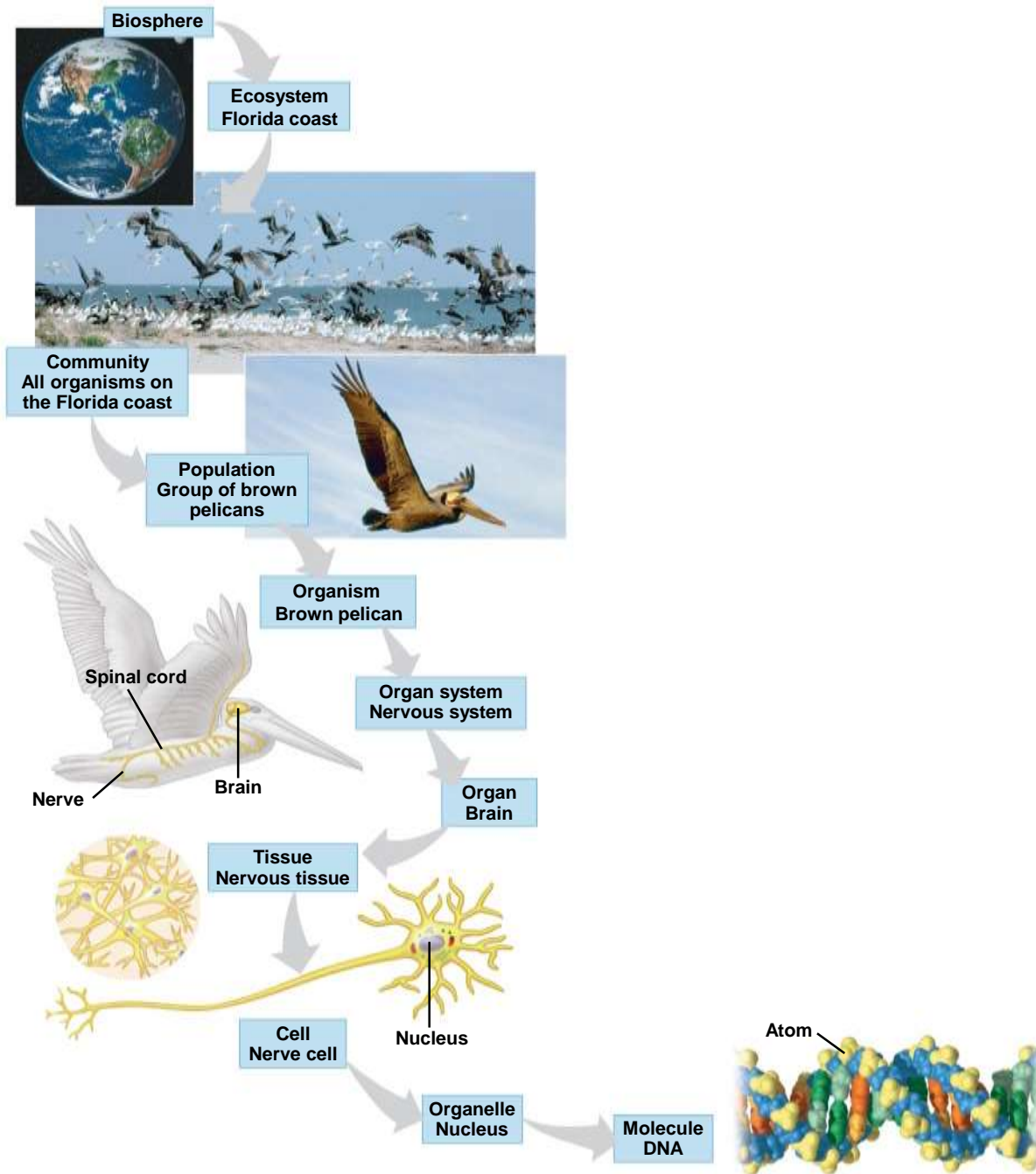

THEMES IN THE STUDY OF BIOLOGY

1.1 I can describe life's hierarchy of organization noting the interrelationships between individuals.

- Life's levels of organization define the scope of biology
 - Life emerges through organization of various levels
 - With addition of each new level, novel properties emerge—called **emergent properties**



