

## OXFORD HIGH SCHOOL SCIENCE DEPARTMENT

### BIOLOGY CURRICULUM

# 322 Biology - Academic (10) Full Year 1.0 Credit

This course is designed to be a hands-on exploration of biology and physiology. Always focused on making the connections between science and technology and their impact on the quality of our lives, the study of biology uses multiple pathways of scientific reasoning to explore the structure and function of living things (How are organisms structured to ensure efficiency and survival?) heredity and evolution (What processes are responsible for life's unity and diversity?) and a variety of other topics designed to build foundational scientific understandings in preparation for the CAPT science test in the spring of the year. The foundation of this class is built on the following essential questions:

# 323 Biology - Honors (10) Full Year 1.0 Credit

This course is designed to be a hands-on exploration of biology and physiology with an increased focus on the high level reading and writing to express scientific thinking for students who want to pursue higher level study of the sciences. Always focused on making the connections between science and technology and their impact on the quality of our lives, the study of biology uses multiple pathways of scientific reasoning to explore the structure and function of living things (How are organisms structured to ensure efficiency and survival?) heredity and evolution (What processes are responsible for life's unity and diversity?) and a variety of other topics designed to build foundational scientific understandings in preparation for the CAPT science test in the spring of the year.

The foundation of both classes is built on the following essential questions:

- How does the structure of an organism impact its function?
- How does an understanding of simple organization to complex organization help us understand how organisms are related and how they have changed over time?
- What processes are responsible for life's unity and diversity?
- How do science and technology impact the quality of our lives?

## ENDURING UNDERSTANDINGS (BROAD IDEAS, USUALLY GROUNDED IN THE DISCIPLINE):

Science is a creative endeavor that uses logical, analytical processes.

### SCIENTIFIC INQUIRY

- Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.
- Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.
- Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists

### SCIENTIFIC LITERACY

- Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science.
- Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

### SCIENTIFIC NUMERACY

- Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

## COURSE SPECIFIC GOALS (ALIGNED WITH CONTENT STANDARDS):

**BIOETHICS** - The practical applications of Biology have both positive and negative impacts and consequences on the biosphere, which must be critically evaluated.

**BIOMACROMOLECULES** - All living things are made from organized chemical compounds

**VIRUSES AND BACTERIA** - Viruses and microorganisms have an essential role in life processes and cycles on Earth.

**THE CELL STRUCTURE AND FUNCTION** - Fundamental life processes depend on the physical structure and the chemical activities of the cell

**GENETICS** - In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.

**BIOTECHNOLOGY** - Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.

**EVOLUTION** - Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.

**ECOLOGY** - Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.

COMMON UNIT EXPECTED PERFORMANCES (ALIGNED WITH STATE EXPECTED PERFORMANCES):

Standard #	Standard/Expected Performance
C-1	Identify questions that can be answered through scientific investigation.
C-2	Read, interpret and examine the credibility and validity of scientific claims in different sources of information.
C-3	Design and conduct appropriate types of scientific investigations to answer different questions.
C-4	Identify independent variables, dependent variables, constants and controls in an experiment.
C-5	Use appropriate tools and techniques to make observations and gather data.
C-6	Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
C-7	Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.
C-7	Assess the reliability and validity of the data that was generated in an investigation and justify confidence in results.
C-8	Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
C-9	Identify an issue and its implications completely.
C-10	Develop an action plan that addresses all aspects of the issue in detail.
C-11	Use a variety of reliable sources of relevant information, data, knowledge, or experiences to take and support a critical stance.

## UNIT I: BIOMACROMOLECULES - ALL LIVING THINGS ARE MADE FROM ORGANIZED CHEMICAL COMPOUNDS

Scope: 7 weeks

Standard #	Standard/Expected Performance	Common Experiences
I-1	Identify the characteristics of the six significant biological elements (carbon hydrogen, nitrogen, oxygen, phosphorus, and sulfur.)	
I-2	Explain the properties of water and the pH scale	
I-3	Describe the characteristics of the four major organic macromolecules that are responsible for the cell's metabolic functions (carbohydrates, proteins, lipids, and nucleic acids).	Characteristics of Life Lab (Genetics/Evolution/Biodiversity Embedded Task, modified)
I-4	Distinguish between biological monomers and polymers and be able to link monomers into polymers by dehydration synthesis.	
I-5	Describe the general role of enzymes in metabolic cell processes.	Enzyme Catalysis Lab (Cell Chemistry/Biotechnology Embedded Task, modified)

