

Winslow Township School District
Microbiology Lab CP (Semester Course)

Unit 4: Microbial Growth

Overview: In this unit students will develop their understanding of the microbial growth in a lab setting on different types of media. Students are expected to continue to demonstrate proficiency in developing and using models and analyzing and interpreting data from labs conducted in the classroom. Students are also expected to demonstrate their understanding of the core ideas through identification of the key sterile techniques and methods for measuring cell growth.

| Overview | Standards for Science | Unit Focus | Essential Questions |
|--|--|--|---|
| <p>Unit 4</p> <p>Microbial Growth</p> | <ul style="list-style-type: none"> • HS-LS1-2 • HS-LS1-3 • HS-ETS1-4 • WIDA 1, 4 | <ul style="list-style-type: none"> • Sterile techniques of bacterial growth • Classification of microbes on the basis of temp. range • Distinguish between different media • Differentiate biosafety levels 1, 2, 3, and 4 • Methods of measuring cell growth • Physical and chemical methods of microbial control | <ul style="list-style-type: none"> • Why is using sterile techniques important to growing bacteria in a lab setting? • Why is it not “one size fits all” when it comes to the type of media for bacterial growth? |
| <p><i>Unit 4: Enduring Understandings</i></p> | <ul style="list-style-type: none"> • Cytoplasmic inclusions within the cytoplasm are characterized by a granular appearance and vary based on cell type. • Culture media can vary in many ingredients allowing the media to select for or against microbes. (most common = nutrient broths and agar plates) • Differential media or indicator media distinguish one microorganism type from another growing on the same media. • Bacteria grow to a fixed size and then reproduce through binary fission which a form of asexual reproduction. Under optimal conditions, bacteria can grow and divide extremely rapidly. • Counting the number of colonies that arise on a pour plate can calculate the concentration by multiplying the count by the volume spread on the pour plate. • Controlling microbial growth is important in the medical field, pharmaceutical and biotechnology industries, academic research, and food industry. • The degree of acceptable microbial presence can differ based on the circumstances. Sterilization as a definition means that all life was terminated, whereas sanitization and disinfection terminates selectively and partially. • Chemical agents that can eliminate or suppress microbial life are separated in different groups based on their use. The major groups are disinfectants, antiseptics, and antibiotics. • Antibacterials are divided into two broad groups according to their biological effect on microorganisms: bactericidal agents kill bacteria, and bacteriostatic agents slow down or stall bacterial growth. | <ul style="list-style-type: none"> • Why are there different biosafety levels when it comes to bacterial growth? • How do you determine the amount of cell growth? | |

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| Curriculum Unit 4 | Standards | | Pacing | |
|---|------------------------------------|--|---------------|------------------|
| | | | Days | Unit Days |
| Unit 4: Microbial Growth | HS-LS1-2 | Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. | 3 | 14 |
| | HS-LS1-3 | Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. | 3 | |
| | HS-ETS1-4 | Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. | 2 | |
| | Assessment, Re-teach and Extension | | 2 | |
| | Midterm | | 2 | |

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| Unit 4 - Microbiology Lab CP | | |
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| Disciplinary Core Ideas | Indicator # | Indicator |
| <p>LS1.A: Structure and Function All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.) Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)</p> <p>ETS1.B: Developing Possible Solutions Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)</p> | HS-LS1-2 | Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. |
| | HS-LS1-3 | Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. |
| | HS-ETS1-4 | Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. |

