Course Title:	**Biology IA:** **CELL BIOLOGY AND MICROBIOLOGY**
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Cycle/Division:	High School
Grade Level:	Grade 10
Credit Unit:	1
Duration:	2 semesters / 5 periods per week

Department's Vision:	Create Innovators who can link to life, with scientific understanding and learning.
Department's Mission:	Provide students with the proper knowledge, skills and scientific principles through hands on activities, research and experimentations, and thus creating young innovators who are ready for real life challenges and problem solving.

COURSE DESCRIPTION:

This course covers basic cell biology, microorganisms, and ecology. Emphasis is on biological chemistry, cell structure and function, cellular metabolism, genetics, energy cycling in an ecosystem, groups of microorganisms, their structure, physiology, genetics, microbial pathogenicity, infectious diseases, immunology, and selected practical applications, and other related topics. Laboratory exercises focus on basic biological investigations and microscope technique with a term lab theoretical and practical assessment.

General Goals:

Understand the importance of biology in our lives and the characteristics of life starting with the cell.

Understand photosynthesis, respiration, and fermentation and how the cell reproduces by mitosis or asexual reproduction.

Understand ecology and the cycling of matter and food in food webs and chains.

Know the differences among different prokaryotes such as bacteria, archaea and Protists and how they act as pathogens comparing their mechanisms to viruses.

Skill Oriented Goals :

Evaluation skills: making judgment about knowledge by introducing new text to solve and tackle problems using the related knowledge taught.
Comprehension: given scientific text or diagrams to analyze and answer questions about, summarize, compare, relate, or experiment...
Communication and social skills: Making movies, ppt., projects, interviews, and presenting the work either individually or with a peer or as a group.
Investigative skills: lab work, research, journals, experimentation...
Mathematical skills: related to investigations in the lab and application in projects.
Technological skills used in science and computer labs.
Knowledge skills: list, define, show, demonstrate, invent, relate etc… using the taught concepts.

GENERAL COURSE LEARNING OBJECTIVES:

1. Describe the diversity of life in the habitats of Earth.
2. List the characteristics of life.
3. Explain the interdependence of organisms in an ecosystem.
4. Identify ways organisms use to maintain homeostasis in their environments.
5. Summarize why evolution is an important theme in biology.
6. Explain how living things are diverse yet have unity.
7. Explain how living things are diverse yet have unity.
8. Outline the main steps of the scientific method.
9. List the elements of a controlled experiment.
10. List the elements of a controlled experiment.
11. Explain when a set of hypotheses become a theory.
12. Describe the importance of tools in scientific researches.
13. Describe the importance of imaging processes in medicine.
14. Identify the use of computers in science.
15. Explain the relationship between molecular genetic tools and biological studies.
16. Describe the unique bonding properties of carbon atoms.
17. Compare the structure and functions of the different types of organic compounds.
18. Describe the parts of a chemical reaction.
19. Describe the energy flow during reactions.
20. Describe the role of catalysts.
21. Describe the role of enzymes in reactions.
22. Review the parts of animal and plant cells.
23. Explain how equilibrium is established as a result of diffusion.
24. Describe simple diffusion through the cell membrane.
25. Distinguish between diffusion and osmosis.
26. Explain how substances cross the cell membrane by facilitated diffusion.

27. Distinguish between passive transport and active transport.
28. Compare endocytosis and exocytosis.
29. Explain how the breaking down of ATP supplies energy to drive chemical reactions.
30. Distinguish between chemosynthesis and photosynthesis.
31. Explain why almost all producers depend on photosynthesis.
32. Describe the role of chloroplast, chlorophyll and other pigments in photosynthesis.
33. Summarize the main reactions that occur during photosynthesis.
34. Summarize the main reactions that occur during photosynthesis.
35. Describe the role of cellular respiration in ATP production.
36. Identify the main steps of cellular respiration.
37. Describe the relationship between cellular respiration and photosynthesis.
38. Describe the relationship between cellular respiration and photosynthesis.
39. Differentiate between the main steps of fermentation and cellular respiration.
40. Distinguish between lactic acid fermentation and alcoholic fermentation.
41. Describe the importance of cell differentiation.
42. Describe the difference between different types of pathogen.
43. Describe why viruses are not considered living organisms.
44. Describe the basic structure of viruses.
45. Describe how viruses are classified.
46. Explain how RNA and DNA viruses are replicated.
47. Identify some viral diseases, their causes, symptoms and treatments.(figure 3-4)
48. Explain the phylogenetic relationship between the domains Archaea, bacteria, and eukarya.
49. Identify the habitats of Archaea.
50. Classify bacteria according to their shape and cell wall structure.
51. Describe the internal and the external structure of prokaryotic cells.
52. List three types of genetic recombination that prokaryotes use.
53. Describe the uses of bacteria in ecosystem, medicine and industry.
54. Describe the ways bacteria can cause diseases.
55. Explain how bacteria can develop resistance to antibiotics.
56. Identify some bacterial diseases, their causes, symptoms and treatments.
57. Describe the evolution of antibiotic resistant bacteria.
58. Describe the changes occurring during the cell cycle.
59. Distinguish between mitosis and cytokinesis.
60. Relate the cell size to cell division.
61. Describe the changes occurring during the cell cycle.
62. Distinguish between mitosis and cytokinesis.
63. Relate the cell size to cell division
64. Describe the structure of a chromosome.
65. Identify the differences in structure between prokaryotic chromosomes and eukaryotic chromosomes.
66. Compare the number of chromosomes in different species.
67. Summarize the events of interphase.
68. List the events of mitosis.
69. Summarize the events that occur during mitosis