Biosphere



**Ecosystem
Florida coast**

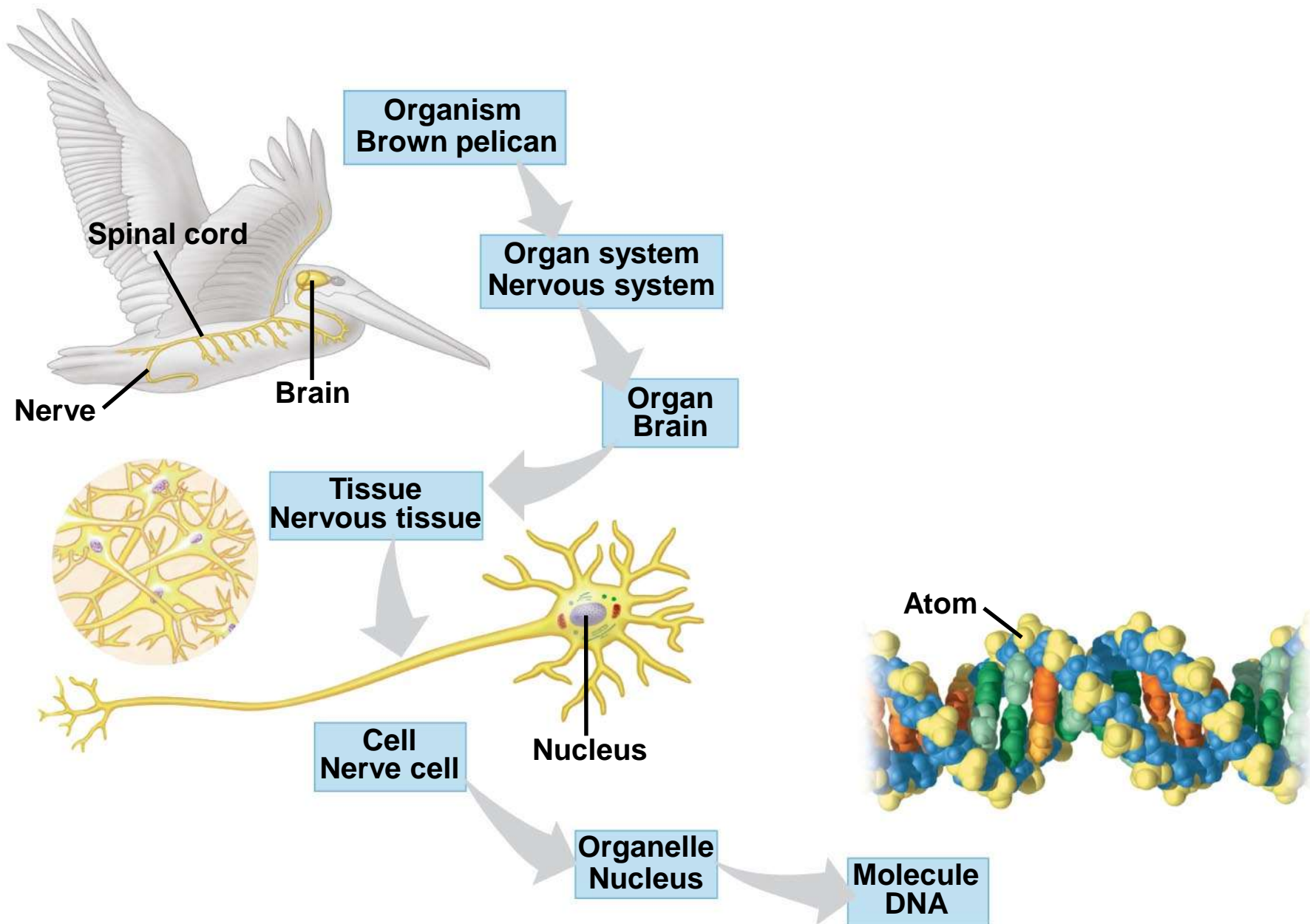


**Community
All organisms on
the Florida coast**

**Population
Group of brown
pelicans**



**Organism
Brown pelican**



1.1 I can describe life's hierarchy of organization noting the interrelationships between individuals.

- The upper tier is a global perspective of life
 - **Biosphere**—all the environments on Earth that support life
 - **Ecosystem**—all the organisms living in a particular area
 - **Community**—the array of organisms living in a particular ecosystem
 - **Population**—all the individuals of a species within a specific area

