



## Foundations of Modern Biology: Genetics, Evolution, and Ethics

### North Carolina Standard Course of Study Objectives

*Foundations of Modern Biology: Genetics, Evolution, and Ethics* addresses the following strands and objectives from the North Carolina Standard Course of Study.

#### I. Science

##### Grade 7

Competency Goal 1: The learner will design and conduct investigations to demonstrate an understanding of scientific inquiry.

Objectives:

- 1.01 Identify and create questions and hypotheses that can be answered through scientific investigations.
- 1.02 Develop appropriate experimental procedures for:
  - Given questions.
  - Student-generated questions.
- 1.04 Analyze variables in scientific investigations:
  - Define operationally.
- 1.05 Analyze evidence to:
  - Explain observations.
  - Make inferences and predictions.
  - Develop the relationship between evidence and explanation.
- 1.06 Use mathematics to gather, organize, and present quantitative data resulting from scientific investigations:
  - Analysis of data.
  - Prediction models.
- 1.07 Prepare models and/or computer simulations to:
  - Test hypotheses.
  - Evaluate how data fit.
- 1.08 Use oral and written language to:
  - Defend conclusions of scientific investigations.
- 1.09 Use technologies and information systems to:
  - Research.
  - Gather and analyze data.
- 1.10 Analyze and evaluate information from a scientifically literate viewpoint by reading, hearing, and/or viewing:
  - Scientific text.
  - Articles.
  - Events in the popular press.

**Competency Goal 5:** The learner will conduct investigations and utilize appropriate technologies and information systems to build an understanding of heredity and genetics.

Objectives:

- 5.01 Explain the significance of genes to inherited characteristics:
  - Genes are the units of information.



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- Parents transmit genes to their offspring.
- Some medical conditions and diseases are genetic.
- 5.02 Explain the significance of reproduction:
  - Sorting and recombination of parents' genetic material.
  - Potential variation among offspring.
- 5.03 Identify examples and patterns of human genetic traits:
  - Dominant and recessive.
  - Incomplete dominance.
- 5.04 Analyze the role of probability in the study of heredity:
  - Role of each parent in transfer of genetic traits.
  - Analysis of pedigrees

### **Grade 8**

**Competency Goal 1:** The learner will design and conduct investigations to demonstrate an understanding of scientific inquiry.

Objectives:

- 1.01 Identify and create questions and hypotheses that can be answered through scientific investigations.
- 1.02 Develop appropriate experimental procedures for:
  - Given questions
  - Student generated questions.
- 1.04 Analyze variables in scientific investigations:
  - Identify dependent and independent.
  - Use of a control.
  - Manipulate.
  - Describe relationships between.
  - Define operationally.
- 1.05 Analyze evidence to:
  - Explain observations.
  - Make inferences and predictions.
  - Develop the relationship between evidence and explanation.
- 1.06 Use mathematics to gather, organize, and present quantitative data resulting from scientific investigations:
  - Analysis of data.
  - Prediction models.
- 1.07 Prepare models and/or computer simulations to:
  - Test hypotheses.
  - Evaluate how data fit.
- 1.08 Use oral and written language to:
  - Defend conclusions of scientific investigations.
- 1.09 Use technologies and information systems to:
  - Research.



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- Gather and analyze data.
- 1.10 Analyze and evaluate information from a scientifically literate viewpoint by reading, hearing, and/or viewing:
- Scientific text.
  - Articles.
  - Events in the popular press.

**Competency Goal 5:** The learner will conduct investigations and utilize appropriate technologies and information systems to build an understanding of evidence of evolution in organisms and landforms.

Objectives:

- 5.02 Correlate evolutionary theories and processes:
- Biological.
  - Geological.
- 5.03 Examine evidence that the geologic evolution has had significant global impact including:
- Distribution of living things.
  - Major geological events.

### High School Courses

#### Biology

**Competency Goal 1:** The learner will develop abilities necessary to do and understand scientific inquiry.

Objectives:

- 1.01 Identify biological questions and problems that can be answered through scientific investigations.
- 1.02 Design and conduct scientific investigations to answer biological questions.
- Create testable hypotheses.
  - Identify variables.
  - Use a control or comparison group when appropriate.
  - Analyze and interpret data.
  - Communicate findings.
- 1.03 Formulate and revise scientific explanations and models of biological phenomena using logic and evidence to:
- Explain observations.
  - Make inferences and predictions.
  - Explain the relationship between evidence and explanation.
- 1.05 Analyze reports of scientific investigations from an informed, scientifically-literate viewpoint including considerations of:
- Appropriate sample.
  - Adequacy of experimental controls.



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- Replication of findings.
- Alternative interpretations of the data.

**Competency Goal 3:** The learner will develop an understanding of the continuity of life and the changes of organisms over time.

Objectives:

- 3.03 Interpret and predict patterns of inheritance.
- Dominant, recessive and intermediate traits.
  - Multiple alleles.
  - Polygenic inheritance.
  - Sex-linked traits.
  - Independent assortment.
  - Test cross.
  - Pedigrees.
  - Punnett squares.
- 3.05 Examine the development of the theory of evolution by natural selection including:
- Development of the theory.
  - The origin and history of life.
  - Fossil and biochemical evidence.
  - Mechanisms of evolution.
  - Applications (pesticide and antibiotic resistance).

