Murrieta Valley Unified School District **Board Submission: March 2016**
HIGH SCHOOL COURSE OUTLINE

Course Title: Medical Biology

Department: Science

Course #: 3550

Grade Level/s: 9-12

Length of Course: Year

Prerequisite/s: Completion of Algebra and Geometry

UC/CSU (A-G) Req: (D) Laboratory Science

Brief Course Description: This course meets UC/CSU (D) laboratory and District life science graduation requirement. This course is designed to prepare the college-bound student for the rigors they will encounter as they enter college science courses and satisfies the laboratory science requirement for entrance into most colleges. The emphasis of study will be on human biological concepts and processes as they apply to various biological systems. This class differs from Biology in that there is an emphasis on human biological processes with lab activities based on medical related subject matter such as disease processes, cellular metabolism, and medical laboratory testing. Students will gain experience in the use of various scientific instruments, tools and measuring devices as well as the proper techniques for use. A minimum of 35% of class time will be spent on laboratory experiences.

I. GOALS

The students will:

A. Understand the scientific process and that biologists use this process when they study the natural world

B. Understand that science, technology and societal values are intertwined and every member of society has a responsibility in the use of science and technology for the good of all

C. Understand the use of the scientific method in medical procedures, diagnoses and research

D. Understand how to evaluate the validity of medical research articles

E. Understand the use and scientific application of a placebo

F. Understand the importance of technology and statistics in biomedical research

G. Use scientific literature and other appropriate sources for research and information (e.g., boiling point of water, famous scientists, causes of disease)

H. Understand and utilize control variables (e.g., uses a control when appropriate, dependent and independent variables)

I. Use scales and appropriate units (e.g., resolution, conversion) of measurement (e.g., meters, millimeters; standard and metric; degrees Celsius, Fahrenheit and Kelvin; calorie; light-years) for the degree of accuracy required

J. Understand the difference between scientifically valid and invalid sources

K. Understand the technological developments in the biomedical field and how they impact society (e.g., DNA fingerprinting, genetic engineering, cloning, organ transplant, in vitro fertilization, pharmacology, cancer and HIV/AIDS research and treatment, vaccines, antibiotics, biochemical warfare)

L. Understand the costs and budget implications of technological development (e.g., young/old; developing nations, underprivileged classes, plant and animal populations, various ecosystems)

M. Understand ethical responsibilities associated with scientific enterprise and appropriate use of new discoveries

N. Understand ethical concerns associated with scientific research (e.g., testing on animals, humans)

O. Understand ethical concerns associated with various scientific and technological developments (e.g., germ warfare, atomic bomb, genetic engineering, human cloning)

P. Develop research skills as it relates to the historical development of the modern practice of medicine (diagnostic and treatment) and procedures used within specific medical areas

Q. Increase scientific literacy skills and develop a medical vocabulary and apply the terminology to the study of the human anatomy and physiology

R. Understand the importance of clinical laboratory applications

II. OUTLINE OF CONTENT FOR MAJOR AREAS OF STUDY

Semester 1

A. Scientific Method (HS-ETS1)
   1. Steps in the scientific process (HS-ETS-2,3)
   2. Laboratory safety and skills
   3. Computer and technology integration

B. Cell Biology (HS-LS1)
   1. Atoms and their interactions
   2. Organic compounds

3. Prokaryotic and eukaryotic cells and viruses
4. Cell structures and functions

C. Energy Pathways (HS-LS1-5)
1. Photosynthesis
2. Cellular respiration and fermentation

D. Cell Reproduction
1. Mitosis (HS-LS1-4)

Semester 2

A. Genetics (HS-LS3)
1. Mendel's Laws and Punnett squares
2. Meiosis
3. DNA and RNA structures (HS-LS3-1)
4. Protein synthesis
5. Mutations
6. Patterns of inheritance
7. Recombinant DNA

B. Evolution (HS-LS4)
1. Fossil records
2. Natural selection and evidence of evolution
3. Darwin
4. Adaptations
5. Homologous structures
6. Comparative embryology
7. Mechanisms of evolution
8. Population genetics
9. Genetic drift
10. Speciation
11. Patterns of evolution

C. Physiology (HS-LS1)
1. Respiratory system
2. Bacteria and viruses
3. Immune system
4. Nervous system
5. Endocrine system

