



MINNESOTA
Academic Standards - Science Grades 9-12
***Biology: The Dynamics of Life* © 2004**

OBJECTIVES	PAGE REFERENCES
I. HISTORY AND NATURE OF SCIENCE	
A. Scientific World View The student will understand the nature of scientific ways of thinking and that scientific knowledge changes and accumulates over time.	
1. The student will be able to distinguish among hypothesis, theory and law as scientific terms and how they are used to answer a specific question.	SE: 11-16, 18 <i>Inside Story</i> 17 TWE: AL 12-13 TPK 13 DI 18 E 18
2. The student will be able to explain how scientific and technological innovations as well as new evidence can challenge portions of or entire accepted theories and models including but not limited to cell theory, atomic theory, theory of evolution, plate tectonic theory, germ theory of disease and big bang theory.	SE: 172, 255-258, 380-382, 393 TWE: UM 381
3. The student will recognize that in order to be valid, scientific knowledge must meet certain criteria including that it: be consistent with experimental, observational and inferential evidence about nature; follow rules of logic and reporting both methods and procedures; and be falsifiable and open to criticism.	SE: 11, 15-18 <i>Problem-Solving Lab</i> 347 TWE: Br 15 CT 17 E 23 P 394
4. The student will explain how traditions of ethics, peer review, conflict and general consensus influence the conduct of science.	SE: 12-13, 16-17, 21-22 TWE: QD 15 E 18 D 282 En 284
5. The student will recognize that some scientific ideas are incomplete, and opportunity exists in these areas for new advances.	SE: 22, 212-213 <i>Biology and Society</i> 26 TWE: D 144 BJ 353

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B. Scientific Inquiry The student will design and conduct a scientific investigation.	
1. The student will design and complete a scientific experiment using scientific methods by determining a testable question, making a hypothesis, designing a scientific investigation with appropriate controls, analyzing data, making conclusions based on evidence and comparing conclusions to the original hypothesis and prior knowledge.	SE: <i>MiniLab</i> 22 <i>Design Your Own BioLab</i> 58-59, 164-165, 330-331, 522-523, 734-735, 756-757, 834-835, 910-911 <i>Internet BioLab</i> 274-275 TWE: UA 11 DI 30
2. The student will distinguish between qualitative and quantitative data.	SE: 19-21 <i>Problem-Solving Lab</i> 20, 954 TWE: UPK 19 E 21 DI 23
3. The student will apply mathematics and models to analyze data and support conclusions.	SE: <i>MiniLab</i> 92, 102, 268, 350 <i>Problem-Solving Lab</i> 101 TWE: A 23 UM 260
4. The student will identify possible sources of error and their effects on results.	SE: <i>Design Your Own BioLab</i> 85, 355, 415, 545, 989 TWE: Br 15
5. The student will know that professional scientists and engineers have ethical codes.	SE: 14, 21-22 <i>Biotechnology</i> 688 <i>Biology and Society</i> 990, 1044 TWE: SP 24 AB 660
6. The student will give examples of how different domains of science use different bodies of scientific knowledge and employ different methods to investigate questions.	SE: <i>Problem-Solving Lab</i> 72 <i>Biotechnology</i> 660 <i>Biotechnology Careers</i> 958 TWE: I 100 CH 216 TS 304
C. Scientific Enterprise The student will understand the relationship between science and technology and how both are used.	
1. The student will compare and contrast the purposes and career opportunities of engineering, technology and science.	SE: <i>Careers in Biology</i> 38, 230, 297, 351, 448, 674 TWE: CB 38, 230, 297, 351, 448, 674
2. The student will provide an example of a need or problem identified by science and solved by engineering or technology.	SE: 341-353, 1010-1011 <i>Biology and Society</i> 60 <i>Biotechnology</i> 304, 356, 660, 688, 1018 <i>Problem-Solving Lab</i> 492 TWE: P 16, 394 BS 60 AB 356
3. The student will provide an example of how technology facilitates new discoveries and the development of scientific knowledge.	SE: 171-173 <i>Biotechnology</i> 304, 356, 1018 <i>Focus On</i> 1064-1065