1.1 I can describe life's hierarchy of organization noting the interrelationships between individuals.

- The middle tier is characterized by the organism, an individual living thing, which is composed of
 - **Organ systems**—have specific functions; are composed of organs
 - **Organs**—provide specific functions for the organism
 - **Tissues**—made of groups of similar cells

1.1 I can describe life's hierarchy of organization noting the interrelationships between individuals.

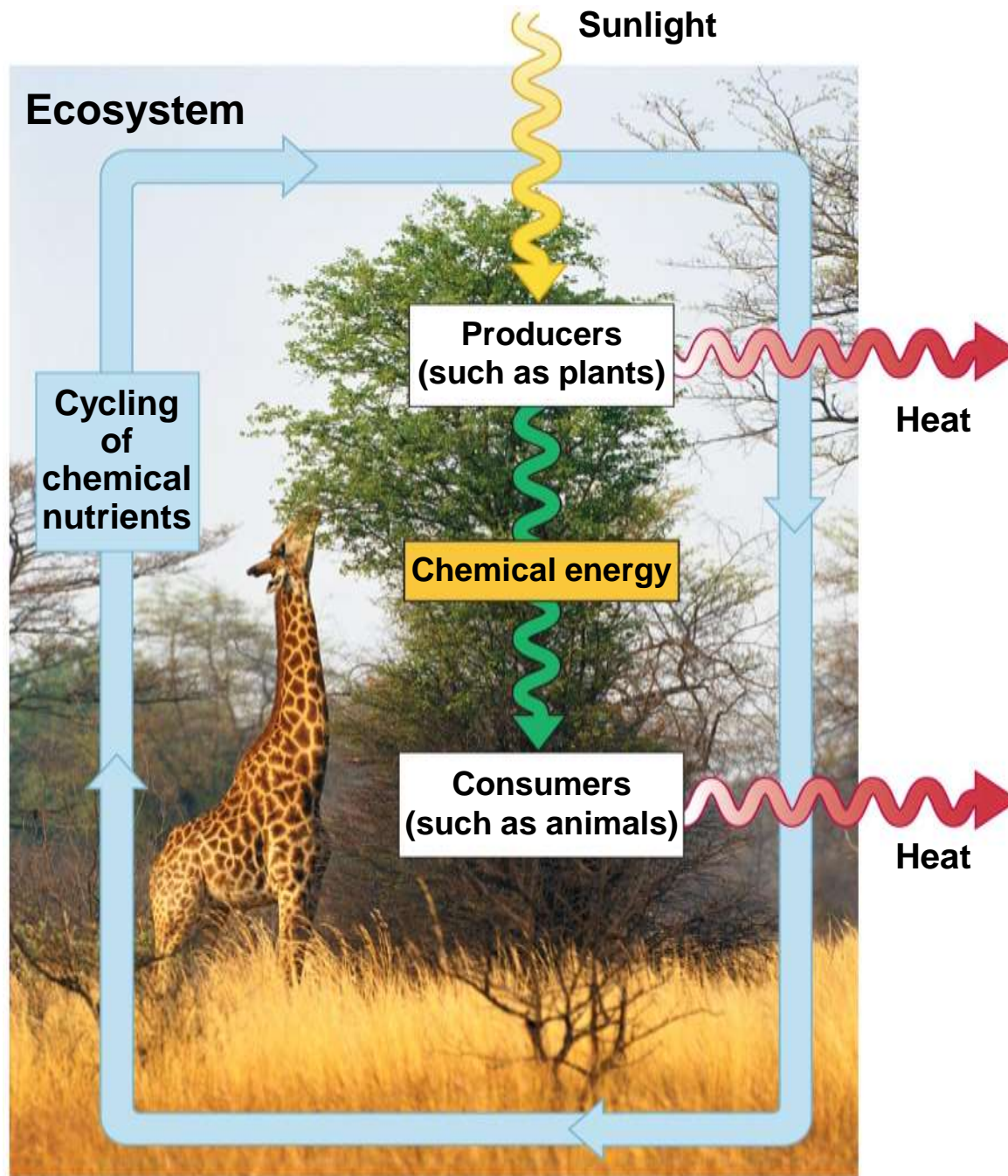
- Life emerges at the level of the cell, the lower tier, which is composed of
 - **Molecules**—clusters of atoms
 - **Organelles**—membrane-bound structures with specific functions
 - **Cells**—living entities distinguished from their environment by a membrane