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Assessment Plan

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| <ul style="list-style-type: none"> • Exploratory activities • Warm-up/Ticket Out activities • Class discussions • Student Participation • Teacher Observations • Virtual/Hands-On Labs • Self-Test Assessments • Staining Comparison Chart • Clinical Case Study Analysis | <ul style="list-style-type: none"> • Quizzes and Tests (Chapter 6/7 of “Microbiology: An Introduction, 11th edition” by Tortora, Funke, and Case) • Authentic assessments and projects • Exploratory activities • Presentations • Lecture Notes • Think-Pair-Share • Graphic Organizers • Study Questions at the end of each chapter • Multiple Choice and Critical Thinking at the end of each chapter |
| Resources | Activities |
| <ul style="list-style-type: none"> • Chromebooks • Textbook (“Microbiology: An Introduction, 11thed” Tortora, Funke, and Case) • Web Quests • Virtual Field Trips • Video Streaming • BrainPOP • Puzzlemaker: Game Based Learning Discovery Education <p>Diversity, Equity & Inclusion Educational Resources https://www.nj.gov/education/standards/dei/</p> | <ul style="list-style-type: none"> • Use various forms of expository writing-procedural writing, narrative writing, descriptive writing, labeling, as well as to create visuals, graphs, tables, diagrams and charts. • Use scientific argumentation with exercises on writing claims, using evidence to support your claim and explaining the reasoning behind their claim. • Mini-lessons • Independent reading • Films • Website exploration • Discussions, dialogues • Debates • Laboratory experiments • Partner or small group work • Student presentations, reports, journals, reflections • In-class assessments • Written reports, essays, research, and homework |

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Instructional Best Practices and Exemplars

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|--|--|
| <ol style="list-style-type: none"> 1. Identifying similarities and differences 2. Summarizing and note taking 3. Reinforcing effort and providing recognition 4. Homework and practice 5. Nonlinguistic representations | <ol style="list-style-type: none"> 6. Cooperative learning 7. Setting objectives and providing feedback 8. Generating and testing hypotheses 9. Cues, questions, and advance organizers 10. Manage response rates |
|--|--|

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills

The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language. Additional opportunities to address 9.1, 9.2 & 9.4:

Philadelphia Mint

<https://www.usmint.gov/learn/kids/resources/educational-standards>

Different ways to teach Financial Literacy.

- <https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/>9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJLSA.W1, 7.1.AL.PRSNT.4).
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
- 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

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Modifications for Special Education/504

Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignment. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

- Small group instruction
- Audio books/ Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Modeling and guided practice
- Read directions aloud
- Repeat, rephrase and clarify directions
- Extended time as needed
- Break down assignments into smaller units
- Provide shortened assignments
- Modify testing format
- Repeat directions as needed
- Graphic organizers
- Study Guides, Study Aids and Re teaching as needed

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Modifications for At-Risk Students

Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations

- Audio books and Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Extended time as needed
- Read directions aloud
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Recognize success
- Provide timelines for work completion
- Break down multi-step tasks into smaller chunks
- Provide copy of class notes and graphic organizer

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| English Language Learners | Modifications for Gifted Students |
|---|--|
| <p>All WIDA Can Do Descriptors can be found at this link: https://wida.wisc.edu/teach/can-do/descriptors</p> <p>Grades 9-12 WIDA Can Do Descriptors...</p> <p><i>Listening...</i></p> <ul style="list-style-type: none"> • Process <u>recounts</u> by... <ul style="list-style-type: none"> ○ Categorizing perspectives of multiple speakers ○ Identifying important information on specific event & concept from lecture/presentation • Process <u>explanations</u> by... <ul style="list-style-type: none"> ○ Recognizing specific language used to enhance clarity and precision ○ Recognizing and following language related to the same event or phenomenon throughout presentations • Process arguments by... <ul style="list-style-type: none"> ○ Identifying strengths, limitations, and potential biases from oral presentations ○ Organizing claims and counter claims presented in debates <p><i>Speaking...</i></p> <ul style="list-style-type: none"> • <u>Recount</u> by... <ul style="list-style-type: none"> ○ Adjusting presentation style, degree of formality, word choice, tone, and information to the context and audience ○ Presenting information that follows discipline specific organization (e.g., orientation to topic, sequence of events, conclusion) • <u>Explain</u> by... <ul style="list-style-type: none"> ○ Providing precision and accuracy in classifications, procedures, processes, and accounts using abstraction, technical language, and a variety of active/passive verb forms ○ Following discipline-specific organization (e.g., orienting the reader, details, conclusion) and supporting presentations with graphs, formulas, quotes or other media • <u>Argue</u> by... <ul style="list-style-type: none"> ○ Organizing claims and counter claims in debates with evidence from multiple sources ○ Negotiating differing cultural perspectives in pairs or small groups <p><i>Reading...</i></p> <ul style="list-style-type: none"> • Process <u>recounts</u> by... <ul style="list-style-type: none"> ○ Analyzing and comparing how authors use language for specific purposes and audiences ○ Identifying how authors develop and maintain cohesion by connecting ideas or events in extended texts • Process <u>explanations</u> by... <ul style="list-style-type: none"> ○ Recognizing discipline-specific patterns (e.g., orienting the reader, part-whole classification, neutral/ authoritative tone) ○ | <p>Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic.</p> <ul style="list-style-type: none"> • Raise levels of intellectual demands • Require higher order thinking, communication, and leadership skills • Differentiate content, process, or product according to student’s readiness, interests, and/or learning styles • Provide higher level texts • Expand use of open-ended, abstract questions • Critical and creative thinking activities that provide an emphasis on research and in-depth study • Enrichment Activities/Project-Based Learning/ Independent Study <p>Additional Strategies may be located at the links:</p> <ul style="list-style-type: none"> ❖ Gifted Programming Standards ❖ Webb’s Depth of Knowledge Levels and/or Revised Bloom’s Taxonomy ❖ REVISED Bloom’s Taxonomy Action Verbs |

