

Index of Major Scientific Concepts and Terms in *Biology in a Box* Units & Exercises

Note: This document can serve as a starting point for selection of *Biology in a Box* units & exercises for use in the classroom to address Tennessee curriculum standards. In some cases, specific exercises addressing a particular topic are listed. However, in other cases, entire units are listed, along with an overview of how the exercises within the listed units can be related to a particular theme.

Abiotic components of ecosystems

Unit 1 – factors influencing fossilization (Exercise 1)

Unit 3 – temperature (major theme throughout unit)

Unit 5 – environmental factors influencing phenotype (Exercise 2)

Unit 6 – adaptations of animal phyla to environmental factors

Unit 8 – environmental factors influencing variation (theme throughout, but focused on in even more detail in Exercise 8)

Unit 9 – environmental factors influencing tree growth (discussed briefly)

Unit 10 – environmental factors influencing behavior (throughout the unit)

Acceleration

Unit 4 – Exercise 1

Adaptation

Unit 2 – animal adaptations to diet (throughout)

Unit 3 – animal adaptations to temperature (Exercises 1 & 2)

Unit 5 – genetic basis of adaptation (throughout)

Unit 6 – diversity of animal adaptations (throughout)

Unit 7 – animal adaptations for movement (Exercise 1)

Adaptation (cont.)

Unit 8 – the role of variation in adaptation (Exercise 8)

Unit 9 – adaptation in trees

Unit 10 – behavioral adaptations (throughout; Exercise 7 is an excellent example)

Aerobic respiration

See **respiration**

Alleles

Unit 5 – Exercises 2, 3, & 4

Amino acids

Unit 5 – not discussed in detail, but would work well with this unit

Animal growth, development, & reproduction

Unit 5 – reproduction a major theme (Exercises 2-4)

Unit 6 – diversity in animal development & life cycles (explored throughout)

Unit 8 – variation in growth patterns (Exercise 8)

Unit 10 – learned behaviors

Animals

Unit 1 – fossil animals (throughout)

Unit 2 – diversity in animal diet types (throughout)

Animals (cont.)

Unit 3 – diversity in animal body coverings (Exercises 1 & 2)
Unit 5 – animal reproduction (Exercises 2-4)
Unit 6 – overview of major animal phyla (throughout)
Unit 7 – animals of Tennessee (throughout)
Unit 8 – mollusk diversity (Exercise 8)
Unit 10 – animal senses & behavior (throughout)

Animal senses

Unit 10 – Exercises 1-4

Animal structure

Unit 1 – comparison of extinct & extant animals (throughout)
Unit 2 – animal structures related to diet; the skeletal system
Unit 3 – animal body coverings (Exercises 1 & 2)
Unit 6 – diversity in animal body plans (throughout)
Unit 8 – variation in mollusk shells (Exercise 8)
Unit 10 – animal sensory structures (throughout)

Animals, diet types

Unit 2 – explored in all exercises
Unit 3 – obtaining energy from food (predation & herbivory) – throughout
Unit 7 – obtaining energy from food (predation); identifying animal diet types through scats (Exercise 2)

Archimedes' Principle

Unit 4 – Exercise 2

Atoms & molecules

Unit 1 – radioactive decay (Exercise 3)
Unit 5 – elements in DNA molecules (Exercise 1)

ATP

Unit 2 – not discussed, but can work with discussions of how food is converted to ATP
Unit 3 – not discussed, but can work with discussions of how food is converted to ATP
Unit 5 – not discussed, but can work with discussions of ATP's role in replication

Autotrophs

Unit 6 – discussed briefly in introduction
Unit 9 – would work well with this unit on trees

Biodiversity

Unit 1 – diversity in the fossil record (Exercises 1 & 3)
Unit 2 – diversity in animal diet types (throughout)
Unit 3 – diversity in animal body coverings (Exercises 1 & 2)
Unit 5 – genetic diversity
Unit 6 – overview of major animal phyla (throughout)
Unit 7 – animals of Tennessee (throughout)
Unit 8 – mollusk diversity (Exercise 8)
Unit 9 – diversity of Tennessee trees (Exercise 1)
Unit 10 – diversity in animal behavior (throughout)

Biogeochemical cycles

Unit 6 – not discussed, but could discuss with roles of various living organisms in biogeochemical cycling

Biogeochemical cycles (cont.)

