



ARIZONA
Science Standards High School
***Biology: The Dynamics of Life* © 2004**

OBJECTIVES	PAGE REFERENCES
Strand 1: Inquiry Process	
Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.	
Concept 1: Observations, Questions, and Hypotheses	
Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.	
PO 1. Evaluate scientific information for relevance to a given problem.	SE: <i>MiniLab</i> 6 <i>Problem-Solving Lab</i> 16, 447, 492 <i>Internet BioLab</i> 238-239, 274-275 <i>Design Your Own BioLab</i> 964-965 TWE: QD 15
PO 2. Develop questions from observations that transition into testable hypotheses.	SE: 11-12 <i>Problem-Solving Lab</i> 16 <i>MiniLab</i> 22 <i>Design Your Own BioLab</i> 164-165, 522-523, 734-735 TWE: TTPK 13
PO 3. Formulate a testable hypothesis.	SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 496-497, 522-523, 544-545, 756-557 <i>Problem-Solving Lab</i> 768 TWE: UAA 11 QD 12 TTPK 13
PO 4. Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).	SE: <i>Problem-Solving Lab</i> 95, 318 <i>MiniLab</i> 198, 343, 398 <i>Internet BioLab</i> 274-275, 414-415 TWE: AL 266-267, 316-317
Concept 2: Scientific Testing (Investigating and Modeling)	
Design and conduct controlled investigations.	
PO 1. Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.	SE: 14-15 <i>Thinking Critically</i> 28 (#13) <i>Design Your Own BioLab</i> 164-165, 496-497 <i>Investigate BioLab</i> 188-189, 214-215 <i>Reference Handbook</i> 1106-1109 TWE: AC 15 AS 735
PO 2. Identify the resources needed to conduct an investigation.	SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 496-497, 522-523, 734-735, 756-757, 834-835 <i>Apply Your Skill</i> 59, 735, 757 TWE: TTPK 13

OBJECTIVES	PAGE REFERENCES
<p>PO 3. Design an appropriate protocol (written plan of action) for testing a hypothesis:</p> <ul style="list-style-type: none"> • Identify dependent and independent variables in a controlled investigation. • Determine an appropriate method for data collection (e.g., using balances, thermometers, microscopes, spectrophotometer, using qualitative changes). • Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators). 	<p>SE: <i>Skill Review</i> 57 <i>Design Your Own BioLab</i> 58-59, 164-165, 496-497, 522-523, 544-545, 756-757 <i>Apply Your Skill</i> 59, 735, 757 <i>Problem-Solving Lab</i> 768</p> <p>TWE: UAA 11 AS 119, 545</p>
<p>PO 4. Conduct a scientific investigation that is based on a research design.</p>	<p>SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 496-497, 522-523, 544-545, 756-757 <i>Apply Your Skill</i> 59, 735, 757</p> <p>TWE: AL 12-13</p>
<p>PO 5. Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.</p>	<p>SE: <i>Internet BioLab</i> 24-25, 414-415, 544-545, 626-627 <i>Design Your Own BioLab</i> 58-59, 164-165, 910-911 <i>Share Your Data</i> 415, 627 <i>Skill Handbook</i> 1099-1101</p> <p>TWE: AS 59, 911</p>
<p>Concept 3: Analysis, Conclusions, and Refinements Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.</p>	
<p>PO 1. Interpret data that show a variety of possible relationships between variables, including:</p> <ul style="list-style-type: none"> • <i>positive relationship</i> • <i>negative relationship</i> • <i>no relationship</i> 	<p>SE: <i>Problem-Solving Lab</i> 37, 95, 101, 619 <i>Design Your Own BioLab</i> 58-59, 164-165, 910-911 <i>MiniLab</i> 92</p> <p>TWE: RE 93</p>
<p>PO 2. Evaluate whether investigational data support or do not support the proposed hypothesis.</p>	<p>SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 330-331, 496-497, 522-523, 734-735, 756-757, 910-911 <i>Internet BioLab</i> 274-275</p> <p>TWE: AL 12-13</p>
<p>PO 3. Critique reports of scientific studies (e.g., published papers, student reports).</p>	<p>Critiques can be incorporated into the following activities.</p> <p>SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 330-331, 496-497, 522-523, 734-735, 756-757, 910-911 <i>Internet BioLab</i> 274-275, 544-545 <i>Biology and Society</i> 388</p> <p>TWE: TS 17 CA 17</p>

