



This document is designed to help North Carolina educators teach the Essential Standards (Standard Course of Study). NCDPI staff are continually updating and improving these tools to better serve teachers.

Biology

2009-to-2004 Standards Crosswalk

This document is a general comparison of the current 2004 Science Standard Course of Study and the new 2009 Science Essential Standards. It provides initial insight into sameness and difference between these two sets of standards. This document is not intended to answer all questions about the nuance of the new standards versus the old - in fact, we imagine you will develop questions as you do a close reading of the new standards. Please send the science section of NC DPI any thoughts, feedback, questions and ideas about additional resources that would help you start preparing to teach the Essential Standards. Email Beverly Vance at bvance@dpi.state.nc.us.

Important Note: The current 2004 SCOS will continue to be the operational standards in the 2010-11 and 2011-12 school years as resource materials are developed to support the new Science Essential Standards, professional development is conducted and assessments are designed to align to the new Science Essential Standards. We expect the new Essential Standards to be taught and assessed in schools for the first time in the 2012-13 school year. That said, we are providing Essential Standards resources now and over the next two-years so that schools and teachers can get a head start on internalizing and planning to teach the new standards.

2009 Essential Standards		2004 NC SCOS		Comments
Strand	Objective	Goal	Objective	
	Essential Standard Text of Clarifying objective		Text of objective	
Structures and Functions of Living Organisms	Understand the relationship between the structures of cells and their organelles. Bio.1.1.1 Summarize the structure and function of organelles in eukaryotic cells (including: the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.	Physical, Chemical and Cellular Basis of Life	2.02 Investigate and describe the structure and functions of cells including: <ul style="list-style-type: none"> Cell organelles 	This is the only bullet that addresses this clarifying objective. The following bullets are addressed in clarifying objective Bio.1.1.3. <ul style="list-style-type: none"> Cell specialization Communication among cells within an organism

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
		Text of Clarifying objective				
Bio.1.1.2		Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.		2.02	Investigate and describe the structure and functions of cells including: <ul style="list-style-type: none"> • Cell organelles 	This is the only bullet that addresses this clarifying objective. The following bullets are addressed in clarifying objective Bio.1.1.3. <ul style="list-style-type: none"> • Cell specialization • Communication among cells within an organism
			Unity and Diversity of Life	4.01	Analyze the classification of organisms according to their evolutionary relationships. <ul style="list-style-type: none"> • Similarities and differences between eukaryotic and prokaryotic organisms 	This is the only sub part of objective 4.01 that addresses this clarifying objective. The following bullets are addressed as indicated in parentheses: <ul style="list-style-type: none"> • The historical development and changing nature of classification systems (Bio.3.5.1) • Similarities and differences among the eukaryotic kingdoms: Protists, Fungi, Plants, Animals (Addressed in Middle Grades 8.L.4.1 and subsumed in historical development) (Bio.3.5.1) • Classify organisms using keys (Bio.3.5.2)
	Bio.1.1.3		Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.	Physical, Chemical	2.02	Investigate and describe the structure and functions of cells including: <ul style="list-style-type: none"> • Cell specialization • Communication among cells within an organism

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
		Text of Clarifying objective				
			Life and the Changes of	3.01	Analyze the molecular basis of heredity including: <ul style="list-style-type: none"> Gene regulation 	This is the only bullet that addresses the clarifying objective. The following bullets are addressed in Essential Standard 3.1: <ul style="list-style-type: none"> DNA replication Protein synthesis (transcription, translation).
Structures and Functions of Living Organisms	Analyze the cell as a living system.		Physical, Chemical and	2.03	Investigate and analyze the cell as a living system. <ul style="list-style-type: none"> Maintenance of homeostasis Movement of materials into and out of cells 	These are the only bullets that address the clarifying objective. The following bullet is addressed in clarifying objective Bio.4.2.2. <ul style="list-style-type: none"> Energy use and release in biochemical reactions
	Bio.1.2.1	Explain how homeostasis is maintained in a cell and within an organism in various environments (including: temperature and pH).				
	Bio.1.2.2	Analyze how cells grow and reproduce in terms of interphase, mitosis and cytokinesis.	Life and the	3.02	Compare and contrast the characteristics of asexual and sexual reproduction.	
	Bio.1.2.3	Explain how specific cell adaptations help cells survive in particular environments (focus on unicellular organisms).				In the 2004 Curriculum (objective 4.03), structural adaptations of plants and animals were discussed. Clarifying objective Bio.1.2.3 focuses mainly on unicellular organisms.
Ecosystems	Analyze the interdependence of living organisms within their environments.		Ecological Relationships	5.02	Analyze the flow of energy and the cycling of matter in the ecosystem. <ul style="list-style-type: none"> Relationship of the carbon cycle to photosynthesis and respiration Trophic levels- direction and efficiency of energy transfer 	
	Bio.2.1.1	Analyze the flow of energy and cycling of matter (such as water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.				