Unit 9 – not discussed, but trees' roles in nutrient cycling could be addressed

Biomes

Unit 3 – adaptation of animal body coverings to various climates (Exercises 1 & 2)

Biotechnology

Unit 3 – applications in insulation (Exercises 2 & 3)

Unit 4 – density in biology & technology (Exercise 3)

Biotic components of ecosystems

Unit 1 – factors influencing fossilization

Unit 2 – obtaining energy from food (consumption of other organisms – herbivory and predation)

Unit 3 – obtaining energy from food (consumption of other organisms – herbivory and predation)

Unit 5 – biotic factors influencing phenotype

Unit 6 – animal diversity

Unit 7 – obtaining energy from food (consumption of other organisms – herbivory and predation)

Unit 8 – biotic factors influencing variation

Unit 9 – biotic factors influencing tree growth

Unit 10 – biotic factors influencing behavior

Body cavities

Unit 6 – distinctions among acoelomates, pseudocoelomates, and coelomates discussed throughout

Bonds, chemical

Unit 5 – types of bonds in DNA molecules (Exercise 1)

Carbon cycle

See **biogeochemical cycles**

Carbon dating

Unit 1 – Exercise 2

Carnivores

See **animals, diet types**

Cells

Unit 3 – cellular use of energy (discussed briefly)

Unit 5 – DNA, chromosomes, inheritance, gametogenesis (all exercises)

Unit 6 – discussion of animal and plant cells (brief)

Unit 9 – specialized plant cells

Celsius temperature scale

See **temperature**

Central nervous system

See **nervous system**

Change, chemical

Unit 1 – chemical changes during fossilization (Exercise 1)

Unit 2 – chemical changes/obtaining energy from food (discussed briefly)

Unit 3 – chemical changes/obtaining energy from food (discussed briefly)

Unit 4 – cellular respiration and photosynthesis (discussed briefly in introduction)

Unit 9 – photosynthesis (discussed briefly)

Change, physical

Unit 1 – formation of sedimentary rocks;
physical changes during fossilization

Chemical bonds

See **bonds, chemical**

Chemical change

See **change, chemical**

Chromosomes

Unit 5 – Exercises 2 & 3

Circulatory system

See **organ systems**

Cladistics/Cladograms

Unit 6 – Exercise 6

Classification

Unit 1 – Exercise 4

Unit 2 – classification of animals by diet
type

Unit 6 – major theme throughout; particular
focus in Exercise 6

Classification (cont.)

Unit 8 – defining species/partitioning
variation

Unit 9 – different tree families (not
discussed in great detail)

Climate

See **biomes**

Codominance

Unit 5 – not mentioned specifically, but
could work well in discussion of inheritance
patterns (Exercises 2 & 3)

Coevolution

Unit 10 – could work well with exercises on
vision and smell, in the context of
coevolution of plants and pollinators
(Exercises 2 & 3)

Conservation

Unit 1 – not a major focus, but can easily
talk about extinction (using fossil examples)

Unit 5 – not a major focus, but can discuss
the importance of maintaining genetic
diversity and variation for conservation

Unit 6 – not a major focus, but easy to focus
on importance of maintaining biodiversity

Unit 7 – focus on TN animals may spark
interest in conservation at the local scale

Unit 8 – not a major focus, but can discuss
the importance of maintaining genetic
diversity and variation for conservation

Unit 9 – focus on TN trees may spark interest
in conservation at the local scale

Covalent bonds

See **bonds, chemical**

Density

Unit 4 – Exercise 3

Development, animal

See **animal growth, development, &
reproduction**

Dicots

See **plants**

Diet types of animals

See **animals, diet types**

Digestive system

Unit 2 – could easily be worked in to this unit, which discusses animal diet types

Unit 3 – could easily be worked in to the role of food and the digestive system in maintaining body temperature

Unit 6 – digestive systems of various animal phyla are discussed throughout

Dihybrid crosses

Unit 5 – Exercise 2

Diversity

See **biodiversity**

DNA

Unit 5 – major theme throughout

Dominant & recessive traits

Unit 5 – Exercises 2, 3, & 4

Earth materials

Unit 4 – physical properties of various earth materials (mass, density, etc.)

