biomedical science & her/his ability to design, conduct, & communicate results of an experiment or design project is demonstrated in lab/project reports. For every major lab activity & project, each student will write a formal lab/project report.

The lab/project report should encompass all the customary sections. Such sections include: * Title Page * Purpose * Research and Theoretical Background * Procedure (and/or observation) * Data and Calculation * Graphs * Discussion of Results * Self-Assessment Reflection on New Learning (as appropriate) * Bibliography (as appropriate)
NOTE: Lab reports are evaluated using the Biomedical Sciences Lab Report Scoring Rubric included in the course syllabus.

MAINTAINING A BIO-MEDICAL SCIENCES NOTEBOOK: Each student maintains a personal Biomedical Sciences Notebook for most major projects. Notebooks follow *Guidelines for the Biomedical Scientist Notebook* included in class syllabus. The Biomedical Sciences Notebook documents in written form efforts of student-author on one or more projects in a time-sequential form. It is the equivalent of a technical diary that also includes analysis and reflections on learning. The Bio-Medical Scientist Notebook contains: ideas of its author, alternatives considered, decisions reached, interactions with other people & with organizations, changes made along the way, & implementation flow of projects, labs, etc.

BIOMEDICAL SCIENCE LEARNING BLOG/LOG/JOURNAL: Students write frequently, including forms of analytical, expository, & reflective writing. Students are regularly asked to respond articles and/or to writing prompts, to record their learning and thinking about biomedical sciences concepts, & to describe in writing their progress in achieving mastery of essential standards and habits of mind (Costa & Kallick)/ habits of a scientist. (included in course syllabus)

BIOMEDICAL SCIENCE POSTER ASSIGNMENT: Choose a biomedical science concept or development that especially intrigues you. Explore this concept or development, including doing a telephone or internet "interview" with an expert on this concept./development. Then prepare a science poster on the concept and its importance in our current and future world.

BIOMEDICAL TERMINOLOGY: GLOSSARY OF TERMS (Biomedical Career Building: Developing

Knowledge and Facility in the use of Medical Terminology Associated with Applied Anatomy and Physiology, Body Systems, Diseases and Medical Conditions, Biomedical Procedures and Processes, etc.) . Each student will maintain a section of her/his portfolio devoted to Biomedical Terminology. There is an expectation that each student will define and master a minimum of at least 10 biomedical terms each week. Students can take bio medical terminology challenge quizzes to demonstrate mastery, but can also do so through authentic use of terms in lab reports, research reports, essays, and other course assignments.

BIOMEDICAL COLLEGE AND CAREER READINESS KNOWLEDGE AND SKILL BUILDING (a sampling of assignments; one or two in each unit of study)

** Biomedical College and Career Readiness Building: Medical-Legal Responsibilities, Ethics, and Confidentiality*:

Students will also review the Legal responsibilities of medical professionals as well as the Role of Ethics and Confidentiality in Medical fields. In small groups, students will discuss a set of medical ethics scenarios (some which involve medical confidentiality) and review the Hippocratic oath.

* *Biomedical Career Building: Speaker and Learning Activities related to Cultural Diversity in Health Care* (age, gender, culture, socio-economic, religious, sexual orientation, etc.) Students will research what a medical professional needs to know about cultural diversity and make a plan for increasing their own knowledge and skill in at least one aspect of cultural literacy.

Learning Activity: Students will review information and write up a 1-2 page summary of their findings on each of three articles available at http://www.nibib.nih.gov/HealthEdu/ScienceEdu. These are from the National Institutes of Health's National Institute of Biomedical Imaging and BioEngineering (NIBIB)'s Technologies and/or Stories of Discovery. Topics include:

- *Biomedical Engineering: Technologies to Improve Health*
- *Imaging in Biology and Medicine*
- *Historical Perspective of Biomedical Imaging: from MRI to fMRI*

- Many of the skills identified as needed for biomedical professionals are cross-cutting skills that apply in a variety of career fields. Each student self-assesses her/himself on the following medical career (& college) skills. He/she then chooses one of the skills to concentrate on & develop to mastery (or provide evidence of real growth in this particular skill) by the end of the course. *Skills include: Leadership/ persuasiveness, problem solving, physical stamina, networking skills, teamwork, manual dexterity, initiative, ability to teach others.*

* MOCK INTERVIEWS: Health Academy Advisory Board members and other medical, health, and biomedical science partners will assist the Academy in offering a day of interview practicums for students. Each student will carefully prepare for her/his interview. Students will have a choice of several "mock" jobs for which they may interview. Based on the job/career opening they choose, they will:

A. Research the organization and identify success factors
B. Develop a "pitch" – Each student should prepare and practice how he/she will show that he/she possesses the success skills necessary for the job. Students should be prepared to support the claims in your letter of inquiry and resume. For each project/job/activity on a resume, students should be able to discuss what they learned,, what they found

challenging, impact on yourself and/or others, etc.

C. Students should prepare & practice responses to likely questions: 1) Tell me about yourself; 2) Why did you decide to enter the Health Academy? OR why are you interested in health/medical/biomedical field? 3) How are you doing academically? 4) Why are you interested in this position? 5) Why do you want to work for our organization/firm/department? 6) What are your strengths? 7) What three accomplishments are you most proud of? 8) What are your weaknesses? 9) Discuss a time you were not successful & what you learned from this experience? 10) What questions do you have for me? *(Note: Interviewer will not ask all the questions, but these are typical questions.)*
D. Students will spend some time researching and brainstorming tips for effective interviews, such as what to say and what not to say, how to dress for success, make eye contact, be confident (but not arrogant), etc. Class will share/discuss.
D. Students will participate in one or more mock interviews, telephone interviews, or Skype interviews.