OBJECTIVES	PAGE REFERENCES
PO 4. Evaluate the design of an investigation to identify possible sources of procedural error, including: <ul style="list-style-type: none"> • sample size • trials • controls • analyses 	SE: <i>Internet BioLab</i> 24-25, 274-275, 544-545, 626-627 <i>Design Your Own BioLab</i> 58-59, 164-165, 734-735 <i>Investigate BioLab</i> 84-85, 104-105 TWE: EA 59, 85, 105, 165, 275, 627, 735
PO 5. Design models (conceptual or physical) of the following to represent "real world" scenarios: <ul style="list-style-type: none"> • carbon cycle • water cycle • phase change • collisions 	TWE: QD 53 PR 55 CA 133
PO 6. Use descriptive statistics to analyze data, including: <ul style="list-style-type: none"> • mean • frequency • range (See MHS-S2C1-10)	SE: <i>Internet BioLab</i> 24-25, 626-627 <i>Investigate BioLab</i> 104-105, 214-215, 386-387 <i>MiniLab</i> 407, 948, 981 TWE: SYD 25 AL 432-433
PO 7. Propose further investigations based on the findings of a conducted investigation.	SE: <i>Internet BioLab</i> 24-25 <i>Apply Your Skill</i> 59, 85, 165, 497, 523, 715, 735, 875 <i>Design Your Own BioLab</i> 756-757 TWE: AS 13, 39, 725, 735, 757, 875 AYS 523
Concept 4: Communication Communicate results of investigations.	
PO 1. For a specific investigation, choose an appropriate method for communicating the results.	Communication of results can be incorporated into the following activities. SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 330-331, 496-497, 522-523, 570-571, 734-735, 756-757
PO 2. Produce graphs that communicate data. (See MHS-S2C1-02)	SE: <i>Internet BioLab</i> 24-25, 414-415 <i>MiniLab</i> 92, 1010 <i>Problem-Solving Lab</i> 95, 101 <i>Design Your Own BioLab</i> 910-911 TWE: MA 407
PO 3. Communicate results clearly and logically.	Communication of results can be incorporated into the following activities. SE: <i>Design Your Own BioLab</i> 58-59, 164-165, 330-331, 496-497, 522-523, 570-571, 734-735, 756-757
PO 4. Support conclusions with logical scientific arguments.	SE: <i>MiniLab</i> 6 <i>Design Your Own BioLab</i> 164-165, 330-331, 910-911 <i>Problem-Solving Lab</i> 203 <i>Investigate BioLab</i> 214-215, 1016-1017 <i>Internet BioLab</i> 238-239, 544-545

OBJECTIVES	PAGE REFERENCES
Strand 2: History and Nature of Science	
Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.	
Concept 1: History of Science as a Human Endeavor	
Identify individual, cultural, and technological contributions to scientific knowledge.	
PO 1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.	SE: 11-12, 21-23, 337-338, 341, 345, 347-348, 349-353, 1024-1025, 1039 <i>Section Assessment 23 (#5)</i> , 353 (#5) <i>BioTechnology</i> 356, 660 TWE: BJ 353
PO 2. Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.	SE: 171-172, 253, 260, 281-282, 283, 381-382, 393-396, 443-444, 1024-1025 TWE: CDIV 8, 264, 284, 429, 976 EN 282
PO 3. Analyze how specific changes in science have affected society.	SE: 21-23, 345, 347-348, 349-353, 380, 1010-1011, 1024-1025, 1029-1030, 1039 <i>Biology and Society</i> 388, 498 TWE: AL 350 QD 381 EN 1029 EX 1030
PO 4. Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.	SE: 21-23, 344, 347-348, 351-353, 1040-1041 <i>Biology and Society</i> 388, 1044 <i>BioTechnology</i> 688
Concept 2: Nature of Scientific Knowledge	
Understand how science is a process for generating knowledge.	
PO 1. Specify the requirements of a valid, scientific explanation (theory), including that it be: <ul style="list-style-type: none"> • logical • subject to peer review • public • respectful of rules of evidence 	SE: 17, 18 <i>Skill Review</i> 18 <i>BioDigest</i> 30 <i>Focus On</i> 1060-1061 TWE: EX 18
PO 2. Explain the process by which accepted ideas are challenged or extended by scientific innovation.	SE: 11-18, 171-173, 380-383 <i>Skill Review</i> 18 <i>BioDigest</i> 30 <i>Biology and Society</i> 388 <i>Focus On</i> 1060-1061 TWE: CT 17 CA 388
PO 3. Distinguish between pure and applied science.	SE: 21, 22-23, 341-348, 349-353 <i>BioTechnology</i> 356, 660 <i>Biology and Society</i> 388 <i>Connection to Earth Science</i> 438 TWE: QD 342