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- Identifying authors' precision and accuracy in classifications, comparisons, accounts, or procedures as a result of clear language choices
- Process arguments by...
 - Evaluating word choice and nuance as tools for distinguishing facts, claims, reasoned judgment, and opinions
 - Identifying the logical connections among claims, counterclaims, reasons, and evidence

Writing...

- Recount by...
 - Summarizing content-related notes from lectures or readings
 - Producing research reports using multiple sources of information
- Explain by...
 - Developing ideas about phenomena with relevant and sufficient facts, extended descriptions, concrete details, or quotations
 - Maintaining discipline-specific patterns that bridge across key uses (e.g., explanation to argument in history, explanation to recount for information reports)
- Argue by...
 - Evaluating positive and negative implications associated with various positions (e.g., historical events, scientific discoveries, individuals)
 - Organizing information logically and coherently to represent contrasting views

Oral Language...

- Discuss by...
 - Identifying and reacting to subtle differences in speech and register (e.g., hyperbole, satire, comedy)
 - Producing coherent oral discourse appropriate to task, purpose, and audience
 - Synthesizing and sharing information from a variety of sources and perspectives

Students will be provided with accommodations and modifications that may include:

- Relate to and identify commonalities in Social Studies and science in student's home country
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Teacher Modeling
- Peer Modeling
- Label Classroom Materials - Word Walls

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Interdisciplinary Connections

English Language Arts/Literacy

1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **RST.11-12.1** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6)
2. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **RST.11-12.7** (HS-LS2-6)
3. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **RST.11-12.8** (HS-LS2-6)
4. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **RST.11-12.9** (HS-ETS1-1),(HS-ETS1-3)
5. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **WHST.9-12.2** (HS-LS2-1),(HS-LS2-2)
6. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **WHST.9-12.7** (HS-LS1-3)
7. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. **WHST.11-12.8** (HS-LS1-3)
8. Draw evidence from informational texts to support analysis, reflection, and research. **WHST.9-12.9** (HS-LS1-1)
9. **WIDA Standards 1** English language learners communicate for social and instructional purposes within the school setting
10. **WIDA Standards 4** English language learners communicate information, ideas, and concepts necessary for academic success in the content area of science
11. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **SL.11-12.5** (HS-LS1-2)

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Mathematics

1. Reason abstractly and quantitatively. **MP.2** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6)
2. Model with mathematics. **MP.4** (HS-LS2-1),(HS-LS2-2)
3. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **HSN.Q.A.1** (HS-LS2-1),(HS-LS2-2)
4. Define appropriate quantities for the purpose of descriptive modeling. **HSN.Q.A.2** (HS-LS2-1),(HS-LS2-2)
5. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **HSN.Q.A.3** (HS-LS2-1),(HS-LS2-2)
6. Represent data with plots on the real number line. **HSS-ID.A.1** (HS-LS2-6)
7. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **HSS-IC.A.1** (HS-LS2-6)

Integration of Computer Science and Design Thinking NJSL 8

- 8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.
- 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
- 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
- 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
- 8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
- 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
- 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.