Each student will follow up with Thank you letter to the person who interviewed her/him.

* Biomedical Science Career Search: Students research one area of biomedical science specialization. Each Student writes up her/his findings & describes the type of work involved in this career as well as education/training & knowledge & skill requirements involved. If possible, students include one or more primary sources as part of their research. Some possible biomedical science career specialists include: medical microbiology, clinical chemistry, transfusion science, hematology (morphology and physiology of blood), histopathology, cytology, virology, and immulogy.

Students can also choose to explore related biomedical careers in anatomical pathology, blood transfusion, clinical biochemistry, cytogenetics, cytopathology & cervical cytology, electron microscopy (specialized area of histopathology), embryology & andrology (dealing w. infertility treatments), external quality assurance, hematology & hemostasis & thrombosis, histocompatibility and immunegenetics, molecular genetics, pharmacy, phlebotomy, tissue banking, toxicology, and virology.

Students might also wish to look at biomedical career ladders and consider careers such as anatomical pathology technician, pharmacy technician, phlebotomist, etc.

CASE STUDIES (sampling)

Case History (Muscle Physiology): Parents of a 3-year-old noticed that their daughter was walking "on her toes," had a waddling gait, fell frequently & had difficulty getting up again, & was not able to run because of the difficulty in raising her knees. At age five, there was a progressive muscular weakness & muscle wasting. Weakness of the trunk muscles led to increased lordosis & a protuberant abdomen. At age nine, she was confined to a wheelchair. Contractures appeared, first in the feet, as the gastrocnemius muscles tightened. Questions: This hereditary X-linked recessive disease characterized by progressive muscular weakness is ____. What does dystrophy mean? Why is this term used to describe this case? What muscles would be involved in walking "on the toes"? What muscles are "weakening"? Name the trunk muscles that weaken in certain cases of lordosis and abdominal protuberance. Describe a treatment plan for this patient.

Case History: Muscle Physiology: A 17-year-old was working vigorously with a summer construction crew building a new greenhouse. In the intense heat of the day, she began to experience severe pain in the muscles of her limbs and carpopedal spasms. The cramping made her muscles feel like hard knots. The

foreman of the construction crew suggested that she drink some salt water and rest a while. Questions: What is the cause of the cramping? Describe carpopedal spasms. Why is the ingestion of salt and water beneficial?

* A 21-year-old noncompliant female with a history of type I (insulin-dependent) diabetes mellitus was found in a coma. Her blood glucose was high, as was her urine glucose, urine ketones, & serum ketones. Her serum bicarbonate was < 12mEq/L. Her respiration was exaggerated & her breath had an acetone odor. Her blood pressure was 90/60 & her pulse weak & rapid (120). Questions: Define noncompliant. Is this patient experiencing ketoacidosis or insulin shock? Explain your answer. Why is the serum bicarbonate low? What is the acid-base status of this individual? What is the cause of the dyspnea, hypotension, & tachycardia? What type of treatment does this person need?

* Case Study: *A female patient complained of severe, dull, aching pain, & cramping in lower abdomen. There are no other physical findings. A laparoscopy revealed the presence of ectopic endometrial tissue on the uterine wall and ovaries. Danazol (a synthetic andogen and inhibitor of gonadotropins), 600 mg/day, was prescribed for up to nine months to inhibit ovulation, suppress the growth of the abnormal endometrial tissue, and achieve appreciable symptomatic relief, with a 30% possibility of conception after withdrawal of the therapy. Questions: What is this condition called? What causes it? What is ectopic endometrial tissue? What is the rationale for using danazol, a gonadotropin inhibitor? Do you think oral contraceptives could also be used as a treatment? If so, why?*

CIRCULATORY SYSTEM AND THE PROPERTIES OF BLOOD LEARNING ACTIVITIES

Clarence Smith, age 35, is sent by his physician for a blood test. The lab results indicate his white blood cell count (number of WBC per ml of blood) is 18,000. The typical WBC count for a man his age is 6000-9000, meaning Clarence's white blood cell count is considerably higher than normal. If you were Clarence's physician, what might his white blood cell count tell you//mean?

- One treatment for certain types of leukemia is to try to kill all of the stem cells in the bone marrow through radiation and chemotherapy and then give the patient a bone marrow transplant from another person (the donor). Can just anyone be a donor? Who is most likely to be an effective donor? Explain.
- Explain how it is possible that on rare occasions even O-negative blood could produce a transfusion reaction in a patient.
- Case Situation: Training at High Attitude Enhances Athletic Performance: The University of Texas Southwestern Medical Center studied the performance of 39 elite college male & female runners before & after they lived for 28 days at high altitudes. Researchers found that living at moderately high altitudes (2500 m), combined with lower altitude training, resulted in significantly greater improvement in oxygen uptake & performance over equivalent sea-level training for most athletes. Athletes who responded best to this "high-low" training model were found to have a significantly larger increase in erythropoietin concentration after 30 hours at altitude compared to athletes who did not respond to the high-low training method. To what might you attribute the greater oxygen uptake & performance of athletes who responded best to the high-low training method? Would a measurement of the athletes' hematocrit levels be pertinent to this study? Why or why

not?