OBJECTIVES	PAGE REFERENCES
PO 4. Describe how scientists continue to investigate and critically analyze aspects of theories.	SE: 17, 18 <i>BioDigest</i> 30 <i>Biology and Society</i> 388 <i>Focus On</i> 1060-1061 TWE: EYV 1061
Strand 3: Science in Personal and Social Perspectives Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.	
Concept 1: Changes in Environments Describe the interactions between human populations, natural hazards, and the environment.	
PO 1. Evaluate how the processes of natural ecosystems affect, and are affected by, humans.	SE: 118-120, 116-120 <i>Biology and Society</i> 60, 600 <i>Physical Science Connection</i> 118 <i>Connection to Earth Science</i> 128 TWE: EN 56 AL 118-119
PO 2. Describe the environmental effects of the following natural and/or human-caused hazards: <ul style="list-style-type: none"> • flooding • drought • earthquakes • fires • pollution • extreme weather 	SE: 37, 68-69, 118-120 <i>Chapter Assessment</i> 88 (#10) <i>Connection to Chemistry</i> 106 <i>Skill Review</i> 120 <i>MiniLab</i> 122 <i>Biology and Society</i> 600, 716 TWE: EN 119
PO 3. Assess how human activities (e.g., clear cutting, water management, tree thinning) can affect the potential for hazards.	SE: 118-120 <i>Skill Review</i> 120 <i>MiniLab</i> 122 <i>Biology and Society</i> 600, 716 TWE: EN 117 PSC 119 GF 600 TS 716
PO 4. Evaluate the following factors that affect the quality of the environment: <ul style="list-style-type: none"> • urban development • smoke • volcanic dust 	SE: 117-120 TWE: QD 117
PO 5. Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.	SE: 121-125 <i>Problem-Solving Lab</i> 124 <i>Skill Review</i> 125 <i>Biology and Society</i> 854 TWE: CA 123 MA 123 IN 123 AS 125 FYO 854

OBJECTIVES	PAGE REFERENCES
Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.	
PO 1. Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems: <ul style="list-style-type: none"> • various forms of alternative energy • storage of nuclear waste • abandoned mines • greenhouse gases • hazardous wastes 	Cost-benefit analyses can be incorporated into discussions of the following. SE: 118, 119 <i>Physical Science Connection</i> 118 TWE: EN 117 PSC 119
PO 2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.	SE: 21-23 <i>Problem-Solving Lab</i> 16 <i>Biology and Society</i> 26, 388, 600, 938, 1044 TWE: GF 600
PO 3. Support a position on a science or technology issue.	SE: <i>Forming Your Opinion</i> 26, 600, 854, 938, 1044 TWE: IN 345 TS 388 GF 600
PO 4. Analyze the use of renewable and nonrenewable resources in Arizona: <ul style="list-style-type: none"> • water • land • soil • minerals • air 	Arizona-specific conditions can be incorporated into the following materials. SE: 118-120, 122, 125 <i>Skill Review</i> 120 <i>MiniLab</i> 122 TWE: PSC 119
PO 5. Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).	SE: 121-125 <i>Real World BioChallenge</i> 88 <i>Problem-Solving Lab</i> 124 <i>Biology and Society</i> 600, 854 TWE: MA 123 IN 123 CA 123 AS 125 GF 600
Concept 3: Human Population Characteristics Analyze factors that affect human populations.	
PO 1. Analyze social factors that limit the growth of a human population, including: <ul style="list-style-type: none"> • affluence • education • access to health care • cultural influences 	SE: 100-103 TWE: IN 100
PO 2. Describe biotic (living) and abiotic (nonliving) factors that affect human populations.	Point out to students that humans also are affected by abiotic factors. SE: 37-38, 52-55, 56-57, 65-66, 91-93, 96-99, 100-103 TWE: CDIV 47 RE 53