70. Summarize the events that occur during mitosis
71. Describe the control of the cell cycle.
72. Explain how differentiation in stem cells is important for multicellular organisms.
73. Compare the number of chromosomes in different species.
74. Explain the difference between sex chromosomes and autosomes.
75. Distinguish between haploid and diploid cells.
76. Define ecology, ecologists, and summarize the levels of organization they study.
77. Know producers and consumers and compare photosynthesis to chemosynthesis.
78. Identify the relations in a food chain and food web.
79. Identify different cycles of matter.
80. Identify 2 different kinds of pyramids and explain their relation to food.
81. Know the concepts of habitats and niche and the difference between exclusion and equivalents.

STANDARDS/BENCHMARKS:

Structure and Function

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Matter and Energy in Organisms and Ecosystems

HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. **

HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Interdependent Relationships in Ecosystems
HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new
ecosystem. **
HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* **
HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. **

Inheritance and Variation of Traits
HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Natural Selection and Evolution
HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Engineering Design

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
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.

RESOURCES:

HOLT Biology book and online resources
One Stop Planner, Linked Lesson presentations, Extended Visual Labs
You Tube movies
E-games and links
Teacher's Extended Handouts
Lab Handouts

COURSE OUTLINE:

Chapter 1

Section 1: The Study of Life

Section 2: Unifying Themes 0f Biology

Section 3: Scientific Thinking and Processes

Section 4: Biologists' Tools and Technology

Chapter 2

Section 3: Carbon-Based Molecules

Section 4: Chemical Reactions

Section 5: Enzymes

Chapter 3

Section 1: Cell Theory

Section 2: Cell Organelles

Section 3: Cell Diffusion

Section 4: Diffusion and Osmosis

Section 5: Active Transport, Endocytosis, and Exocytosis.

Chapter 4

Section 1: Chemical Energy and ATP

Section 2: Overview of Photosynthesis

Section 4: Overview of Cellular Respiration

Section 6: Fermentation

Chapter 5:

Section 1: The Cell Cycle

Section 2: Mitosis and CytoKinesis

Section 4: Asexual Reproduction

Section 5: Multicellular Life

Chapter 13:

- Section 1: Ecologists study relationships
- Section 2: Biotic and Abiotic Factors
- Section 3: Energy in Ecosystems
- Section 4: Food Chains and Food Webs
- Section 5: Cycling of matter
- Section 6: pyramid Models

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Chapter 14:

- Section 1: Habitat an d Niche
- Section 2: Community Interactions

Chapter 18

- Section 1: Studying Viruses and Prokaryotes.
- Section 2: Viral Structure and Replication
- Section4: Bacteria and Archaea
- Section 5: Beneficial Roles of Prokaryotes
- Section 6: Bacterial Diseases and Antibiotics

GRADING:

1. Quizzes /tests are given every other week as assigned by school. **Our tests and assessments** consist of multiple-choice, short answer, direct application problems, critical thinking situations, refer to figures, texts, graphs and/or open response items. They are aligned with Michigan benchmarks. A student failing any of his quizzes would have to sit for a **support class and retest** to achieve his 60% which is our passing mark. **A progress report is sent to the parent eventually after sitting for the make up exam.** 40 % is given to students that do not have a medical excuse for missing such an assessment. The department considers the highest 2 grades out of 3 exams.

2.Skill Based Assignments are done in class where a student has his resources all opened in front of him to answer a set of questions under verbal, nonverbal, quantitative, and spatial domains.

3. Research Sessions are done under where students can debate as groups and check the internet for resources and answers to support their ideas. This kind of Assessment is lined under **Research Lab Sessions or the copybook Journals**. They are evaluated to info, creativity, presentation, discussion and relation to the subject.

4.Daily assessments and drop quizzes take place to check the understanding of students.
5. Laboratory work is checked for research, completeness, accuracy, understanding the experiment, group work, and reports submitted completed. The general lab course has a separate grade than the subject labs.The policy of the general lab is attached within the manual itself.

7. Projects are integrated across and assigned for every term. They are evaluated to accuracy, creativity, info and relation to the subject.

Grade Distribution:

SCIENCE DEPARTMENT GRADE DISTRIBUTION	
HIGH SCHOOL	
End of Semester Exam	30%
Quizzes	30%
Skill based Assessment	5%
Project	10%
Research/Journal	5%
Labs	10%
MAP	5%
Drop Quizzes	5%

Cross-Curricular Project(s):

- Once per semester across disciplines