

Verona Public School District Curriculum Overview

Medical Biology - Part A



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Supervisor:
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Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

This semester course is a hands-on, lab-oriented class designed for those students interested in the field of medicine. To be successful, students should have a strong understanding of the concepts covered in Biology; such as Body Systems, Cell Biology, Genetics and Evolution. Students will learn through simulations, case studies and many hands-on investigations. This course will emphasize scientific and critical thinking coupled with exposure to technical writing and effective communication of research findings. The lessons in this course encourage students to think about the relationships among knowledge, choice, behavior, and human health. The semester will be divided into two units of study: Infectious Disease and Immunology, and Biochemistry and Nutrition.

Emerging infectious diseases can arise when changes in human behavior open new routes of disease transmission, or when microbes that are adapted for other hosts or environments acquire an ability to infect humans. The ecology of Earth has been dramatically impacted by the intense economic and social activities of a burgeoning human population. This part of the course will survey a wide range of human pathogens and relate their emergence to environmental, human, and microbiological factors. Specific organisms will be studied in depth to illustrate microbial threats as well as epidemiological investigations, research, vaccine development, and other strategies deployed to control disease emergence and spread. Finally, the principles covered in the class will be applied to a discussion of socioeconomic vulnerabilities to several infectious agents that may emerge.

The second half of the semester focuses to prepare students to understand how carbohydrates, fats and proteins function in the body; how each macronutrient, alone and when combined, undergoes integrated metabolism within tissues; and how the macronutrients integrate to affect overall metabolism, disease risk and recovery. Students will be exposed to cases studies and labs to further their knowledge of the material discussed in class.

Prerequisite(s):
Biology

Standard 8: Technology Standards

8.1: Educational Technology: <i>All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.</i>	8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming: <i>All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.</i>
A. Technology Operations and Concepts B. Creativity and Innovation C. Communication and Collaboration D. Digital Citizenship X E. Research and Information Fluency X F. Critical thinking, problem solving, and decision making	A. The Nature of Technology: Creativity and Innovation B. Technology and Society X C. Design D. Abilities for a Technological World E. Computational Thinking: Programming

SEL Competencies and Career Ready Practices

Social and Emotional Learning Core Competencies: <i>These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities</i>	Career Ready Practices: <i>These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.</i>
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.	X CRP2. Apply appropriate academic and technical skills. X CRP9. Model integrity, ethical leadership, and effective management. CRP10. Plan education and career paths aligned to personal goals.
Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.	X CRP3. Attend to personal health and financial well-being. X CRP6. Demonstrate creativity and innovation. X CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. X CRP11. Use technology to enhance productivity.
Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.	X CRP1. Act as a responsible and contributing citizen and employee. X CRP9. Model integrity, ethical leadership, and effective management.
Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.	X CRP4. Communicate clearly and effectively and with reason. X CRP9. Model integrity, ethical leadership, and effective management. X CRP12. Work productively in teams while using cultural global competence.
Responsible decision making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.	X CRP5. Consider the environmental, social, and economic impact of decisions. X CRP7. Employ valid and reliable research strategies. X CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. X CRP9. Model integrity, ethical leadership, and effective management.

Standard 9: 21st Century Life and Careers

9.1: Personal Financial Literacy: <i>This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.</i>	9.2: Career Awareness, Exploration & Preparation: <i>This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.</i>	9.3: Career and Technical Education: <i>This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.</i>
A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing X E. Becoming a Critical Consumer F. Civic Financial Responsibility X G. Insuring and Protecting	A. Career Awareness (K-4) B. Career Exploration (5-8) X C. Career Preparation (9-12)	A. Agriculture, Food & Natural Res. B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services K. Information Technology L. Law, Public, Safety, Corrections & Security M. Manufacturing N. Marketing X O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Course Materials

Core Instructional Materials: <i>These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.</i>	Differentiated Resources: <i>These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.</i>
<ul style="list-style-type: none"> Teacher developed materials 	<ul style="list-style-type: none"> Don't drink the water: Investigating a Cholera Epidemic - case study viewing, followed by a lab CNN - articles on different infectious diseases - student analysis and reflection CDC - reading of published cases - students analysis, reflection and discussion of different findings Naegleria and graphing assignment - plotting of temperature and cases throughout a 30 year span HIV case study THE VACCINE WAR: The Growing Debate Over Vaccine Safety Homeostasis Heart Rate Lab Cardiovascular Case Study Diabetes Case Study - analysis or different patients with a reflection



Unit Title / Topic: Infectious Diseases and Immunology

Unit Duration: 10 weeks

Stage 1: Desired Results

Established Goals:

To explore viruses/infectious diseases, how they can infect the human body, compromise the immune system, and interfere with normal human body functions.