Unit 9 – wood products & their properties (Exercise 2)

Ecosystems

Unit 3 – adaptation of animal body coverings to various climates (Exercises 1 & 2)

Ecosystems, abiotic components of

See **abiotic components of ecosystems**

Ecosystems, biotic components of

See **biotic components of ecosystems**

Electromagnetic spectrum

Unit 3 – could work in with discussion of sunlight/heat

Unit 9 – could be worked in with photosynthesis (not discussed in detail)

Unit 10 – the exercise on vision (Exercise 3) is a great place for this

Electrons

See **atoms & molecules & bonds, chemical**

Embryonic development

Unit 6 – diversity in animal development (explored throughout)

Energy

Unit 1 – radioactive decay (Exercise 3)

Unit 2 – chemical changes/obtaining energy from food (discussed briefly)

Unit 3 – chemical changes/obtaining energy from food (discussed briefly); thermodynamics & heat energy (throughout)

Unit 4 – potential & kinetic energy (Exercise 1)

Unit 6 – cellular respiration & photosynthesis (briefly discussed in introduction)

Unit 7 – sound & waves (Exercise 4)

Unit 8 – photosynthesis (discussed briefly in Exercise 8)

Unit 9 – photosynthesis (converting light energy to chemical energy; discussed briefly)

Unit 10 – sound & waves (Exercises 4 & 5)

Enzymes

Unit 2 – Not discussed in detail, but could be worked into a discussion of food/digestion

Enzymes (cont.)

Unit 5 – brief discussion of enzymes and roles in DNA replication (Exercise 1)

Epistasis (interaction among genes)

Unit 5 – Exercise 3

Eukaryotes

Unit 6 – distinction between eukaryotes and prokaryotes in introduction

Extinct organisms

Unit 1 – major theme of entire unit
Unit 6 – can easily focus on comparing modern organisms with extinct ones

Fahrenheit temperature scale

See **temperature**

Food chains/food webs

Unit 2 – predators & prey

Forces

Unit 4 – Exercise 1

Fossil record

Unit 1 – Exercises 2 & 4

Fossilization

Unit 1 – Exercise 1

Friction

Unit 4 – Exercise 1 (mentioned briefly)

Fungi

Unit 6 – major characteristics mentioned briefly in intro

Gametes

Unit 5 – Exercises 2 & 3

Gas exchange

Unit 6 – Exercise 8

Genes

Unit 5 – major theme throughout

Geologic time scale

Unit 1 – Exercise 2

Geology

Unit 1 – Major theme throughout

Germ layers

Unit 6 – discussed in detail throughout

Gravity

Unit 4 – Exercise 1

Growth, animal

See **animal growth, development, & reproduction**

Gymnosperms

See **plants**

Half-life

See **carbon dating & decay, radioactive**

Hardy-Weinberg equilibrium

Unit 5 – not discussed in detail, but this unit provides ample opportunity to expand on this topic

Herbivores

See **animals, diet types**

Heredity

Unit 5 – major theme throughout

Heterotrophs

Unit 2 – a good unit to explain that animals are all heterotrophs, since this unit focuses on animal diet types

Unit 6 – distinction between heterotrophs and autotrophs in introduction

Hydrogen bonds

See **bonds, chemical**

Hydrologic cycle

See **biogeochemical cycles**

Incomplete Dominance

Unit 5 – not discussed in detail, but would work well in exercises about heredity (Exercises 2 & 3)