OBJECTIVES	PAGE REFERENCES
PO 3. Predict the effect of a change in a specific factor on a human population.	SE: <i>Section Assessment</i> 103 (#5) TWE: AS 83, 103 RT 103
Strand 4: Life Science Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.	
Concept 1: The Cell Understand the role of the cell and cellular processes.	
PO 1. Describe the role of energy in cellular growth, development, and repair.	SE: 184, 221-224 <i>Section Assessment</i> 224 (#1) TWE: UAA 221
PO 2. Compare the form and function of prokaryotic and eukaryotic cells and their cellular components.	SE: 173-174, 179-187 <i>Section Assessment</i> 174 (#4) <i>MiniLab</i> 182 <i>Investigate BioLab</i> 188-189 <i>BioDigest</i> 245-246
PO 3. Explain the importance of water to cells.	SE: 152-153, 156, 177, 195-198 <i>Section Assessment</i> 200 (#1, #2)
PO 4. Analyze mechanisms of transport of materials (e.g., water, ions, macromolecules) into and out of cells: • passive transport • active transport	SE: 198-199 <i>Reading Check</i> 199 <i>Section Assessment</i> 200 (#3, #4) <i>BioDigest</i> 247
PO 5. Describe the purposes and processes of cellular reproduction.	SE: 203, 204, 206-210 <i>Reading Check</i> 203 <i>BioDigest</i> 247 TWE: EN 206 IS 209
Concept 2: Molecular Basis of Heredity Understand the molecular basis of heredity and resulting genetic diversity.	
*PO 1. Analyze the relationships among nucleic acids (DNA, RNA), genes, and chromosomes.	SE: 163, 203-204, 211, 246, 263, 281-284, 288 <i>Inside Story</i> 205 TWE: VL 205
PO 2. Describe the molecular basis of heredity, in viruses and living things, including DNA replication and protein synthesis.	SE: 263-266, 281-285, 288-295, 478-480 <i>Inside Story</i> 286 <i>MiniLab</i> 293 <i>Investigate BioLab</i> 302-303 <i>BioDigest</i> 361-362 TWE: RT 287 QD 289
PO 3. Explain how genotypic variation occurs and results in phenotypic diversity.	SE: 269-270, 311-314, 315-320, 404-408 <i>Section Assessment</i> 279 (#3) <i>MiniLab</i> 407 TWE: TP 405 TTPK 406

OBJECTIVES	PAGE REFERENCES
PO 4. Describe how meiosis and fertilization maintain genetic variation.	SE: 253, 263-270, 361 <i>MiniLab</i> 268 <i>Section Assessment</i> 279 (#3) <i>BioDigest</i> 361
Concept 3: Interdependence of Organisms Analyze the relationships among various organisms and their environment.	
PO 1. Identify the relationships among organisms within populations, communities, ecosystems, and biomes.	SE: 38-43, 70-83 <i>Section Assessment</i> 45 (#2) <i>BioDigest</i> 132 TWE: PR 41 AS 45 UPK 70
*PO 2. Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment.	SE: 37-38, 41-45, 65-66, 97-99 <i>Problem-Solving Lab</i> 37 <i>Section Assessment</i> 45 (#1) <i>Lab: Design Your Own</i> 58-59 TWE: CA 37 AL 38-39
*PO 3. Assess how the size and the rate of growth of a population are determined by birth rate, death rate, immigration, emigration, and carrying capacity of the environment.	SE: 91-99, 100-102 <i>MiniLab</i> 92, 102 <i>Problem-Solving Lab</i> 95 <i>Section Assessment</i> 103 (#2) TWE: IN 97 EX 103
Concept 4: Biological Evolution Understand the scientific principles and processes involved in biological evolution.	
PO 1. Identify the following components of natural selection, which can lead to speciation: <ul style="list-style-type: none"> potential for a species to increase its numbers genetic variability and inheritance of offspring due to mutation and recombination of genes finite supply of resources required for life selection by the environment of those offspring better able to survive and produce offspring 	SE: 395-399, 404-409 <i>Problem-Solving Lab</i> 397 <i>Section Assessment</i> 403 (#1) <i>Internet BioLab</i> 414-415 <i>BioDigest</i> 468 TWE: PR 394 VL 395 CFU 403 AL 408-409
PO 2. Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.	SE: 397-399, 407-409 <i>Problem-Solving Lab</i> 397 <i>MiniLab</i> 398 <i>Section Assessment</i> 403 (#3) <i>Focus on Adaptations</i> 469 TWE: PO 399 CA 468
*PO 3. Describe how the continuing operation of natural selection underlies a population's ability to adapt to changes in the environment and leads to biodiversity and the origin of new species.	SE: 409-413 TWE: RE 410 PR 410 EN 411 EX 413