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Bio.2.1.2	Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.		Unity and Diversity of Life	4.02	Analyze the processes by which organisms representative of the following groups accomplish essential life functions.	The specific groups have been omitted. It was believed that this objective alone could be a comparative physiology course. Please note general focus in the Detailed Description of Course Content.
				4.03	Assess, describe and explain adaptations affecting survival and reproductive success. <ul style="list-style-type: none"> • Structural adaptations in plants and animals (form to function) 	This is the only bullet that directly applies to this clarifying objective. The following bullets are removed: <ul style="list-style-type: none"> • Disease-causing viruses and microorganisms • Co-evolution
				4.05	Analyze the broad patterns of animal behavior as adaptations to the environment. <ul style="list-style-type: none"> • Innate behavior • Learned behavior • Social behavior 	
	4.04	Analyze and explain the interactive role of internal and external factors in health and disease: <ul style="list-style-type: none"> • Parasites 		Only this bullet addresses interaction of organisms. The following bullets are addressed as indicated in parentheses: <ul style="list-style-type: none"> • Genetics (Bio.3.2.3) • Immune response (removed) • Nutrition (Bio.3.2.3) • Toxins (Bio.3.4.3) 		
Bio.2.1.3	Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.		Ecological Relationships	5.01	Investigate and analyze the interrelationships among organisms, populations, communities, and ecosystems. <ul style="list-style-type: none"> • Abiotic and biotic factors • Carrying capacity 	The bullet <ul style="list-style-type: none"> • Techniques of Field Ecology has been eliminated. This can be integrated into laboratory experiences.

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Bio.2.1.4						Commensalism has been purposely left out. There is much debate about whether commensalistic relationships are just early mutualism. We may just not understand the benefits to each organism. Teachers may want to stress that some mutualistic relationships become so obligatory (lichen) that organisms cannot live without them and other relationships are more casual (oxpecker and ox).
		Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing availability of food, availability of shelter, number of predators and disease).	5.01	Investigate and analyze the interrelationships among organisms, populations, communities, and ecosystems. <ul style="list-style-type: none"> • Abiotic and biotic factors • Carrying capacity 	The bullet <ul style="list-style-type: none"> • Techniques of Field Ecology has been eliminated. This can be integrated into laboratory experiences.	
			5.03	Assess human population and its impact on local ecosystems and global environments. <ul style="list-style-type: none"> • Historic and potential changes in population • Factors associated with those changes 	These are the only bullets that directly apply to the clarifying objective. The remaining bullet topics are addressed in Essential Standard Bio.2.2: <ul style="list-style-type: none"> • Climate change • Resource use • Sustainable practices/ stewardship 	