1.2 I can explain the cycling of matter and flow of energy among organisms in an ecosystem.

- Life requires interactions between living and nonliving components
 - Photosynthetic organisms provide food and are called **producers**
 - Others eat plants (or animals that profit from plants) and are called **consumers**
- The nonliving components are chemical nutrients required for life

1.2 I can explain the cycling of matter and flow of energy among organisms in an ecosystem.

- To be successful, an ecosystem must accomplish two things
 - Recycle chemicals necessary for life
 - Move energy through the ecosystem
 - Energy enters as light and exits as heat



1.3 I can describe the structural and functional aspects of prokaryotic and eukaryotic cells

- Two distinct groups of cells exist
 - **Prokaryotic cells**
 - Simple and small
 - Bacteria are prokaryotic
 - **Eukaryotic cells**
 - Possess organelles separated by membranes
 - Plants, animals, and fungi are eukaryotic

Prokaryotic cell

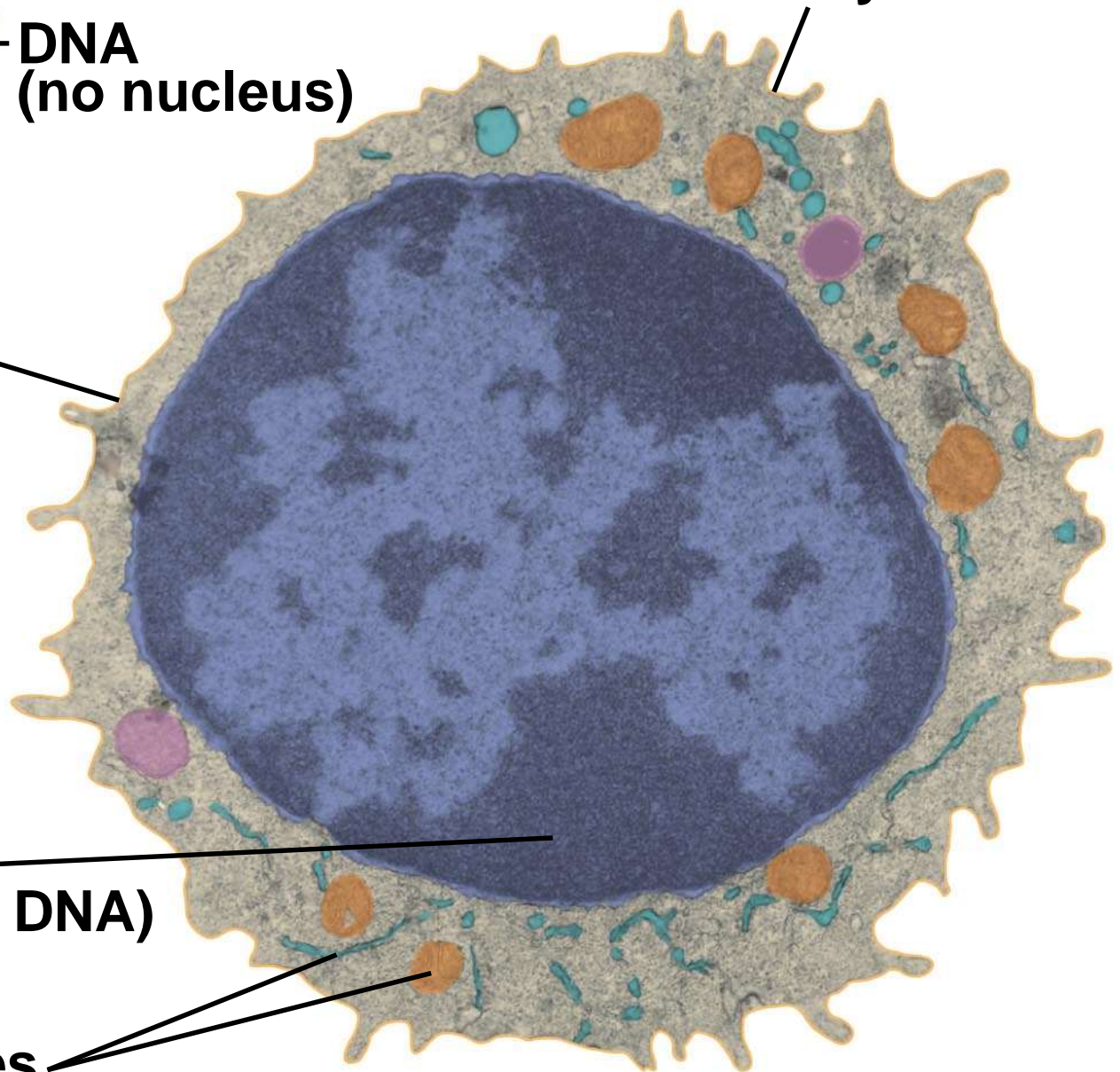
Eukaryotic cell

**DNA
(no nucleus)**

Membrane

**Nucleus
(contains DNA)**

Organelles



EVOLUTION, THE CORE THEME OF BIOLOGY

1.4 I can apply the seven characteristics of life to given examples of organisms

- All living things share common properties
 - **Order**—the complex organization of living things
 - **Regulation**—an ability to maintain an internal environment consistent with life
 - **Growth and development**—consistent growth and development controlled by DNA
 - **Energy processing**—acquiring energy and transforming it to a form useful for the organism

1.4 I can apply the seven characteristics of life to given examples of organisms

- Common properties continued
 - **Response to the environment**—an ability to respond to environmental stimuli
 - **Reproduction**—the ability to perpetuate the species
 - **Evolutionary adaptation**—acquisition of traits that best suit the organism to its environment

PLAY

Video: Sea Horses



(1) Order



(2) Regulation



(3) Growth and development



(5) Response to the environment



(6) Reproduction



(7) Evolutionary adaptation

1.6 I can describe the process and products of natural selection and how it guides evolution

- Natural selection was inferred by connecting two observations
 - Individuals within a population inherit different characteristics and vary from other individuals
 - A particular population of individuals produces more offspring than will survive to produce offspring of their own

1.6 I can describe the process and products of natural selection and how it guides evolution

- Natural selection is an editing mechanism