LYMPATIC SYSTEM AND IMMUNITY LEARNING ACTIVITIES

- Characteristics and treatment of common lymphatic disorders – Working in pairs, students research and chart the characteristics and treatment of Tonsillitis, Lymphadentis (adenitis), Hodgkin's Disease, Mononucleosis, Hypersensitivity, Anaphylaxis (Anaphylactic shock), AIDS and HIV
- Students participate in a practicum related to Applying Standard Immunity Precautions. All students are expected to master key elements of standard precautions, including hand-washing, personal protective equipment, patient care equipment and linens, occupational health and blood-borne pathogens, care of the AIDS patient

SKELETAL AND/OR MUSCULAR SYSTEM RESEARCH AND POSTER (OR OTHER MULTIMEDIA)

Health Careers Research and Poster/Multimedia Presentation on a Disease or Condition of the Skeletal/Bones and/or Muscular Systems: Common diseases of the bones and muscle systems include: Osteoporosis, rheumatoid arthritis, bone cancer, muscular dystrophy, and polymyositis; however, there are many others. Working in pairs or small groups, students will research one of these diseases and prepare a presentation in which they share their findings. They should include the unique symptoms of their chosen disease, the complications, and treatments.

Resources: a lengthy list of conditions and diseases of the skeletal and muscular systems can be found at

http://www.aurorahealthcare.org/yourhealth/healthgate/getcontent.asp?URLhealthgate=98375.html

There are also links to concise, physician-reviewed fact sheets that reflect current information on each condition and disease.

CIRCULATORY SYSTEM AND THE PROPERTIES OF BLOOD – LEARNING ACTIVITIES

Applying Knowledge:

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concentration after 30 hours at altitude compared to athletes who did not respond to the high-low training method. To what might you attribute the greater oxygen uptake & performance of athletes who responded best to the high-low training method? Would a measurement of the athletes' hematocrit levels be pertinent to this study? Why or why not?

RESPIRATORY SYSTEM CASE STUDY

CO2 in Lungs Activity

- Case History: A 17-year-old student has experienced reversible, periodic attacks of chest tightness with coughing , wheezing, & hyperpnea. She states that expiration is more difficult than inspiration. She is most comfortable sitting forward with arms leaning on some support. X-rays and laboratory and pulmonary function tests are as follows: Frequency: 20 breaths/min; Vital Capacity (VC): 2.9 L; FEV1.0: 1.4 L; FEV1.0/FVC 56%; Functional residual capacity (FRC) 3.89 L; Total lung capacity (TLC) 6.82 L; PaO2: 70 mm Hg; PaCO2: 26 mm Hg; Pulse: 108 b/min; BP: 120/76 mm Hg
  Intermittent use of a bronchial smooth muscle dilator (1:1000 epinephrine by nebulizer) for several days caused marked improvement, as evidenced by the following laboratory and pulmonary function tests:
  VC: 4.15 L; FEV1.0: 3.1L; FEV1.0/FVC > 75%; FRC: 3.7 L; TLC 5.96 L; PaO2: 89 mm Hg; PaCO2: 38 mm Hg; Pulse: 129 b/min; BP 122/78 mm Hg

  Questions: What is the disorder of this 17-year-old student? Is this primarily a restrictive or an obstructive disorder? Why? Write the formula for determining residual volume (RV). Determine residual volume before & after use of bronchodilator. Why is expiration more difficult than inspiration in this patient? What does the change in pulmonary function after bronchodilator therapy indicate? Why does the bronchodilator exaggerate the tachycardia? What causes the hypoxemia & the hypocapnemia in this patient? A beta2-adrenergic agent was prescribed for further use because it has less cardio-stimulatory (beta1) effect. Based on your knowledge of beta1 and beta2 receptors, why is this a good suggestion? An anticholinergic agent was also suggested as a possible nebulizer agent. How might this help the breathing problem?

DIGESTIVE SYSTEM Learning Activities include:

- Peristalsis Demonstration and Written Report (1 page)
- *GastroWorld* Activity & Presentations
- *Digestive System Case Study*
- *See also Laboratory Activities*

Resources: http://webanatomy.net/anatomy/digestive_lab-pdf.pdf

URINARY/EXCRETORY SYSTEM LEARNING ACTIVITIES

Applications of Knowledge:

- What do you suppose might happen to hematocrit (the fraction of the blood that is red blood cells) if you were to live at altitudes of greater than 10,000 feet for three months? Explain. * Are you working your kidneys harder than normal when you eat a high-salt diet or drink lots of fluid? Explain your reasoning. * Explain the mechanism for why one feels thirsty after heavy exercise accompanied by sweating.

- Case Situation: Renal Failure Patients are at Risk for Certain Cancers: Students will explore a case situation related to Renal Failure Patients and Risks of Cancers. Students will do additional research on the relationship between renal failure and cancer. Students will write-up their findings. (Research and 4-6 page essay)

  Some facts: Over the past quarter-century the number of Americans with chronic renal failure, also called end-stage renal disease (ESRD), has increased dramatically. The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDKD) has collected and analyzed data on the risk factors, incidence, and outcomes of the condition.