Transfer Goal:

Students will be able to independently use their learning to understand what causes infectious diseases, which ultimately leads them to know what makes us sick and sometimes cause us to die; or how viruses can mutate in humans, and ultimately how they can be prevented and controlled.

Students will understand that:

- We are alive (not rotting) because of a defense system
- The body naturally defends itself against infection
- Certain events or circumstances contributed to outbreaks in the past
- Characteristics of viruses vs. bacteria are different and their role in infectious disease
- Natural selection determines the differential survival of groups of organisms
- Herd immunity can help prevent large epidemics.
- Communicable disease can be controlled by immunization.
- Vaccination protects an individual from infectious diseases.

Essential Questions:

- Why am I not rotting right now?
- What causes diseases?
- How has the development of society influenced the evolution of microorganisms?
- What can be learned from studying past viruses?
- What is the effect of human intervention on the evolution of microorganisms?

Students will know:

Concepts:

- Natural Selection (selective advantage and selective disadvantage, selection pressure)
- Epidemiology and its use investigating an outbreak
- Dose Dependency (range of tolerance)
- It is easy to kill a pathogen that is different from the host without side-effects
- Match the cure/treatment to the disease
- Recognize the strengths and limitations of various defenses against disease, including vaccines and antibiotics.
- The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism. Many diseases can be prevented, controlled, or cured.
- How to analyze different methods of control the spread of pathogenic microorganisms
- How to evaluate potential causes and methods of transmitting infections and how to apply standard precautionary guidelines.
- A great diversity of species increases the chance that at least some organisms survive major changes in the environment.
- What epidemiologist must do to investigate the cause of an epidemic.
- Path of a virus from an animal to the first human host
- The role of antibodies in the body's response to infection.
- Develop an understanding of how disease is transmitted in a population with and without vaccination
- Genes and genome sequence, and viruses
- Synthesize information from class and other sources to produce a class presentation

Content:

- Different modes of transmission and strategies to interrupt transmission
- Bell curve
- Antibody / antigen interaction
- Superbugs
- Bacterial anatomy/physiology
- Viral anatomy/physiology
- Protozoan anatomy/physiology
- flatworm and roundworm anatomy/physiology

Students will be able to:

- culture bacteria
- perform a gram stain
- streak plates
- diagnose a particular disease from a case presentation
- practice appropriate cleaning, disinfecting, and sterilizing processes
- know the steps that are taken to conduct an epidemic investigation, particularly for an unknown disease
- consider the balance between individual choice and public good involved in the topic of vaccination

Stage 2: Acceptable Evidence

Transfer Task:

Students will be assigned a "patient" who is coming in with a possible illness. Using skills accumulated throughout our time, they will need to diagnose their patient (this needs to be worked on) - did not want to forget my train of thinking

Stage 3: Activities to Foster Learning

Learning Activities:

- 1) Mock spreading of a disease among the students in the classroom, followed by a class discussion
- 2) **Cooperative Lesson: "Opening scenario" on *Catching a Fever*** - students share their thoughts on to the question and why they came up with i
- 3) Notes on how infection occurs in humans and what the chain of infection is from person to person.
- 4) Cooperative Groups: *The Chain of Infection* Students are to read the two descriptions of pathogens (E. Coli and Influenza) and identify certain parts of that pathogen - INTERNET needed; sites provided to students
- 5) **Quiz:** Chain of Infection based on a case scenario
- 6) LAB: Don't drink the Water: PART I - Outbreak in a School - students will need to figure out what has caused the outbreak
- 7) **ASK:** What is epidemiology? Discussion on its importance in a scientific field
- 8) Outbreak confirmation: Cholera - what is it? How is it spread?
- 9) LAB: Don't drink the Water: Investigating the Cholera Epidemic - Part II, followed by a post lab discussion
- 10) VIEWING: BBC documentar of Cholera in Haiti - class discussion; followed by a homework assignment question on google classroom
- 11) Outbreak - viewing of mini-clips discussing the topic: "
- 12) **Springboard Activity:** mini-inquiry about viruses and bacteria - detailed picture of viruses and bacteria (unknown)
- 13) ASK: What do you know about viruses and bacteria?
- 14) Notes: an initial lecture to students describing bacteria and viruses and highlighting the differences between them (images need to be provided)
- 15) Research Project: students will research a bacterial or viral pathogen - playing cards will be created by the students (assignment hand-out, with a rubric)
- 16) Playing Card Game
- 17) Closure Activity: Re-direct students attention to the question originally asked; correct inaccurate items on the list, discuss why these thoughts are being revised based on the information discovered in the game
- 18) ASK: What are fomites? - short lesson of what it is and examples of it
- 19) LAB: Fun with Fomites
- 20) Lecture: Natural selection and its role in antibiotic resistance?
- 21) ASK: What do Epidemiologists do? What are their role? Lecture on the difference between infectious diseases vs. environmental diseases
- 22) Case Studies: Food Borne, Cholera and Leukemia
- 23) Introduction: Mumps!!!!!! - students read a clip from CNN about the mumps outbreak in several states
- 24) Class discussion about the rise of the mumps on college campuses
- 25) Discussion: To vaccinate or not to vaccinate, followed by notes on vaccination and what it does
- 26) Clarify misconceptions: students may believe that vaccination only protects against diseases caused by viruses. However, there are vaccines for many diseases
- 27) Simulating Disease Transmission On-line Simulation???? --> check at home to see if this possible
- 28) Viewing: Frontline: *The Vaccine War* - A Trip to Ashland, Oregon - students will create a T-chart: Favors/Opposes Vaccines
- 29) Homework: Students should answer the following questions: What perspectives of vaccinating children are presented in this segment? Why do some parents choose not to vaccinate their children? What might be some consequences of their choices? Support your thoughts with some evidence
- 30) *Infectivus* Simulation (3 Day lab, followed by post-lab discussion questions)
- 31) EBOLA!!! - simulation of an epidemiologic triangle
- 32) As a class, we will read excerpts on the "Hot Zone" → thoughts from students, reactions?
- 33) Notes: Agent, Host and Environment
- 34) Pose the following for the students: "'The single biggest threat to man's continued dominance on the planet is the virus.' Joshua Lederberg, Ph.D., Nobel Laureate" - thoughts on this?
- 35) Movie excerpts from the movie: *Outbreak*, discussion after each specific clip
- 36) At the end, students are to revisit the original quote, what are their thoughts now?
- 37) Closure: Why viruses are thought to be one of the greatest threats to human dominance of the planet?
- 38) In groups, students will need to create a targeted strategy to contain the Ebola outbreak - students must remember the epidemiologic triangle and all that is involved
- 39) Homework: Students will read "1918 Flu Virus Is Resurrected"
- 40) Is this article a FACT or based on opinion - students will need to support their thoughts
- 41) Cooperative Groups: Students should read "Recipe for Destruction" and "1918 Flu and Responsible Science" - how does this tie into the student's assignment?
- 42) Viewing: PBS special on the 1918 Flu
- 43) ASK: Has government bureaucracies interfered with publication of scientific research? → Class share their thoughts
- 44) Cooperative Group: Is it proper to reconstruct this deadly virus in a lab? What are the benefits and risks of this project?
- 45) Notes: What is an epidemic? Discussion of factors that affect epidemics; how have social factors played a role in epidemics - provide examples to students to see if they can identify the social factor
- 46) Presentation: Students will provide an in-depth overview of a single communicable disease - requirements and rubric will be given at about the 5th week, along with one in-class period to be used as time for research and teacher-to-student mentoring



Unit Title / Topic: Nutrition and its Importance to the Human Body

Unit Duration: 10 weeks

Stage 1: Desired Results

Established Goals:

To teach students what nutrition looks like, why it is so vitally important, and how it can be implemented in their lives

Transfer Goal:

Students will be able to independently use their learning to make nutritious food choices consistently and make nutrition a part of their everyday lives.

