

Biology Chapter 1

The Science of Biology

Essential Question: What role does science play in the study of life?

1.1 What is Science?

- In your own words...?

-What are the goals of science?

❑ Science is NOT a collection of
unchanging beliefs about the world.

❑ Scientific Ideas are open to testing,
discussion, and revision.

Science as a Way of Knowing

❑ Science is an organized way of gathering and analyzing evidence about the natural world.

- Science is a process, not a thing

❑ Ways science is different from other human endeavors:

- Science deals only with the natural world.

- Scientists collect and organize information in an orderly way

- Scientists propose explanations that are based off evidence, not belief.



Goals of Science

One goal of science is to provide natural explanations for events in the natural world. Science also aims to use those explanations to understand patterns in nature and to make useful predictions about natural events.

Science, Change and Uncertainty

- ❑ Much of nature remains a mystery because science never stands still
- ❑ Scientists aim for the best understanding of the natural world that current methods can reveal.

-In your own words... Why is there uncertainty in science?



What procedures are at the core of scientific methodology?

Step 1: Observing and Asking Questions

Step 2: Inferring and Hypothesizing

Step 3: Designing Controlled
Experiments

Step 4: Collecting and Analyzing Data

Step 5: Drawing Conclusions

When Experiments Are Not Possible

During the course of an investigation, hypotheses may have to be revised and experiments redone several times.

-Ex: Ethics preventing certain types of experiments
Suspecting a certain chemical causes cancer, tested on people who have already been exposed.

-Researchers always try to study large groups of subjects so that individual differences do not produce misleading results.

.... *Why do you think that is?*

1.2 Science in Context

- ❑ Science and scientists operate in the context of the scientific community and society at large
- ❑ *What scientific attitudes help generate new ideas?*

Curiosity, skepticism, open-mindedness, and creativity help scientists generate new ideas.

Practical Problems and the Role of Technology

- ❑ Pollution

- ❑ Should marshes be protected from development?

Many more problems, what are some you can think of..?

- ❑ Technology, science, and society are closely linked.

- ❑ Discoveries can lead to new technologies, which allow scientists to ask new questions and gather data in new ways

Communicating Results: Reviewing and Sharing Ideas

- ❑ Peer review is a process by which scientific papers are reviewed by anonymous, independent experts.
- ❑ Publishing peer-reviewed articles in scientific journals allows researchers to share new ideas and to test and evaluate each other's work.
- ❑ New findings may spark new questions . These questions lead to new hypotheses that must be independently confirmed by controlled experiments.

What might happen if an article were published without undergoing peer review?

Scientific Theories

- ❑ In science, the word “theory” applies to a well-tested explanation that unifies a broad range of observations and hypotheses and that enables scientists to make accurate predictions about new situations.
- ❑ A useful theory has been thoroughly tested and supported by a great deal of evidence
- ❑ Science is always changing; as new evidence is uncovered, a theory may be revised or replaced by a more useful explanation

Science and Society

- ❑ Using science involves understanding its context in society and its limitations.
- ❑ Pure science does not include ethical or moral viewpoints
- ❑ The way that science is applied in society can be affected by bias.
 - Bias: a particular preference or point of view that is personal, rather than scientific.

1.3 Studying Life

Biology= the study of life

What characteristics do all living things share?

1. Made up of Cells
2. Based on a Universal Genetic Code
3. Obtain and Use Materials and Energy
4. Grow and Develop
5. Reproduce
6. Respond to Their Environment
7. Maintain a Stable Internal Environment
8. Change over Time

Alive:

Bacteria

Plants

Animals

Fungus

Protists

-Uncertain= Viruses

Not Alive:

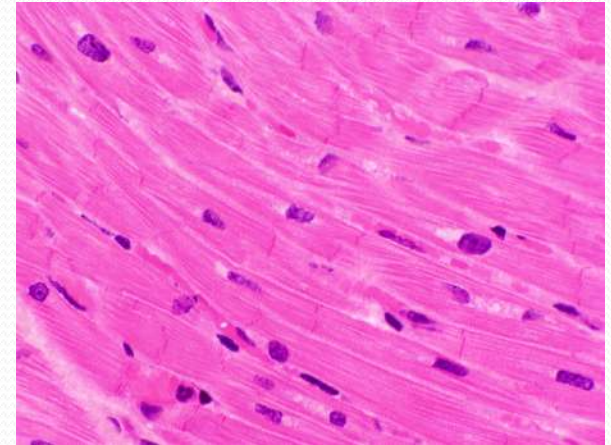
Rocks

Clouds

Sand

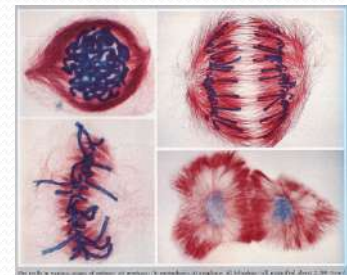
Glass

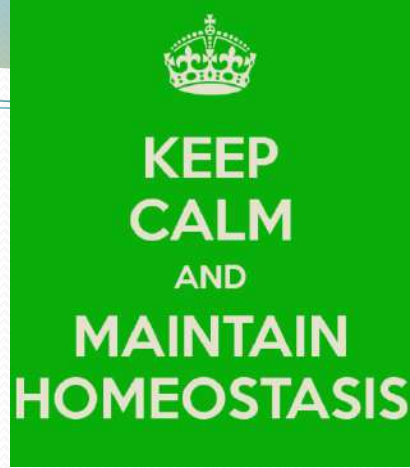
Gases



1. Made Up of Cells- Organisms are composed of 1 or more cells. Cells are the basic unit of life
2. Based on a Universal Genetic Code- All organisms store the complex information they need to live, grow, and reproduce in a genetic code written in a molecule called DNA.

3. Obtain and Use Materials and Energy- The combination of chemical reactions through which an organism builds up or breaks down materials is called *metabolism*.
4. Grow and Develop- Every organism has a particular pattern of growth and development in which cells divide, and differentiate to perform different functions.
5. Reproduce- Plants and animals engage in sexual reproduction. *Sexual reproduction* is when cells from 2 parents unite to form the 1st cell in a new organism. *Asexual reproduction* occurs when a single organism produces offspring identical to itself.





6. Respond to Their Environment- Detect and respond to stimuli. A *stimulus* is a signal to which an organism responds.

7. Maintain a Stable Internal Environment- *Homeostasis*-relatively constant internal physical and chemical conditions that organisms maintain.

8. Change over Time- Organisms evolve over time to strengthen the attributes that help them best survive and reproduce.



Fields of Biology

❑ Biology includes many overlapping fields that use different tools to study life from the level of molecules to the entire planet.

Ex's:

Global Ecology

Biotechnology

Paleontology

Pathology

Genomics and Molecular Biology

Performing Biological Investigations

- ❑ Most scientists use the metric system when collecting data and performing experiments.

- *Why do you think most scientists use the metric system?*

Safety:

- ❑ Careful preparation, Read all steps and follow all safety precautions, always follow teacher's instructions

- ❑ Ask questions if you do not understand!