  Among the NIDDKD findings: there is a strong correlation between diabetes mellitus, hypertension, and kidney problems. In fact, uncontrolled diabetes is the leading cause of renal failure, and uncontrolled hypertension runs a close second. Together these two health conditions account for over 60 percent of all new cases of renal failure every year. The third most important cause of renal failure is glomerulonephritis, or inflammation of the glomerulus. Frequent urinary tract infections also increase the risk of kidney trouble. The NIDDKD recommends that all people with these risk factors should have their urine tested for the presence of protein.

  One treatment for chronic renal failure patients is long-term dialysis. However, dialysis is not a perfect solution. A recent study funded by the NIDDKD and the Italian Association for Cancer Research found that chronic renal failure patients on dialysis experience higher-than-average rates of kidney cancer.

BIOMEDICAL SCIENCE COLLEGE AND CAREER PROFILES: For almost every unit, students also view, read, and summarize a college and career profile in a closely related field, (i.e., a profile of an immunologist, or a clinical lab technician, or a biomedical scientist, etc. accompanies each unit.) Students also do additional research related to the college and career profile (education required, labor market projections, etc.**)** to include in each career profile summary. Each student completes a minimum of a dozen different career profiles in the course of the year. Two among many excellent initial sources for medical career profiles are
http://science.education.nih.ogv/LifeWorks.nsf/interviews *AND*
http://explorehealthcareers.org
Each profile summary is approximately 1-2 pages.

A Sampling of Biomedical Science College and Career Profiles:

***** "Meet" Vivian Morales, Medical and Clinical Lab Technologist. Watch the video and read the interview. Write a Summary that includes the pros of this career, a typical workday, what Morales likes about her work and her career goals. Research the education needed to become a medical technologist, including information found at the American Society for Clinical Pathologists (ASCP) website (http:www.ascp.org Video and Interview at
http://science.education.nih.gov/LifeWorks.net/Interviews/Vivian+Morales

- "Meet" Kedar Naraya, Immunologist. Students will watch a video and read an interview with Narayan about his career as an immunologist. Students will do additional research on immunology as a career field. Students will write a summary of the career profile and include information gleaned from additional research.
  http://science.education.nih.gov/LifeWorks.nsf/Interviews/Kedar+Naraya

***** Meet" Karen Sillers, pharmacist. Students will watch a video and read an interview about

pharmacy as a career. Each student does additional research on the education required to become a pharmacist. Each student writes a summary of the career profile, adding additional information gleaned from her/his research. *NOTE: While Sillers works in the field of veterinary science, most of her training as a pharmacist was similar to a doctor specializing in human pharmacy.* http://www.education.nih.gov/LifeWorks.nsf/Interviews?Karen+Sillers

BIOMEDICAL FIELD RESEARCH AND PRESENTATION– Each student will be assigned a topic dealing with a specific biomedical science field. The student will research this field and analyze how this biomedical field uses its knowledge of biomedical science and, in particular, the science of the human body to improve human life. Students will synthesize and evaluate these concepts to make a projection of where this medical field will gravitate to in the future. Each student will complete a research paper of 3 to 5 pages. Students will also provide a visual aid or power point presentation that will be used in an oral presentation.

MECHANISMS OF DISEASE LEARNING ACTIVITIES

Gum Disease and Heart Disease from NPR – Talk of the Nation (listening/note taking/discussion activity) http://www.npr.org/templates/story/story.php?storyid=4495598

Learning Activity: The Ecology of Your Skin: Bacteria That Live on the Skin. Students explore the physical parameters of the body and how those affect the bacteria that live on the body. http://www.sciencenetlinks.com/lessons.php?BenchmarkID=5&DocID=495

Extended Learning: Rice University: Center for Technology in Teaching and Learning has a "game" called MedMyst: Medical Mysteries on the Web related Infectious Disease (http://medmyst.rice.edu/) (NOTE: This is also available in Spanish.)

Students will write a one to two page review of each of at least one of these three on line learning activities. Review will also include a reflection on learning and how the program they heard or the web site they visited relates to concepts covered in the class and in the text.

DISEASE REPORT AND PRESENTATION– Each student is assigned a topic dealing with a specific disease that affects the human body. A student researches this disease & analyzes what the disease does to the body & how the body reacts & adjusts to the disease to remain at homeostasis. A student also researches any treatments the medical field has developed to fight the assigned disease. A student synthesizes & evaluates information to make a projection of how this disease might progress in the future. Each student completes a research paper of 3 to 5 pages. Students also produce a visual aid or power point presentation that is used in an oral presentation.

M.S. AND GUT BACTERIA Students listen to a Science Update podcast about animal studies that point to the fact that stomach bacteria may play a role in multiple sclerosis (M.S.) http://audio.scienceupdate.com/podcast/100813_sclup.pod.mp3 Students will listen to the 10-minute podcast twice, primarily concentrating on the M.S. segment (the other segments are high interest as well.) Students will take notes, compare notes with a partner and refine their notes. (A write-up of an overview of this M.S. research can also be found at http://www.sciencenetlinks.com/sci_update.php?DocID=417)

*Questions: Why would one NOT suspect that gut bacteria would be linked to M.S.? * What were some of the reasons the experiment was conducted? Why was it important that the researches*

added bacteria back into the sterile mice, to see if they developed M.S.? Suppose the sterile mice still didn't develop M.S. after receiving the bacteria. What conclusion would you draw?