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Ecosystems		Understand the impact of human activities on the environment (one generation affects the next).	Ecological Relationships Among Organisms	5.03			
	Bio.2.2.1	Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.				Assess human population and its impact on local ecosystems and global environments: <ul style="list-style-type: none"> • Historic and potential changes in population • Factors associated with those changes • Climate change • Resource use • Sustainable practices/stewardship 	
	Bio.2.2.2	Explain how the use, protection and conservation of natural resources by humans impact the environment from one generation to the next.				Assess human population and its impact on local ecosystems and global environments: <ul style="list-style-type: none"> • Historic and potential changes in population • Factors associated with those changes • Climate change • Resource use • Sustainable practices/stewardship 	
Evolution and Genetics		Explain how traits are determined by the structure and function DNA.	Continuity of Life and the Changes of Organisms Over Time	3.01			
	Bio.3.1.1	Explain the double-stranded, complementary nature of DNA as related to its function in the cell.				Analyze the molecular basis of heredity including: <ul style="list-style-type: none"> • DNA replication 	This is the only bullet that addresses this clarifying objective. The following bullets are addressed in clarifying objective indicated in parenthesis. <ul style="list-style-type: none"> • Protein synthesis (transcription, translation) (Bio.3.1.2) • Gene regulation (Bio.1.1.3)
	Bio.3.1.2	Explain how DNA and RNA code for proteins and determine traits.				Analyze the molecular basis of heredity including: <ul style="list-style-type: none"> • Protein synthesis (transcription, translation). 	
Bio.3.1.3	Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.			This was included in the 2004 Support Document within the Content Description for Objective 3.01. It is now a Clarifying Objective.			

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
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Evolution and Genetics		Understand how the environment, and/or the interaction of alleles, influences the expression of genetic traits.	Continuity of Life and the Changes of Organisms Over Time	3.02	Compare and contrast the characteristics of asexual and sexual reproduction.	Clarifying objective Bio.3.2.1 deals with meiosis only.
	Bio.3.2.1	Explain the role of meiosis in sexual reproduction and genetic variation.				
	Bio.3.2.2	Predict offspring ratios based on a variety of inheritance patterns (including: dominance, codominance, incomplete dominance, multiple alleles, and sex-linked traits).	Interpret and predict patterns of inheritance. <ul style="list-style-type: none"> • Dominant, recessive and intermediate traits • Multiple alleles • Polygenic inheritance • Sex-linked traits • Independent assortment • Test cross • Pedigrees • Punnett squares 	3.03	Students are expected to do monohybrid crosses only. Test cross has been omitted in the 2009 Curriculum. While teachers should not necessarily expect students at this level to distinguish between codominance and incomplete dominance inheritance on a biochemical level, they should be able to solve problems involving apparent intermediate phenotypes.	
Bio.3.2.3	Explain how the environment can influence the expression of genetic traits.	Unity and Diversity of Life	4.04	Analyze and explain the interactive role of internal and external factors in health and disease: <ul style="list-style-type: none"> • Genetics • Nutrition 	These are the only bullets that directly apply to the clarifying objective. The following bullets are addressed as indicated in parentheses: <ul style="list-style-type: none"> • Immune response (removed) • Parasites (Bio.2.1.3) • Toxins (Bio.3.4.3) 	

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Strand	Objective	Essential Standard	Goal	Objective	Comments		
		Text of Clarifying objective				Text of objective	
Evolution and Genetics		Understand the application of DNA technology.	Continuity of Life and the Changes of Organisms Over Time	3.04			
	Bio.3.3.1	Interpret how DNA is used for comparison and identification of organisms.				Assess the impact of advances in genomics on individuals and society. <ul style="list-style-type: none"> • Applications of biotechnology 	Human genome project is addressed in clarifying objective Bio.3.3.3.
	Bio.3.3.2	Summarize how transgenic organisms are engineered to benefit society.				Assess the impact of advances in genomics on individuals and society. <ul style="list-style-type: none"> • Applications of biotechnology 	Human genome project is addressed in clarifying objective Bio.3.3.3.
Bio.3.3.3	Evaluate some of the ethical issues surrounding the use of DNA technology (including: cloning, genetically modified organisms, stem cell research, and Human Genome Project).		Assess the impact of advances in genomics on individuals and society. <ul style="list-style-type: none"> • Human genome project • Applications of biotechnology 				
Evolution and Genetics		Explain the theory of evolution by natural selection as a mechanism for how species change over time.	Continuity of Life and the Changes of Organisms Over Time	3.05			
	Bio.3.4.1	Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.				Examine the development of the theory of evolution by natural selection including: <ul style="list-style-type: none"> • Development of the theory • The origin and history of life • Fossil and biochemical evidence 	The following bullets are addressed in clarifying objectives Bio.3.4.2 and Bio.3.4.3. <ul style="list-style-type: none"> • Mechanisms of evolution • Applications (pesticide and antibiotic resistance)
	Bio.3.4.2	Explain how natural selection influences the changes in species over time.				Examine the development of the theory of evolution by natural selection including: <ul style="list-style-type: none"> • Mechanisms of evolution 	
Bio.3.4.3	Explain how various disease agents (bacteria, viruses, chemicals) can influence natural selection.		Examine the development of the theory of evolution by natural selection including: <ul style="list-style-type: none"> • Applications (pesticide and antibiotic resistance) 				