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4. The student will know that technological changes and scientific advances are often accompanied by social, political, environmental and economic changes.	SE: 21-23 <i>Biology and Society</i> 26, 498 <i>Biotechnology Careers</i> 351 <i>Biotechnology</i> 660, 688
5. The student will recognize that science and technology are influenced by cultural backgrounds and beliefs and by social needs, attitudes, values and limitations.	SE: 21-23 <i>Biology and Society</i> 26, 388, 836 <i>Applying Biotechnology</i> 660 <i>Biotechnology</i> 688
D. Historic Perspectives The student will recognize the historical and cultural context of scientific endeavors and how they influence each other.	
1. The student will be able to trace the development of a scientific advancement, invention or theory and its impact on society.	SE: 171-172, 253-260, 281-282, 341-342, 393-396 TWE: TS 388
2. The student will provide examples of scientific advancements contributed by other civilizations and cultures.	SE: 154, 172 <i>History & Biology</i> xxxvi-1 TWE: CD 8, 20, 145, 284 CA 116
3. The student will compare and contrast the differences between scientific theories and theories from other bodies of knowledge, and the importance of each in a science discussion.	SE: 21-22 <i>Connection to Literature</i> 86 <i>Connection to Art</i> 628 TWE: E 23 CD 394
IV. LIFE SCIENCE	
A. Cells The student will comprehend that all living things are composed of cells, and that the life processes in a cell are based on molecular interactions.	
1. The student will relate cellular structures to their functions.	SE: 175-185, 288-295 <i>Problem-Solving Lab</i> 176 <i>Connection to Literature</i> 190 TWE: CA 183 DI 187
2. The student will compare and contrast the structures found in typical plant, animal and bacterial cells.	SE: <i>Inside Story</i> 186, 486 <i>Investigate BioLab</i> 188 <i>MiniLab</i> 490 TWE: AL 182
3. The student will explain the role of the cell membrane as a highly selective barrier in diffusion, osmosis and active transport.	SE: 175-178, 195-200 TWE: E 178 DC 181 En 199
4. The student will describe the role of enzymes as catalysts in metabolism and cellular synthesis of new molecules.	SE: 161-162, 211, 281, 918 TWE: CT 162
5. The student will differentiate between the processes of photosynthesis and respiration in terms of energy flow, reactants and products.	SE: 225-230, 237, 561 TWE: CA 228 A 237
6. The student will describe and compare the processes of mitosis and meiosis and their roles in the cell cycle.	SE: 204, 206-209, 211, 265-269 TWE: A 213

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B. Diversity of Organisms The student will classify, compare and contrast the diversity of organisms on Earth and their modes of accommodating the requirements for life.	
1. The student will relate the structure, complexity and organization of organ systems to the methods of obtaining, transforming, releasing and eliminating the matter and energy used to sustain the organism.	SE: 561, 651, 727, 764-765, 917-923, 985-987, 1048 TWE: UM 918 DI 987 B 1048
2. The student will recognize that organisms have both innate and learned behavioral responses to internal and external stimuli, including the tropic responses in plants.	SE: 624-625, 859-867, 868-873 <i>Problem-Solving Lab</i> 624 <i>MiniLab</i> 860 <i>Investigate BioLab</i> 874-875 TWE: CA 861 VL 865 P 869 UM 871
3. The student will use scientific evidence, including the fossil record, homologous structures, embryological development or biochemical similarities, to classify organisms in order to show probable evolutionary relationships and common ancestry.	SE: 370-371, 393, 399-403, 409-411, 423-427 <i>Biology and Society</i> 388 <i>MiniLab</i> 429 TWE: CD 411 A 435
C. Interdependence of Life The student will describe how the environment and interactions between organisms can affect the number of species and the diversity of species in an ecosystem.	
1. The student will describe the factors related to matter and energy in an ecosystem that both influence fluctuations in population size and determine the carrying capacity of a population.	SE: 46-54, 56-57, 91-93, 95-99, 100-103 <i>Problem-Solving Lab</i> 50, 95 <i>Inside Story</i> 55, 94 TWE: CA 50 PSC 52 QD 53, 97
2. The student will explain how adaptations of species and co-evolution with other species are related to success in an ecosystem.	SE: 42-43, 91, 95, 113 TWE: CB 43
3. The student will identify examples of mutualism, commensalism, and parasitism in a stable ecosystem.	SE: 44-45, 48-49 TWE: R 44 CA 50, 56
4. The student will predict and analyze how a change in an ecosystem, resulting from natural causes, changes in climate, human activity or introduction of invasive species, can affect both the number of organisms in a population and the biodiversity of species in the ecosystem.	SE: 65-69, 91-93, 111, 115-120 TWE: CA 82 E 83 Un 114