**Competency Goal 4:** The learner will develop an understanding of the unity and diversity of life.

Objectives:

- 4.01 Analyze the classification of organisms according to their evolutionary relationships.
- The historical development and changing nature of classification systems.
  - Similarities and differences between eukaryotic and prokaryotic organisms.
  - Similarities and differences among the eukaryotic kingdoms: Protists, Fungi, Plants, Animals.

### **Advanced Placement Biology**

Competency Goal 1: The learner will develop abilities necessary to do and understand scientific inquiry.

Objectives:

- 1.01 Identify questions and create hypotheses that can be answered through scientific investigations.
- 1.02 Design and conduct scientific investigations to answer biological questions.
- Identify variables.

### ***Duke TIP Independent Learning***



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- Use a control or comparison group when appropriate.
  - Analyze and interpret data.
  - Communicate findings.
- 1.03 Formulate and revise scientific explanations and models of biological phenomena using logic and evidence to:
- Explain observations.
  - Make inferences and predictions.
  - Explain the relationship between evidence and explanation.
- 1.05 Analyze reports of scientific investigations from an informed, scientifically-literate viewpoint including considerations of:
- Appropriate sample.
  - Adequacy of experimental controls.
  - Replication of findings.
  - Consideration of alternative interpretations of the data.

**Competency Goal 4:** The learner will develop an understanding of the basis of heredity and the role of molecular genetics.

Objectives:

- 4.03 Interpret and use the principal patterns of inheritance.
- 4.09 Examine past and present research on heredity and molecular genetics.
- Explore the work of Mendel.

**Competency Goal 5:** The learner will develop an understanding of biological evolution.

Objectives:

- 5.01 Examine the evidence that supports an evolutionary view of life.
- 5.02 Recognize the implications of chemical evolution and its impact on the origin of life.
- 5.03 Analyze current models for the early evolution of life.
- Biological macromolecules.
  - Prokaryotic cells.
  - Eukaryotic cells.
- 5.04 Analyze the mechanisms of evolution, their role, results and implications.
- Identification of patterns and the responsible mechanisms.
  - Analyze heredity and its link to natural selection.
  - Examine speciation.
  - Examine macroevolution.
  - Recommended laboratory – *Population Genetics and Evolution*
- 5.05 Investigate the contributions of early researchers, (e.g. Pasteur and Darwin) and their impact on the current view of evolutionary biology.



**Competency Goal 6:** The learner will develop an understanding of the unity and diversity of life.

Objectives:

- 6.01 Analyze evolutionary patterns.
  - Examine DNA analysis.
  - Examine biochemical analysis.
  - Examine morphological research.
- 6.02 Survey the diversity of life.
  - Examine representative organisms.
- 6.03 Analyze and apply current phylogenetic classification including:
  - Domains.
  - Kingdoms.
  - Major Phyla and divisions of animals and plants.
- 6.04 Analyze evolutionary relationships.
  - Investigate evidence.
  - Explore research methods.
  - Analyze use of research.
- 6.06 Examine past and present research on the unity and diversity of life.

## **II. Mathematics**

### **Grade 7**

**Competency Goal 1:** Number and Operations, Measurement, Geometry, Data Analysis and Probability, Algebra.

Objectives:

- 1.01 Develop and use ratios, proportions, and percents to solve problems.

**Competency Goal 4:** The learner will understand and use graphs and data analysis.

Objectives:

- 4.05 Solve problems involving two or more sets of data using appropriate statistical measures.

### **Grade 8**

**Competency Goal 4:** The learner will understand use graphs and data analysis.

Objectives:

- 4.01 Collect, organize, analyze, and display data (including scatterplots) to solve problems.
- 4.03 Identify misuses of statistical and numerical data.



### **III. Social Studies**

#### **Grade 9**

**Competency Goal 1:** Historical Tools and Practices – The learner will identify, evaluate, and use the methods and tools valued by historians, compare the views of historians, and trace the themes of history.

Objectives:

- 1.01 Define history and the concepts of cause and effect, time, continuity, and perspective.
- 1.02 Analyze and interpret primary and secondary sources to compare views, trace themes, and detect bias.
- 1.04 Define the themes of society, technology, economics, politics, and culture and relate them to the study of history.

**Competency Goal 6:** Patterns of Social Order – The learner will investigate social and economic organization in various societies throughout time in order to understand the shifts in power and status that have occurred.

Objectives:

- 6.02 Analyze causes and results of ideas regarding superiority and inferiority in society and how those ideas have changed over time.

**Competency Goal 7:** Technology and Changing Global Connections – The learner will consider the short- and long-term consequences of the development of new technology.

Objectives:

- 7.01 Assess the degree to which discoveries, innovations, and technologies have accelerated change.
- 7.02 Examine the causes and effects of scientific revolutions and cite their major costs and benefits.

**Competency Goal 8:** Patterns of History – The learner will assess the influence of ideals, values, beliefs, and traditions on current global events and issues.

Objectives:

- 8.01 Trace developments in literary, artistic, and religious traditions over time as legacies of past societies or as cultural innovations.
- 8.03 Classify within the broad patterns of history those events which may be viewed as turning points.

#### **Grade 11**

**Competency Goal 7:** The Progressive Movement in the United States (1890-1914) – The learner will analyze the economic, political, and social reforms of the Progressive Period.

Objectives:



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7.04 Examine the impact of technological changes on economic, social, and cultural life in the United States.

**Competency Goal 9:** Prosperity and Depression (1919-1939) – The learner will appraise the economic, social, and political changes of the decades of “The Twenties” and “The Thirties.”