OBJECTIVES	PAGE REFERENCES
*PO 4. Predict how a change in an environmental factor (e.g., rainfall, habitat loss, non-native species) can affect the number and diversity of species in an ecosystem.	SE: 37, 68-69, 97, 115-120, 378 <i>Problem-Solving Lab</i> 115 <i>Section Assessment</i> 120 (#4)
PO 5. Analyze how patterns in the fossil record, nuclear chemistry, geology, molecular biology, and geographical distribution give support to the theory of organic evolution through natural selection over billions of years and the resulting present day biodiversity.	SE: 370-375, 378-379, 383-385, 399-403 <i>MiniLab</i> 371 <i>Problem-Solving Lab</i> 372 <i>Section Assessment</i> 385 (#3) <i>Skill Review</i> 385 TWE: DI 383
PO 6. Analyze, using a biological classification system (i.e., cladistics, phylogeny, morphology, DNA analysis), the degree of relatedness among various species.	SE: 445-449, 450-453, 456 <i>Problem-Solving Lab</i> 447 <i>MiniLab</i> 453 <i>Section Assessment</i> 459 (#5) TWE: CA 451 VL 452 UM 453
Concept 5: Matter, Energy, and Organization in Living Systems (Including Human Systems) Understand the organization of living systems, and the role of energy within those systems.	
PO 1. Compare the processes of photosynthesis and cellular respiration in terms of energy flow, reactants, and products.	SE: 225-228, 230, 231-232, 234, 237 <i>Inside Story</i> 229, 233 <i>Skill Review</i> 237 <i>BioDigest</i> 247 TWE: AL 234-235
PO 2. Describe the role of organic and inorganic chemicals (e.g., carbohydrates, proteins, lipids, nucleic acids, water, ATP) important to living things.	SE: 141-142, 152-153, 157-161, 163, 176-178, 198, 222-223 <i>Inside Story</i> 162 <i>Skill Review</i> 163 <i>BioDigest</i> 245 TWE: AS 156 CA 199, 245 UM 222
*PO 3. Diagram the following biogeochemical cycles in an ecosystem: <ul style="list-style-type: none"> • water • carbon • nitrogen 	SE: 52-54, 56-57 <i>Inside Story</i> 55 TWE: RE 53 PR 55 VL 55 CA 133
*PO 4. Diagram the energy flow in an ecosystem through a food chain.	SE: 48-50 <i>Problem-Solving Lab</i> 50 <i>Chapter Assessment</i> 62 (#13) <i>BioDigest</i> 133 TWE: CA 48 RE 49 UM 51

OBJECTIVES	PAGE REFERENCES
PO 5. Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems.	SE: 7, 36-41, 172, 210, 456-459, 605-608, 610-611, 673 <i>Section Assessment</i> 174 (#2), 210 (#3) <i>Inside Story</i> 609 TWE: PO 607 EX 611

Codes Used for TWE Pages

AC	Activity
AL	Additional Lab
AS	Assessment
AYS	Apply Your Skill
BJ	Biology Journal
CA	Challenge Activity
CDIV	Cultural Diversity
CFU	Check for Understanding
CT	Critical Thinking
DI	Discussion
EA	Error Analysis
EN	Enrichment
EX	Extension
EYV	Expanding Your View
FYO	Forming Your Opinion
GF	Going Further
IN	Inquiry
IS	Inclusion Strategy
MA	Modified Assessment
PO	Portfolio
PR	Project
PSC	Physical Science Connection
QD	Quick Demo
RE	Reinforcement
RT	Reteach
SYD	Share Your Data
TP	Tech Prep
TS	Teaching Strategies
TTPK	Tying to Prior Knowledge
UAA	Using an Analogy
UM	Using Models
UPK	Using Prior Knowledge
VL	Visual Learning