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D. Heredity The student will explain how inherited characteristics are encoded by genes.	
1. The student will explain that the instructions for the characteristics of all organisms are carried in nucleic acids.	SE: 162, 281-285, 287-295 <i>Problem-Solving Lab</i> 283 <i>MiniLab</i> 293 <i>BioLab</i> 303 TWE: D 282 I 285
2. The student will define the relationship between DNA, genes and chromosomes.	SE: 203-204, 263-271, 273, 281-285, 288-295 <i>Inside Story</i> 205, 272, 286-287 TWE: CA 272 UA 281
3. The student will describe the structure and function of DNA and distinguish between replication, transcription and translation.	SE: 283-285, 288-295 TWE: TS 286 A 287 DI 287
4. The student will know that different species of multicellular organisms have a characteristic number of chromosomes, and that in typical humans there are 22 autosomal pairs and 2 sex chromosomes.	SE: 203, 263-265, 296, 328 TWE: E 273
5. The student will describe how genetic information is transmitted from parents to offspring through the processes of meiosis and fertilization as they relate to chromosome recombination and sexual reproduction.	SE: 253, 263-266 TWE: UA 267 MA 268 Po 270
6. The student will use Mendel's laws of segregation and independent assortment to determine the genotype and phenotype of a monohybrid cross.	SE: 253-257, 260 <i>Internet BioLab</i> 274 TWE: CD 258, 260
7. The student will differentiate between dominant, recessive, codominant, incompletely dominant, polygenic and sex-linked traits.	SE: 256, 311-313, 315-320, 323-328 TWE: CA 320 DI 329
E. Biological Populations Change Over Time The student will understand how biological evolution provides a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.	
1. The student will understand that species change over time and the term biological evolution is used to describe this process.	SE: 10, 393-413 <i>Internet BioLab</i> 414-415 <i>Connection to Math</i> 416 TWE: R 408 DI 413

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2. The student will use the principles of natural selection to explain the differential survival of groups of organisms as a consequence of: <ul style="list-style-type: none"> o The potential for a species to increase its numbers; o The genetic variability of offspring due to mutation and recombination of genes; o A finite supply of the resources required for life; and o The ensuing selection based on environmental factors of those offspring better able to survive and produce reproductively successful offspring. 	SE: 395-398, 404-408 <i>Problem-Solving Lab</i> 397 <i>MiniLab</i> 398 <i>Internet BioLab</i> 414-415 <i>Connection to Math</i> 416 TWE: AL 408 TPK 416
3. The student will describe how genetic variation between populations is due to different selective pressures acting on each population, which can lead to a new species.	SE: 378-379, 397-399, 405-406, 409-411 <i>Internet BioLab</i> 414-415 TWE: QD 405
4. The student will use biological evolution to explain the diversity of species.	SE: 395, 400, 409-413, 426-427 TWE: UM 398
F. Flow of Matter and Energy The student will describe and explain the cycling of matter and flow of energy through an ecosystem's living and non-living components.	
1. The student will explain the relationship between abiotic and biotic components of an ecosystem in terms of the cycling of water, carbon, oxygen and nitrogen.	SE: 52-54, 56-57 <i>Inside Story</i> 55 TWE: QD 53 R 53
2. The student will know that all matter tends to become more disorganized over time, and that living systems require a continuous input of energy in order to maintain their chemical and physical organizations and prevent death.	SE: 8-9, 221-228, 231-237 TWE: UP 220 UA 221
3. The student will explain that sunlight is transformed into chemical energy by photosynthetic organisms.	SE: 225-226, 247, 510, 559 <i>Internet BioLab</i> 238-239 TWE: P 511
4. The student will explain that respiration releases chemical energy through the breakdown of molecules.	SE: 231-234, 237 <i>Problem-Solving Lab</i> 235 TWE: Cu 233 BJ 234 TP 236
5. The student will understand that matter and energy flow through different levels of organization of living systems, from cells to communities, as well as between living systems and the physical environment as chemical elements are recombined in different ways. Each recombination results in both storage and dissipation of energy.	SE: 42-43, 46-52, 53, 55, 56-57, 61 <i>Biology and Society</i> 60 TWE: CA 48 P 55 E 57

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G. Human Organism The student will understand how all organ systems, including the nervous system, interact to maintain homeostasis.	
1. The student will understand and describe the basic anatomy and physiology of the nervous system and sense organs.	SE: 942-952, 954-955 <i>Inside Story</i> 953 TWE: VL 944 UM 945, 952
2. The student will describe how the functions of individual organ systems are integrated to maintain a homeostatic balance in the body.	SE: 9, 896, 929-931, 1048-1055 <i>Problem-Solving Lab</i> 896 TWE: UM 9

Codes Used for TWE Pages

A	Assessment
AB	Applying Biotechnology
AL	Additional Lab
B	Bellringer
BJ	Biology Journal
Br	Brainstorming
BS	Biology and Society
CA	Challenge Activity
CB	Careers in Biology
CD	Concept Development
CH	Connection to Health
CT	Critical Thinking
Cu	Cultural Diversity
D	Discussion
DC	Demonstrate the Concept
DI	Daily Intervention
E	Extension
En	Enrichment
I	Inquiry
MA	Modified Assessment
P	Project
Po	Portfolio
PSC	Physical Science Connection
QD	Quick Demo
R	Reinforcement
SP	Safety Precautions
TP	Tech Prep
TPK	Tying to Prior Knowledge
TS	Teaching Strategies
UA	Using an Analogy
UM	Using Models
Un	Uncovering Misconceptions
UP	Understanding the Photo
UPK	Using Prior Knowledge
VL	Visual Learning