Inheritance, Mendelian

Unit 5 – Exercises 2 & 4

Inheritance, non-Mendelian

Unit 5 – Exercise 3

Insectivores

See **animals, diet types**

Interactions among organisms

See **biotic components of ecosystems**

Integumentary system

See **organ systems**

Intermolecular forces

See **bonds, chemical**

Ionic bonds

See **bonds, chemical**

Kelvin temperature scale

Unit 3 – not discussed, but easily accomplished; see also **temperature**

Kingdom Animalia

See **animal kingdom**

Landforms

Unit 1 – changes in major landforms throughout Earth's history discussed in Exercise 2

Law of conservation of energy

Unit 3 – can easily be discussed in this unit

Law of conservation of momentum

Unit 4 – easily worked into Exercise 1

Length

See **measurement**

Life cycles

See **animal growth, development, & reproduction**

Light

See **electromagnetic spectrum, energy, photosynthesis, & waves**

Lymphatic system

See **organ systems**

Machines, simple

Unit 4 – not discussed specifically, but Unit 4 can easily supplement discussion of simple machines

Mass

Unit 4 – Exercises 1 & 3; see also **measurement**

Measurement

Unit 1 – physical properties of fossils & sedimentary rock (Exercises 1 & 3)

Unit 2 – measuring skulls & teeth (Exercise 3)

Unit 3 – measuring fur samples, insulative properties, temperature (Exercises 2 & 3)

Unit 4 – entire unit

Unit 5 – qualitative properties of phenotypes (Exercises 2 & 3)

Unit 6 – animal body sizes (throughout)

Unit 7 – measuring animal tracks; qualitative properties of scats (Exercises 1 & 2)

Unit 8 – describing variation (entire unit)

Unit 9 – wood density (Exercise 2)

Mendel's law of independent assortment

Unit 5 – Exercise 2

Mendel's law of independent segregation

Unit 5 – Exercise 2

Metabolism

Unit 2 – can easily be worked into this unit on diet types

Unit 3 – discussion of maintenance of body temperatures in endotherms and ectotherms in Exercise 2

Minerals

Unit 1 – not discussed in great detail, but would work well with this unit overall

Mitochondria

See **cells**

Molecules

See **atoms & molecules**

Monocots

See **plants**

Monohybrid cross

Unit 5 – Exercise 2

Motion

Unit 2 – animal skeletal systems (Exercise 3)

Unit 4 – Exercise 1

Unit 7 – inferring animal movement from tracks (Exercise 1)

Multiple alleles

Unit 5 – Exercises 2 & 3

Muscular system

Unit 2 – briefly discussed in this unit unit, which focuses on the skeletal system of animals; this unit could easily work well for expansion on this topic

Mutation

Unit 5 – Exercise 1

Natural selection

See **adaptation**

Nervous system

Unit 6 – nervous systems of various animal phyla are compared

Unit 10 – would work well in discussion of exercises on senses (throughout)

Neurons

See **nervous system**

Newton's laws of motion

Unit 4 – Exercise 1

Nitrogen cycle

See **biogeochemical cycles**

Nonvascular plants

See **plants**

Nuclear energy

See **carbon dating & decay, radioactive**

Nucleic acids

See **DNA**

Omnivores

See **animals, diet types**

Organ systems

Unit 2 – the skeletal system discussed in detail; discussion on muscular and digestive systems easily worked into this unit

Unit 3 – the integumentary system discussed in detail

Unit 6 – compares and contrasts organ systems in various animal phyla

Organelles

See **cells**

Peripheral nervous system

See **nervous system**

Phosphorus cycle

See **biogeochemical cycles**

Photosynthesis

Unit 6 – mentioned briefly in introduction

Unit 8 – mentioned briefly in Exercise 8

Unit 9 – mentioned briefly, but this unit on forestry would work well with a lesson on plants and photosynthesis

Phylogenies

Unit 1 – Exercise 3

Unit 6 – Exercise 6

Physical change

See **change, physical**

Physical properties

See **measurement**

Physiology

Unit 2 – chemical changes/obtaining energy from food (discussed briefly)