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Strand	Objective	Essential Standard	Goal	Objective		
		Text of Clarifying objective	Unity and	4.04	Analyze and explain the interactive role of internal and external factors in health and disease: <ul style="list-style-type: none"> Toxins 	This is the only bullet that directly applies to the clarifying objective. See comments for clarifying objective Bio.2.1.3.
Evolution and Genetics	Bio.3.5.1	Analyze how classification systems are developed upon speciation.	Unity and Diversity of Life	4.01	Analyze the classification of organisms according to their evolutionary relationships. <ul style="list-style-type: none"> The historical development and changing nature of classification systems 	The following bullets in clarifying objective 4.01 are addressed as indicated in parentheses. <ul style="list-style-type: none"> Similarities and differences between eukaryotic and prokaryotic organisms (Bio.1.1.2) Similarities and differences among the eukaryotic kingdoms: Protists, Fungi, Plants, Animals (Addressed in Middle Grades 8.L.4.1 and subsumed in historical development) Classify organisms using keys (Bio.3.5.2)
		Explain the historical development and changing nature of classification systems.			Analyze the classification of organisms according to their evolutionary relationships (including: dichotomous keys and phylogenetic trees).	Analyze the classification of organisms according to their evolutionary relationships. <ul style="list-style-type: none"> Classify organisms using keys
Molecular Biology	Bio.4.1.1	Understand how biological molecules are essential to the survival of living organisms.	Physical, Chemical and	2.01	Compare and contrast the structure and functions of the following organic molecules: <ul style="list-style-type: none"> Carbohydrates Proteins Lipids Nucleic acids 	
		Compare the structures and functions of the major biological molecules (carbohydrates, proteins, lipids, and nucleic acids) as related to the survival of living organisms.				

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Strand	Objective	Essential Standard	Goal	Objective	Text of objective	Comments
		Text of Clarifying objective				
				2.03	Investigate and analyze the cell as a living system including: <ul style="list-style-type: none"> • Energy use and release in biochemical reactions 	The following bullets are addressed in clarifying objectives Bio.1.2.1 and Bio.4.2.2. <ul style="list-style-type: none"> • Maintenance of homeostasis • Movement of materials into and out of cells
	Bio.4.1.2	Summarize the relationship among DNA, amino acids and proteins in carrying out the work of cells and how this is similar in all organisms.		2.01	Compare and contrast the structure and functions of the following organic molecules: <ul style="list-style-type: none"> • Proteins • Nucleic acids 	The following bullets are addressed in clarifying objective Bio.4.1.1. <ul style="list-style-type: none"> • Carbohydrates • Lipids
			Continuity of Life and	3.01	Analyze the molecular basis of heredity including: <ul style="list-style-type: none"> • DNA replication • Protein synthesis (transcription, translation) • Gene regulation 	
	Bio.4.1.3	Explain how enzymes act as catalysts for biological reactions.	Physical, Chemical	2.04	Investigate and describe the structure and function of enzymes and explain their importance in biological systems.	
Molecular Biology	Analyze the relationships between biochemical processes and energy use in the cell.		Physical, Chemical and Cellular Basis of Life	2.05	Investigate and analyze the bioenergetic reactions: <ul style="list-style-type: none"> • Aerobic Respiration • Anaerobic Respiration • Photosynthesis 	
	Bio.4.2.1	Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.				
	Bio.4.2.2	Explain ways that organisms use released energy for maintaining homeostasis (active transport).				
				2.03	Investigate and analyze the cell as a living system including: <ul style="list-style-type: none"> • Maintenance of homeostasis • Movement of materials into and out of cells • Energy use and release in biochemical reactions 	

Goal 1 in 2004 SCOS, “develop abilities necessary to do and understand scientific inquiry,” should be integrated in classroom instructional unit design.