Learning Activity: Gum and Heart Disease. Students will explore the recently discovered link between oral bacterial infections and heart disease.
http://www.sciencenetlinks.com/sci_update.php?DocID=264

HOMEOSTATIS LEARNING ACTIVITIES

Learning Activity: Homeostatis in Systems: *Students are exposed to various examples of negative feedback mechanisms (blood pressure, body temperature, & blood sugar) in human anatomy & Physiology. They are asked to identify the receptor, control center, & effector, as well as to explain how the negative feedback mechanism serves to maintain homeostasis. Students work with a graphic organizer of the negative feedback mechanism & apply it to new situations. Evidence of student learning takes place as students develop their own negative feedback mechanism. As a result of this activity, students are able to describe how maintenance of a relatively stable internal environment is required for continuation of life, and explain how stability is challenged by changing physical, chemical, & environmental conditions, as well as the presence of pathogens. Details for one version of this lesson can be found at http://dnet01.ode.state.oh.us/ims.itemdetails/lessondetail.aspx?id=0907f84c80531c66*

Extended Learning: * Students research a negative feedback mechanism that a nonhuman organism may use to maintain a relatively stable internal environment. Students present their findings in the form of posters or oral presentations. * Students can readily experience a real-world application of homeostasis disruption by measuring heart rate, then exercising and re-measuring the heart rate. Then, they should measure the length of time that it takes for the heart rate to return to normal.

DIABETES LEARNING ACTIVITIES

- Working in pairs, students will research information and statistics related to complications of diabetes, prevalence of diabetes and pre-diabetes, direct and indirect costs of diabetes, diabetes statistics for our community. (Complications related to heart disease and stroke, high blood pressure, blindness, kidney disease, amputations
- Students * participate in a Chalk Talk activity around the following question: Do you think that schools have the right (or responsibility) to regulate what students eat at school (breakfast, lunch, & drinks)? * Participate in a reciprocal reading activity using an article on the epidemic of diabetes in America. * Complete case studies, research, & service learning projects related to diabetes. *Learn more about how biomedical science is trying to solve the health challenge of diabetes. * Develop a diabetes care plan for a teen with diabetes. * Exercise health advocacy & take action to increase understanding of diabetes in their families, school, & community. * Complete a Glucose Regulation Activity * Complete a Venn Diagram Activity

Resources: American Diabetes Association http://www.diabetes.org
Diabetes Curriculum (one among many sources):
http://www.southcentraltxahec.org/html/diabetes/DiabetesCurriculum.pdf
(teaching about preventing Type II Diabetes)
Centers for Disease Control (CDC) Science Ambassador Lesson Plans: Diabetes: A national Epidemic

http://www.cdc.gov/excite/ScienceAmbassador/ambassador_pgm/lessonplans/Diabestes%20National%20epidemic.pdf
http://www.cdc.ogv/diabetes/faq/basics.htm
http://www.nim.nih.gov/medlineplus/tutorials/diabetesintroduction/htm/index.htm
http://www.howstuffworks.com/diabetes.htm
http://www.kent.k12.wa.us/staff/Linda.Jancola/6Trait/what.htm (6-Trait writing rubric to support effective writing)
http://www.cdc.gov/diabetes/ndep OR www.ndep.nih.gov (National Diabetes Education Program)
Diabetes Animation www.nhhe.com/biosci/genbio/animation_quizzes/graphics/mm5s8c.ram

DIABETES CASE STUDY As part of an in depth study of diabetes, students will complete a series of case studies. *(one example)*
Patient Background: A 54-year old male lawyer has had high blood glucose for over a year, but only now after a random reading exceeds 300 mg/dL on an office visit is he willing to admit that he has diabetes. He has had a previous heart attack & is taking several cardiovascular & hypertensive medications. His physical exam today is normal. He has a BMI of 28. He admits to feeling a little tired, recently, and has been getting up at night to urinate at least two to three times per week.

Clinical Profile: Age: 54; Weight: 212 Lbs. Height: 6'1" BMI:28; Blood Glucose Last A1C: 10.2% Fructosamine: 429 mmo/L (ni <250); Random: 358 mg/dL Lipid Profile: Total: 153 mg/dL LDL: 70 mg/dL HDL: 41 mg/dL Triglcerides: 225 mg/dL; Kidney Profile: Creatinine: 0.8 mg/dL; Microbuminuria: negative; Liver Function: ALT: normal SAST: normal; Blood Pressure Normal: 13090 mmHg; Cardiovascular condition: Previous myocardial infarction; Eye Exam: Normal; Foot *Exam:* Normal pulses and sensation; Lifestyle: No diabetes meal plan at this time; limited exercise and rare activity; Current medications: for blood glucose: none;
For other conditions: HCTZ, 25 mg qd; Metoprolol (Toprol XL), 50 mg qd; Aspirin 81 mg qd; Simvactin (Zocor) 20 mg qd

Working in pairs, decide how you would initially treat this patient. Give reasons for your decision: (diet and exercise alone; diet and exercise plus an oral agent; diet and exercise plus an incretin mimetic; diet and exercise plus insulin)
See: http://www.bd.com/us/diabetes/hcp/main.aspx for additional Diabetes Case Studies
American Diabetes Association http://professional.diabetes.org/CPR_search.aspx
Center for Disease Control http://www.cdc.gov/diabetes/
National Diabetes Information Clearinghouse http://diabetes.niddk.nih.gov
National Diabetes Education Program (NDEP) http://www.ndep.nih.govv/
http://www.niddk.nih.gov/DiabetesDocs.html
http://www.discoveryofinsulin.com

DIABETES IN THE FAMILY CASE STUDY
Students examine a case study of a woman with a family history of diabetes and create a "family health portrait" that will assess her risk of developing Type 2 Diabetes. Using the family health portrait to record the woman's family history, students identify her generic, behavioral, and environmental risk factors for type 2 diabetes and make recommendations for lifestyle changes.
Scenario: *Pretend you are Tina's doctor. After discussing her family history with her in your office, you know that to assess her risk of developing Type 2 Diabetes, you need more information about Tina's behavioral and environmental risk factors. What sorts of things would you like to know*

about Tina?/ask Tina?