Unit 3 – chemical changes/obtaining energy from food/photosynthesis (discussed briefly); thermodynamics & heat energy (throughout)

Unit 6 – cellular respiration & photosynthesis (briefly discussed in introduction)

Unit 7 – sound & waves (Exercise 4)

Unit 8 – photosynthesis (discussed briefly in Exercise 8)

Unit 9 – photosynthesis (converting light energy to chemical energy; discussed briefly)

Unit 10 – sound & waves (Exercises 4 & 5)

Plant structure

Unit 9 – Exercise 1

Plants

Unit 1 – fossil and “living fossil” plants presented in Exercise 1

Unit 2 – discussion of plant material in diet of herbivores

Unit 6 – distinction among plant and animal kingdoms drawn in introduction

Plants (cont.)

Unit 9 – entire unit on forestry; a good place to bring up differences in gymnosperms & angiosperms, monocots & dicots, etc.

Unit 10 – plant/pollinator relationships explored in Exercises 2 & 3

Plate tectonics

Unit 1 – not discussed, but would work well with this unit

Pollution

See **conservation**

Polygenic traits

Unit 5 – Exercise 3

Prokaryotes

Unit 6 – distinction between prokaryotes and eukaryotes in introduction

Properties, physical

See **measurement**

Proteins

Unit 5 – not discussed in detail, but would work well in the context of the genetic coding of proteins

Radiocarbon dating

See **carbon dating**

Recessive traits

Unit 5 – Exercises 2 & 3

Reproduction

Unit 5 – Exercises 2-4

Reproduction, asexual

Unit 6 – Mentioned in discussion of several animal phyla throughout

Reproduction, sexual

Unit 5 – Exercises 2-4

Unit 6 – Mentioned in discussion of several animal phyla throughout

Respiration

Unit 2 – obtaining energy from food (discussed briefly)

Unit 3 – obtaining energy from food (discussed briefly)

Rock cycle

Unit 1 – would work well with Exercises 1 & 2

Scientific method

Unit 10 – Exercise 1

Sedimentary rock

Unit 1 – Exercises 1 & 2

Seeds

See **plants**

Sex linkage

Unit 5 – not discussed in detail, but would work well on exercises on inheritance (Exercises 2, 3, & 4)

Senses, animal

See **animal senses**

Simple machines

See **machines, simple**

Skeletal system

Unit 2 – major theme throughout

Unit 6 – subphylum Vertebrata discussed throughout

Soils

Unit 1 – not discussed, but could work with this unit

Unit 9 – not discussed, but could work well with discussion of trees

Solar system

Unit 4 – not discussed in detail, but could work well with the discussion of forces and mass in this unit

Sound

Unit 7 – sound & waves (Exercise 4)

Unit 10 – sound & waves (Exercises 4 & 5)

Speciation

Unit 1 – Exercise 3

Unit 6 – Exercise 6

Unit 8 – Exercise 6

Speed

Unit 4 – Exercise 1

Stimuli

Unit 10 – explored in all exercises on the senses (Exercises 1-4)

Structure, animal

See **animal structure**

Structure, plant

Unit 6 – plant cells mentioned briefly in introduction

Unit 9 – Exercise 1

Succession

Unit 9 – Exercise 5

Symbiosis

See **biotic components of ecosystems**

Taxonomy

See **classification**

Tectonic plates

See **plate tectonics**

Temperature

Unit 3 – throughout; Celsius & Fahrenheit temperature scales; relationship between heat and temperature; thermal conductivity (Exercise 3)

Thermodynamics

Unit 3 – Exercises 2 & 3

Traits, dominant

See **dominant & recessive traits**

Traits, recessive

See **dominant & recessive traits**

Urinary system

See **organ systems**

Vascular plants

See **plants**

Variation

Unit 8 – major theme throughout

See also **biodiversity**

Velocity

Unit 4 – Exercise 1

Water cycle

See **biogeochemical cycles**

Waves

See **energy**

Weather

See **biomes**

Weight

Unit 4 – Exercise 1

See also **measurement**