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
Atoms that make up biological molecules	2.1, 2.6, 2.8, 2.9, 2.10, 2.17		4.1-4.3	Students may complete associated concept activities and quizzes online
Water	2.11- 2.15	31(6, 18, 21)	4.4	
Organic compounds	3.1, 3.3		5.1	
Carbohydrates	3.4- 3.7	49 (3, 6, 16)	5.2	
Lipids	3.8-3.10	49 (4, 8, 10, 11)	5.3	
Proteins	3.11-3.15	49 (12, 13, 17)	5.4	
Enzymes	5.5-5.9	49 (19); 87 (12, 13, 14)	5.5	

**UNIT II: VIRUSES AND BACTERIA - VIRUSES AND MICROORGANISMS HAVE AN ESSENTIAL ROLE IN LIFE PROCESSES AND CYCLES ON EARTH.**

Scope: 5 weeks

Standard #	Standard/Expected Performance	Common Experiences
II-1	Describe the similarities and differences between bacteria and viruses.	Movie: <i>Outbreak</i> Sponge Soup Lab
II-2	Describe how infectious diseases are transmitted, and explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases.	Transmission of Disease Activity Disease transmission case study
II-3	Explain beneficial roles of microorganisms.	
II-4	Describe the transfer of nitrogen between biological, geological, and chemical systems in the biosphere	

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
Microscopic Life	4.1-4.3		16.1	Students may complete associated concept activities and quizzes online
Viruses	10.17-10.21	207 (2)	16.5	
Bacteria	16.7-16.6	341 (5, 6, 11, 15)	16.2-16.4	
Immune system	24.1-24.15	503 (2, 4, 5, 14, 16)	31.1-31.4	
Cycles	37.16-37.21	763 (9, 11, 12)	36.1, 36.3	

**UNIT III: THE CELL STRUCTURE AND FUNCTION - FUNDAMENTAL LIFE PROCESSES DEPEND ON THE PHYSICAL STRUCTURE AND THE CHEMICAL ACTIVITIES OF THE CELL**

Scope: 5 weeks

Standard #	Standard/Expected Performance	Common Experiences
III-1	Describe significant similarities and differences in the basic structure of plant and animal cells	Onion Root Mitosis
III-2	Explain cell homeostasis and the role of the plasma membrane.	Diffusion Lab
III-3	Explain the transfer of carbon in living systems.	

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
Cell structures	4.5-4.14, 4-17-4.19	69 (5, 6, 8-14, 20-21, 23)	6.1	Students may complete associated concept activities and quizzes online
Membranes and homeostasis	5.10-5.20	87 (2, 4-6, 11)	6.2-6.4	
Energy transfers/ATP	5.1-5.4	87 (7, 9)	7.3	
Cellular Respiration	6.1-6.16	105 (2, 4-6, 9-11, 13, 15)	7.4-7.6	
Photosynthesis	7.1-7.11	121 (1), 122 (4-10, 12-13, 15)	7.1-7.2, 8.1-8.4	
Mitosis	8.4-8.11	150 (3-6, 8), 151 (13, 15, 18-19)	9.1-9.4	

**UNIT IV: GENETICS - IN SEXUALLY REPRODUCING ORGANISMS, EACH OFFSPRING CONTAINS A MIX OF CHARACTERISTICS INHERITED FROM BOTH PARENTS.**

Scope: 6 weeks

Standard #	Standard/Expected Performance	Common Experiences
IV-1	Explain how meiosis contributes to the genetic variability of organisms.	Onion Root Mitosis
IV-2	Use the Punnett Square or other deductive techniques to predict the distribution of traits in monohybrid and dihybrid crossings.	
IV-3	Deduce the probable mode of inheritance of traits (e.g., recessive/dominant, sex-linked) from pedigree diagrams showing phenotypes.	
IV-4	Describe the difference between genetic disorders and infectious diseases.	Movie: <i>Lorenzo's Oil</i>
IV-5	Explain the difference between Medelian and polygenic traits	Polygenic inheritance activity