You talk with Tina and she tells you that she knows her diet could be healthier. She says she hasn't been eating very many fruits and vegetables lately, and she also tells you that she doesn't get a lot of physical activity in a normal day. She would like to go out for a walk each day after dinner, but she lives in a neighborhood that is a high-traffic area and doesn't have any sidewalks. You weigh Tina and measure her height. She weighs 120 pounds and is 5'1" tall. Tina asks you what her risk of developing type 2 diabetes is and wants to know how she can reduce her risk.

Resources: Diabetes in the Family Case Study:
http://www.cdc.gov/excite/ScienceAmbassador/ambassador_pgm/lessonplans/Hartke%20Family%20History%20Lesson%20Plan.pdf

Additional Web Resources: Family History: http://www.hhs.gov/familyhistory/

Diabetes: http://www.ndep.nih.gov/diabetes/pubs/TipsFeel_Eng.pdf

Diabetes: http://diabetes.niddk.nih.gov/dm/pubs/riskfortype2/index.htm#7

DIABETES WEB QUESTS Assignment: Working in small groups, students will complete ONE of the following Web Quests and make presentations to their peers about their findings and work. Students will then design and implement a Service Learning project related to Diabetes in which they apply their knowledge and skills.

WEB QUEST I: Scenario: A student in your PE class has just found out he has diabetes. Working in groups of 4, you and your peers will assume the roles of people who will help him understand his condition and what he needs to do to take care of himself.

Roles: Jimmy's doctor will explain what diabetes is (definition of Type1 diabetes, information on diabetes, information from the ADA); Jimmy's nurse will explain how medication is used to treat diabetes (how diabetes is treated, how diabetes is monitored and managed; the nutritionist will explain the best kind of diet for Jimmy (Healthy eating, build a healthy plate, carbohydrates and diabetes, diabetes and nutrition); the teacher will learn how diabetes might change Jimmy's school day (school and diabetes).

Task: To learn all you can about diabetes and how it will impact Jimmy's life. Together the group will agree on a definition of diabetes, describe a treatment plan, & suggest exercise & diet recommendations. Each member of the group will write a one-page summary of their character's contribution to Jimmy's care plan. As a group you will prepare & present your findings & conclusions to at least two other groups and & your individual role write-ups to your teacher. You may wish to use illustrations, graphics, props, etc. to enhance your presentation.

http://teacherweb.com/PA/BHS/DiabetesWebQuest/h3.aspx

WEB QUEST II: Scenario: Jenny is a 17-year-old girl who is overweight and has been diagnosed with Type II Diabetes. Jenny has to make changes in her lifestyle in order to live a long healthy life, and to avoid taking medication. What changes does Jenny have to make? How is she going to do this? Where will she find support in managing her illness?

http://wellnessworksbest.blogspot.com/2008/10/managing-my-diabetes-webquest.html

Resources: *American Diabetes Association, Life Clinic, Your total health, Diabetes Guide for Teens* ;

Task: Give a brief description of what type 2 diabetes is, and how it will impact her health if she does not change her lifestyle & take care of herself. * Come up with a menu of food items that Jenny should include in her daily diet. * Plan a week's menu for Jenny including all of the foods she

can eat, & the times she should eat them. * Make a list of the foods that Jenny should limit &/or keep out of her diet. * Come up with a detailed exercise plan for Jenny. * Find community resources & supports for Jenny to aid her in managing her diabetes.

WEB QUEST III: Understanding Diabetes in the Pre-Hospital Environment. Students are given a pre-hospital patient scenario description by your instructor. Working in groups of three, the goal is to research the disease, its processes, correctly identify it, & create a pre-hospital treatment plan for the patient's medical condition. Students then create a Power Point or video or slide how or other multimedia presentation explaining their work, the patient's condition, & their treatment plan. https://www.msu.edu/~johanna/WebQuest/index.html
American Diabetes Association - http://www.diabetes.org/main/homepage.jsp; Healthy People 2010 Information related to Diabetes - http://www.healthypeople.gov/document/HTML/Volume1/05Diabetes.htm; Medline Plus (National Institutes of Health): Diabetes http://www.nlm.nih.gov/medlineplus/diabetes.html; WebMD Diabetes Help Center – http://www.webmd.com

WEB QUEST IV: "Overall prevalence of type 2 diabetes in Native Americans is 12.2 percent vs. 5.2 percent of the general population." This web quest involves students in a Native American community, researching and designing a menu plan for the school to combat diabetes. Student teams will prepare a presentation for the school board. Resources include information on Type II Diabetes, Food labels, calories, carbohydrates, journal activity on food intake, and balanced meal information. Tools include a calorie chart, calorie calculator, and carb calculator. http://www.osdlc.org/SNS/documents.webquest.htm