 - It results from exposure of heritable variations to environmental factors that favor some individuals over others
 - Over time this results in evolution of **new species adapted to particular environments**
 - **Evolution** is biology's core theme and explains unity and diversity of life



Pangolin

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Killer whale

THE PROCESS OF SCIENCE

1.7 I can compare discovery science and hypothesis-based science

- Two approaches are used to understand natural causes for natural phenomena
 - **Discovery science**—uses verifiable observations and measurements to describe science
 - **Hypothesis-based science**—uses the data from discovery science to explain science
 - This requires proposing and testing of hypotheses

1.7 I can describe the goals and limitations of scientific investigations

- We solve everyday problems by using hypotheses
 - An example would be the reasoning we use to answer the question, “Why doesn’t the flashlight work?”
 - Using deductive reasoning we realize that the problem is either the (1) bulb or (2) batteries.
 - The hypothesis must be testable
 - The hypothesis must be falsifiable

1.8 I can describe the structure and components of a controlled experiment

- A **hypothesis** is a proposed explanation for a set of observations
 - The hypothesis must be **testable**
 - The hypothesis must be **falsifiable**
- The experiment must have a **control group**
- **Independent Variable** – The factor being changed/tested for
- **Dependent Variable** – The factor that stays the same



Observations



Question

**Hypothesis #1:
Dead batteries**

**Hypothesis #2:
Burned-out bulb**

**Hypothesis #1:
Dead batteries**

**Prediction:
Replacing batteries
will fix problem**



Test prediction



Test falsifies hypothesis

**Hypothesis #2:
Burned-out bulb**

**Prediction:
Replacing bulb
will fix problem**



Test prediction



Test does not falsify hypothesis

BIOLOGY AND EVERYDAY LIFE

1.9 I can describe ways in which biology, technology, and society are connected

- Many of today's global issues relate to biology (science)
 - Many of these issues resulted from applications of **technology**
 - Science and technology are interdependent, but their goals differ
 - Science wants to understand natural phenomena
 - Technology applies science for a specific purpose

1.9 I can identify the appropriate metric unit to use in an experiment

Common metric units

LENGTH

Meter (m)

Centimeter (cm)

Kilometer (km)

Millimeter (mm)

WEIGHT

Newton (N)

MASS

Gram

Kilogram

milligram

VOLUME

Liter (l)

Milliliter (ml)

Centimeter cubed (cm³)

Meter cubed (m³)

SPEED or VELOCITY

m/sec

km/hr

TEMPERATURE

Celsius (° C)