D. Ecology (HS-LS2)
1. Principles of Ecology
2. Communities and Biomes
3. Population Biology
4. Biological diversity and Conservation

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III. ACCOUNTABILITY DETERMINANTS

A. Key Assignments

1. The Scientific Process in Diagnosis Lab
   Students will learn about the scientific process as it applies to medical diagnoses. The activity is set up as patient rooms (stations) with 5 patients that require a diagnosis. Students will use inquiry and the scientific method to analyze patient symptoms and perform tests to determine a diagnosis for each patient.
2. Catalase Lab
   Students will study the catalase found in liver cells. Students will be using chicken or beef liver. It might seem strange to use dead cells to study the function of enzymes. This is possible because when a cell dies, the enzymes remain intact and active for several weeks, as long as the tissue is kept refrigerated. Students will use inquiry and the scientific method to analyze the function of enzymes.
3. Cell Specialization and Organ Systems
   Students have the opportunity to learn and observe the function of organ systems and the specialized cells that form those systems while diagnosing a medical condition affecting those systems. The lab is separated into 5 patients/stations, each including symptom comparison, cellular image comparison, and a diagnostic test. The body systems covered include digestive, immune, skeletal, nervous, and respiratory. Students observe how a disease localized to a single body system can affect and create symptoms in multiple body systems
4. Photosynthesis How Is It Important to Medicine?
   Students use a leaf disk assay to measure the rate of photosynthesis and observe oxygen as a product. The scenario is set-up to have the students compare three different leaf types that are being considered for the plant to be used in the process of creating a new diabetes medication. Their research team is responsible for determining which plant's leaves have the fastest rate of photosynthesis, and should therefore be used to create the medication. The background provides links to how the photosynthesis process can be used as a clean energy source to produce medications, and in photodynamic therapies to treat cancer and acne.
5. Aerobic and Anaerobic Conditions
   Students will have the opportunity to observe aerobic and anaerobic respiration in the human body. In Part A, students relate increases in pulse rate, body temperature and respiratory rate during exercise to the increased need for energy and the cycling of oxygen and carbon dioxide throughout the body. In Part B, students relate the presence of muscle fatigue to lactic acid produced through anaerobic respiration.
6. Biodiversity and Health
   Students will set up a collection area to examine biodiversity found in ecosystems surrounding the school. Students will also examine how changing conditions in a small ecosystem can impact biodiversity and individual populations. Following the activity, students will have the opportunity to research how pesticides can change conditions in an ecosystem and impact human health.
7. Evolution in Action: Antibiotic Resistance
   Students participate in a simulation which involves a medical lab team that works for HASPI Hope Hospital. Penicillin is an antibiotic commonly used at the hospital to treat skin infections. Recently, the staff has noticed a decline in the effectiveness of penicillin on Staphylococcus aureus infections. Two patients have just come to the hospital and

both are exhibiting symptoms of a "Staph" infection. Since antibiotic-resistant Staph infections can get worse quickly, the team has been asked to test the bacteria from both patients for resistance to penicillin.

B. Assessment Methods
   1. Daily Student Observation of Classroom Participation, Effort and Achievement
   2. Classwork/Homework
   3. Performance Tasks
   4. Laboratory Experiments, Reports and Assessments
   5. Projects
   6. Presentations
   7. Quizzes
   8. End of Unit Tests
   9. Semester Final Exams
   10. Completion of Biology Content Standard Test

IV. INSTRUCTIONAL MATERIALS AND METHODOLOGIES

A. Required Textbook(s)
   1. Nowicki, Stephen. *Biology*. McDougal Littell, 2008.

B. Supplementary Materials
   1. Mader, Sylvia S. *Human Biology*, McGraw-Hill Education, 1988.
   2. www.Aris.mhhs.com
   3. www.HASPI.org

C. Instructional Methodologies
   1. Hands-on learning opportunities using tools and scientific equipment
   2. Direct instruction
   3. Guided Inquiry
   4. Discourse
   5. Laboratory Activities and Projects
   6. Interactive Tools
   7. Presentations, Exhibits and Competitions
   8. Self-Directed, Cooperative and Collaborative Learning
   9. Problem-Based Learning
   10. Visual Representations and Concrete Models
   11. SDAIE (Specially Designed Academic Instruction in English) methods