Learning Challenge*: *Community-Action-Research-GO According to the Office of Minority Health, 12.4 of Mexican Americans 20-and-over are diagnosed with diabetes & 11.0 of 18 and older Hispanic/Latinos are diagnosed with Diabetes. African-Americans, too, are twice as likely to have diabetes as Whites. In 2007, CDC estimated that 14.7% of non-Hispanic blacks were diagnosed with diabetes. Asians, in general, have diabetes rates similar to non-Hispanic whites (8% v. 7.1%); however, native Hawaiians & Filipinos have higher rate of diabetes. Given what students have learned about diabetes thus far, students extend their research & develop service learning projects that are related to diabetes & that benefit their school and/or community. They may choose to target a particular group.

EXTENDED LEARNING ACTIVITY: DESIGNING WEB PAGE OR WEB QUEST RELATED TO AN IMPORTANT HUMAN DISEASE Students are encouraged to design a web page and/or web Quest related to a historically important human disease. They can choose to work alone, with a partner, or as part of a small group.

BIOMEDICAL SCIENCE IN THE MEDIA - In the course of the year each student chooses 10 articles on a biomedical science related issue or issues and complete a reading assessment that includes a summary and a personal reflection regarding the article. The assessment should include the title, publication date, and source of the article. There is an expectation that a minimum of five article assessments will be completed each semester.

THINKING CRITICALLY ABOUT CURRENT BIOMEDICAL SCIENCE ISSUES - Students choose an article related to biomedical science from a list/set of articles provided by the teacher. After reading the article, students will state the article's primary claim; List the evidence provided to support the claim, and then using the criteria for evidence provided, will examine each

piece of evidence to determine whether it meets a basic standard of scientific acceptability. Each student will write up a close examination of the article and its scientific claims.
Criteria for evidence: *1) Scientific evidence is observation-based and quantifiable. In contrast, inferential evidence is merely descriptive; 2) The source and quality of the evidence should be apparent. Cited, verifiable references to previous work by others is a big plus. At the very least, the experimental design should be sufficiently described so that you can understand how the data were collected, whether or not there is a control group, what the sample size is, and so on. You should be convinced that the data were collected and presented properly; and 3) The evidence should be free of obvious bias. Who presented the data? Is there any reason to suspect a hidden agenda?*

EXPLORING GENETICS: AN ONLINE LEARNING EXPERIENCE: Students spend three class periods exploring the Genetic Science Learning Center website hosted by the University of Utah (http://learn.genetics.utah.edu/). For several of the sections, students write brief summaries of key learnings. Sections explored include: Tour of the Basics (DNA, Gene, Chromosome, Protein, Heredity, Trait) * For other sections, such as DNA to Protein, students will complete specific interactive learning activities, such as the Build a DNA Molecule Activity, the Transcribe and Translate a Gene exploration, and the What makes a Firefly Glow? Activity.

RESEARCH AND ESSAY: INTEGRATED ASPECTS OF PHYSIOLOGY AND PHARMACOLOGY : While the safety and efficacy of pharmaceutical drugs are subjected to detailed oversight by the FDA (Food and Drug Administration), there is a very big market for dietary supplements and functional foods which are not subjected to similar oversight and production standards. What are the safety concerns that surround the unregulated dietary supplement market? (2-3 pages)

BIOETHICAL DECISION-MAKING: Using a series of case studies, scenarios or bioethical dilemmas, students work in pairs or trios to carefully read & understand the case study as well as identify facts, stakeholders and ethical questions involved. Students make an informed decision regarding their biomedical case study and each student writes a persuasive paper defending her/his point of view.

Sample of Biomedical Dilemma: Abridged Addiction Vaccine Scenario:

A company in Great Britain called Xenova has developed a vaccine that looks promising as a treatment for nicotine addition. The vaccine works by triggering a person's immune system to make antibodies against nicotine. These antibodies recognize & bind to any nicotine that enters the bloodstream, blocking its entry into the brain. As a result, the reward pathway in the brain is not activated. This reduces "the hit" of the cigarette & therefore the cravings that follow. The vaccine is currently being tested in clinical trials to determine its effectiveness & safety.

Enter the near future: Following development of a successful nicotine vaccine, companies are producing vaccines for other drugs using basically the same principle; antibodies that bind to the drug (and other compounds similar to the drug) preventing entry into the brain's reward pathway.

Linda, who is 26 years old, has entered a treatment program for an addictive drug following her arrest for crimes related to her addiction. This is not Linda's first arrest, nor her first time in a treatment program. Because of this, the judge hearing Linda's case sentences her to receive the vaccination that has been developed against her drug of choice. Once vaccinated, Linda will not feel any effects from the drug, nor will she feel any effect from compounds similar to the drug (such as prescription pain killers). Should the judge be allowed to require that Linda have the vaccination?

In pairs or small groups, students answer the following questions: * What are the facts involved in

this biomedical scenario? Who are the stakeholders? Who will be affected by decisions that are made? What are ethical questions raised by this situation? * What are values that play a role in the decision? List at least 3 possible solutions to this problem. * What is your best solution? Why?

THE NATURE OF BIOMEDICAL TECHNOLOGY: Social and economic forces strongly influence which technologies will be developed and used. Which new or emerging biomedical technologies will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.