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
Meiosis	8.12-8.23	150 (2, 9-10), 151 (11-12, 16-17, 20)	9.5-9.6	Students may complete associated concept activities and quizzes online
Mendelian inheritance	9.1-9.24	179 (1-17)	10.1-10.5, 12.1-12.4	

**UNIT V: BIOTECHNOLOGY - SIMILARITIES IN THE CHEMICAL AND STRUCTURAL PROPERTIES OF DNA IN ALL LIVING ORGANISMS  
ALLOW THE TRANSFER OF GENES FROM ONE ORGANISM TO ANOTHER.**

Scope: 4 weeks

Standard #	Standard/Expected Performance	Common Experiences
V-1	Describe the general role of DNA and RNA in protein synthesis.	DNA fingerprinting lab
V-2	Describe, in general terms, how the genetic information of organisms can be altered to make them produce new materials.	pGLO lab
V-3	Explain the risks and benefits of altering the genetic composition and cell products of existing organisms.	Bioengineered Foods STS (Cell Chemistry/Biotechnology Embedded Task) Movie: <i>GATACA</i>

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
DNA structure and function (replication, protein synthesis)	10.1-10.16	207 (3-9)	11.1-11.16	Students may complete associated concept activities and quizzes online
Microbial Genetics	12.1-12.13	251 (5, 8-9)	13.1, 13.2, 13.4	
Cloning, stem cells, genomics, biotech	11.10-12, 12.15-12.17	251 (2-4, 7, 11, 14)	13.4	
Genetically modified organisms	12.18-12.20	251 (12)	13.3	

**UNIT VI: EVOLUTION** - EVOLUTION AND BIODIVERSITY ARE THE RESULT OF GENETIC CHANGES THAT OCCUR OVER TIME IN CONSTANTLY CHANGING ENVIRONMENTS.

Scope: 5 weeks

Standard #	Standard/Expected Performance	Common Experiences
VI-1	Explain how the processes of genetic mutation and natural selection are related to the evolution of species.	
VI-2	Explain how multiple sources of evidence (e.g. fossil records, embryology, molecular biology, microevolution, and anatomy) provide a scientific explanation for the theory of evolution	
VI-3	Describe how structural and behavioral adaptations increase the chances for organisms to survive in their environments	

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
Natural selection	13.1-13.5, 14.4-14.10	276 (1), 277 (3-4)	14.1, 14.3	Students may complete associated concept activities and quizzes online
Population genetics	13.6-13.8, 13.9-13.10	277 (5-6, 15)	15.1	
Evidence for evolution	13.11-13.13, 14.11-14.13, 15.1-15.9	277 (7, 10-12, 14)	14.2, 14.4, 15.3	

**UNIT VII: ECOLOGY** - LIVING ORGANISMS HAVE THE CAPABILITY OF PRODUCING POPULATIONS OF UNLIMITED SIZE, BUT THE ENVIRONMENT CAN SUPPORT ONLY A LIMITED NUMBER OF INDIVIDUALS FROM EACH SPECIES.

Scope: 5 weeks

Standard #	Standard/Expected Performance	Common Experiences
VII-1	Describe how structural and behavioral adaptations increase the chances for organisms to survive in their environments.	
VII-2	Describe the factors that affect the carrying capacity of the environment.	
VII-3	Conduct a case study of an ecosystem	
VII-4	Explain how technological advances have affected the size and growth rate of human populations throughout history.	Human Population Dynamics (Genetics/Evolution/Biodiversity Embedded Task)

Topic	Honors (Biology: Concepts and Connections)	Suggested Practice Questions	Academic (Biology: Exploring Life)	Suggested Practice Questions
Biosphere and biomes	34.1-34.17	700 (2) 701 (3-9, 14-15, 17-18, 21)	34.1-34.4	Students may complete associated concept activities and quizzes and quizzes online
Population dynamics	36.2-36.6, 36.10	741 (6-9, 11-13, 15-16)	35.1-35.3	
Communities	37.1-37.15	763 (3, 5-7, 10, 13-14)	35.4-35.5	