Students will understand that:

- feedback mechanisms maintain homeostasis
- cellular respiration is a chemical process resulting in a transfer of energy
- biological macromolecules' role in health and human development
- proper caloric intake for specific macro/micro nutrients
- obesity is a risk factor for many diseases and disorders
- metabolism is the sum total of all chemical reactions in a living system
- Metabolism is a balance of making and breaking compounds (anabolic reactions and catabolic reactions respectively)

Essential Questions:

- What is food doing to both my mind and body?
- Should we care about what we eat?
- What is "good" nutrition?
- What would it be like to be a sugar molecule moving in and out of the cell?
- Why does my body require a balance of organic macromolecules?

Students will know:

Concepts:

- homeostasis
- positive/negative feedback
- dose dependency
- 1st law of thermodynamics

Content:

- cellular respiration
- biochemical metabolism
- enzymes affect the rates of reactions
- function and process of the digestive system
- causes of obesity
- there are four types of biological macromolecules.
- BMI

Students will be able to:

- Distinguish between positive and negative feedbacks
- state the inputs and outputs of cellular respiration
- identify a macromolecule based on its physical and/or chemical properties
- calculate % calories of macromolecules of various foods
- evaluate the health effects of various foods on humans
- calculate BMI and ideal body weight
- identify the function of the four types of organic compounds
- summarize the importance of enzymes in living organisms

Stage 2: Acceptable Evidence

Transfer Task

As a hospital dietician, it is your job to monitor the types of foods given to your patients. A doctor has recently written an order for a low-carbohydrate diet in order to maximize wound healing. Your task is to identify the types of macromolecule found in variety of foods that you are suggesting for the patient and determine which foods can be safely consumed by your patient.

Stage 3: Activities to Foster Learning

Learning Activities:

- 1) Opening: Learning Scenario for students to see and discuss; post-discussion: What is the importance of nutrition for all living things?
- 2) Ask: Homeostasis - what is it? What is its importance?
- 3) Notes: Homeostasis, Positive and Negative Feedback - provide examples - Bozeman (Homeostasis)
- 4) LAB: Homeostasis and Heart Rate Lab - students are to plan and conduct the investigation, followed by a post-lab discussion
- 5) ASK: What are macromolecules? Why are they vital for living things?
- 6) NOTES: Macromolecules, with examples for each
- 7) LAB: Testing Organic Compounds (Part A)
- 8) ASK: Enzymes - what are they? Why are they important?
- 9) LAB: Enzyme in Action (choose which one you want to do)
- 10) NOTES: Food Calories
- 11) Homework: Your Macromolecule Consumption (students will need to create a diet journal for two days)
- 12) LAB: Your Macromolecule Consumption Data Analysis - calculations, followed by class discussion how our results are similar/different to other countries...why?
- 13) Individual Work: Students will calculate the calories they burned using the data they had collected from their homework assignment, followed by graphing all sets of data - post discussion of follow up questions asked from students
- 14) HW: View TED videos: What's Wrong with what you Eat? and Teach Every Child to Eat - answer questions that follow
- 15) Introduction to Case Studies: "Billy's dilemma" - class discussion of what he is doing correct or incorrect?
- 16) Internet: Introduce students to MyPyramid Tracker - accessing what is being taken in and what of it is needed for the body
- 17) Group Work: Case Studies on three different individuals with their sample diet; students analyze the sample daily menu by calculating the percent difference between the amount of each nutrient that is recommended for good health and the amount of each nutrient that the person in the case is getting based on the sample daily menu
- 18) Digestion Simulation - **Look further into this idea**
- 19) Ask: What makes someone considered to be "obese" ?
- 20) What is BMI? How do doctors/nurses calculate this? Why is it important? - class discussion, followed by examples
- 21) LAB: Biometrics
- 22) WATCH: Supersize Generation, Kids and Obesity - discussion followed
- 23) Homework: Obesity Web Research, followed by class discussion on the following day
- 24) ASK: Why makes a good snack? What type of snacks do students normally eat? What are their nutritional value?
- 25) Notes: Types of groups of snacking; empty calorie snacks - what is that? Why are we addicted to them?
- 26) Class Activity: Using Food-a-Pedia to compare sample foods against each other - between calories and empty calories
- 27) Homework: Students will analyze, review, and compare their favorite snack items using Food-A-Pedia - review the following class meet.
- 28) Presentation of their transfer task