Students are presented with information on several new biomedical technologies. Working in pairs or small groups, they use a bioethical decision-making process to determine potential benefits & risks associated with using (or not using) each of the new technologies. Students make and defend their choice regarding which technology appears to have the greatest potential to benefit society.

RESEARCH PAPER: Students research the history of biomedical science, and write a paper about their findings as well as their predictions of the future of biomedical science. (5-10 pages)

NEW DIRECTIONS IN BIOMEDICAL SCIENCE ESSAYS: Students write TWO Biomedical Science essays of approximately 3-5 pages each. (At least one of these essays should be included in the student's Biomedical Science Portfolio of Work.) Choices include:

◊ Essay on a biomedical science problem: Describe how biomedical science approaches & methods of discovery, measurement, analysis, or modeling have played on important role in either understanding workings of the human body & of disease or of a human biological process or in the development of a particular biomedical science technology

◊ Essay on the future of Biomedical Sciences. Respond to the following: Wayne Clough, a science educator wrote: "It is always dangerous to talk about the future of anything. When computers were first created, T.J. Watson, the founder of IBM, predicted we might need about six of them. As recently as 1977, Ken Olsen, the founder of Digital Equipment Corp., believed that none of us would ever have a computer in our homes. These men were leaders & experts in their fields, & they still got it wrong." Now that you know much more about Biomedical Science, what are your predictions for the future of Biomedical Science? In other words, what will be happening in the field of Biomedical Science 25 years from now? Provide a rationale (evidence, etc.) to support each of your predictions.

◊ Identify an important societal need, determine the magnitude of the problem and quantify the specifications for a Biomedical Science solution that includes technical, ethnical, environmental, legal & other requirements. Write an essay describing your problem & solution. Include the specific ways in which principles and practices of biomedical science help you meet a particular societal need.

◊ Choose a biomedical science concept that especially intrigues you. Explore this concept, including doing a telephone or email "interview" with an expert on this concept. Then write an I-search essay in which you describe the concept, the significance of this concept, and its importance in current and future society.

BIOMEDICAL SCIENCE STUDENT PORTFOLIO & PUBLIC EXHIBITION OF STUDENT WORK Students analyze their own work and determine what pieces best represent their ability and growth. Students create a portfolio (may be electronic). Students must defend and explain their choices. Students collaborate with faculty and biomedical science professionals to determine criteria, exhibition and judging.

E. Instructional Methods and/or Strategies

A variety of instructional strategies will be utilized to accommodate all learning styles and to reinforce language, math and scientific skills while learning biomedical science concepts.

- ☐ Inquiry-based Laboratory explorations and biomedical science projects
- ☐ Direct Instruction (lectures, multimedia presentations, demonstrations of biomedical concepts, principles and procedures, small and large group discussions, seminars, student interactive presentations)
- ☐ Team teaching with biomedical and health professionals and partners
- ☐ Reading and use of a variety of instructional materials and resources (professional journals, reference materials, textbooks, electronic media, scientific literature)
- ☐ Use of technology-based resources (scientific instrumentation, simulations, internet, computer-based instruction)
- ☐ Self-directed, cooperative, and collaborative learning projects (project-based learning, problem-based learning, inquiry learning)
- ☐ Investigative research (both library and internet) and analytic and expository writing
- ☐ Use of biomedical professionals and other community partners as guest speakers, student project consultants, review panels for student exhibitions of work
- ☐ Practicum, field trips and other industry/community-based-learning and/or service-learning experiences
- ☐ Out-of-class work for projects, research & report assignments, & demonstration and presentation preparation.
- ☐ Student portfolios, Biomedical Science notebooks, reflective learning journals, writing in science
- ☐ Student exhibitions

F. Assessment Methods and/or Tools

Assessment of each student's learning and mastery will include, but are not limited to:

- ☐ Long-term projects
- ☐ Laboratory work, practicum, and reports
- ☐ Rubric assessment of biomedical science notebook, essays, & other written assignments
- ☐ Qualitative and quantitative assessments of project performances
- ☐ Portfolio presentations of student work which demonstrate achievement of standards
- ☐ Classroom participation, individual and team effort, demonstrations of mastery, and quality of work
- ☐ Authentic Assessments; Professional and community evaluation of exhibitions of individual/group project work, including formative and summative assessments
- ☐ Exams and quizzes, including essay exam
- ☐ *As a team, students complete a K-W-L chart during the first week of the course in which they brainstorm everything they Know (K) for certain about Biomedical Science:*

Applied Anatomy and Physiology and everything they Wonder (W) or are curious about in the fields of biomedical science and applied anatomy and physiology. Then, as a team of Biomedical Science students, they use textbooks, the Internet, the library, professional experts, etc. to suggest ways they might Learn (L) what we need to know to turn our wonderments into knowledge. The teacher and students revisit the K-W-L chart each quarter and use it as part of summative assessment. Has the class/community of learners achieved its learning goals?

- ☐ *In the first few days, students individually assess on biomedical science knowledge and skills as well as indictors of college and career readiness. Over the course of the year students chart their growth toward mastery and use various assignments and course artifacts to provide evidence of growth and mastery. Evidence is included in each student's individual Biomedical Science Portfolio. Portfolios are reviewed by medical and bioscience professionals in addition to peer and teacher reviews. Each student also uses her/his portfolio in presenting a defense of learning related to the biomedical science course.*