What Can This Mouse (Peromyscus Polionotus) Teach Us About Life Science?

Overview: Inquiring About Life (1 of 2)

- An organism's adaptations to its environment are the result of evolution
  - For example, a beach mouse's light, dappled fur allows the mouse to blend into its surroundings
  - Inland mice of the same species are darker in color, matching their surroundings
- Evolution is the process of change that has resulted in the astounding array of organisms found on Earth
- It is the fundamental principle of biology

Overview: Inquiring About Life (2 of 2)

- **Life Science** is the scientific study of life
- We seek the answers to questions like…
  - Why do flowers have a pleasant scent and why are they brightly colored?
  - How do cells communicate with each other?
  - Why is my younger brother or sister so weird?

Scientific Method

- To answer these questions scientists use the **Scientific Method**
- An organized method to identify answers or reasons about specific observations

Video Time!

- https://www.youtube.com/watch?v=_0X6P5JCh8s

In Studying Nature, Scientists Form and Test Hypotheses

- **Science** is an approach to understanding the living world – **its observation**
- **Inquiry** is the search for information and explanation of natural phenomena
- Science is challenging and adventurous – and sometimes funny!
- Requires careful planning, reasoning, creativity, and persistence
- The scientific process includes making observations, forming logical hypotheses, and testing them

Exploration and Discovery

- Biology begins with careful observations
- Biologists describe natural structures and processes
- By reading about and understanding past studies, scientists can build on the foundations of existing knowledge

Observation – What's Happening?

Gathering and Analyzing Data (1 of 2)

- Recorded observations are called **data**
- Data fall into two categories
  - **Qualitative data**, or descriptions rather than measurements
    - For example, Jane Goodall's observations of chimpanzee behavior
  - **Quantitative data**, or recorded measurements, which are sometimes organized into tables and graphs

Forming and Testing Hypotheses (1 of 2)

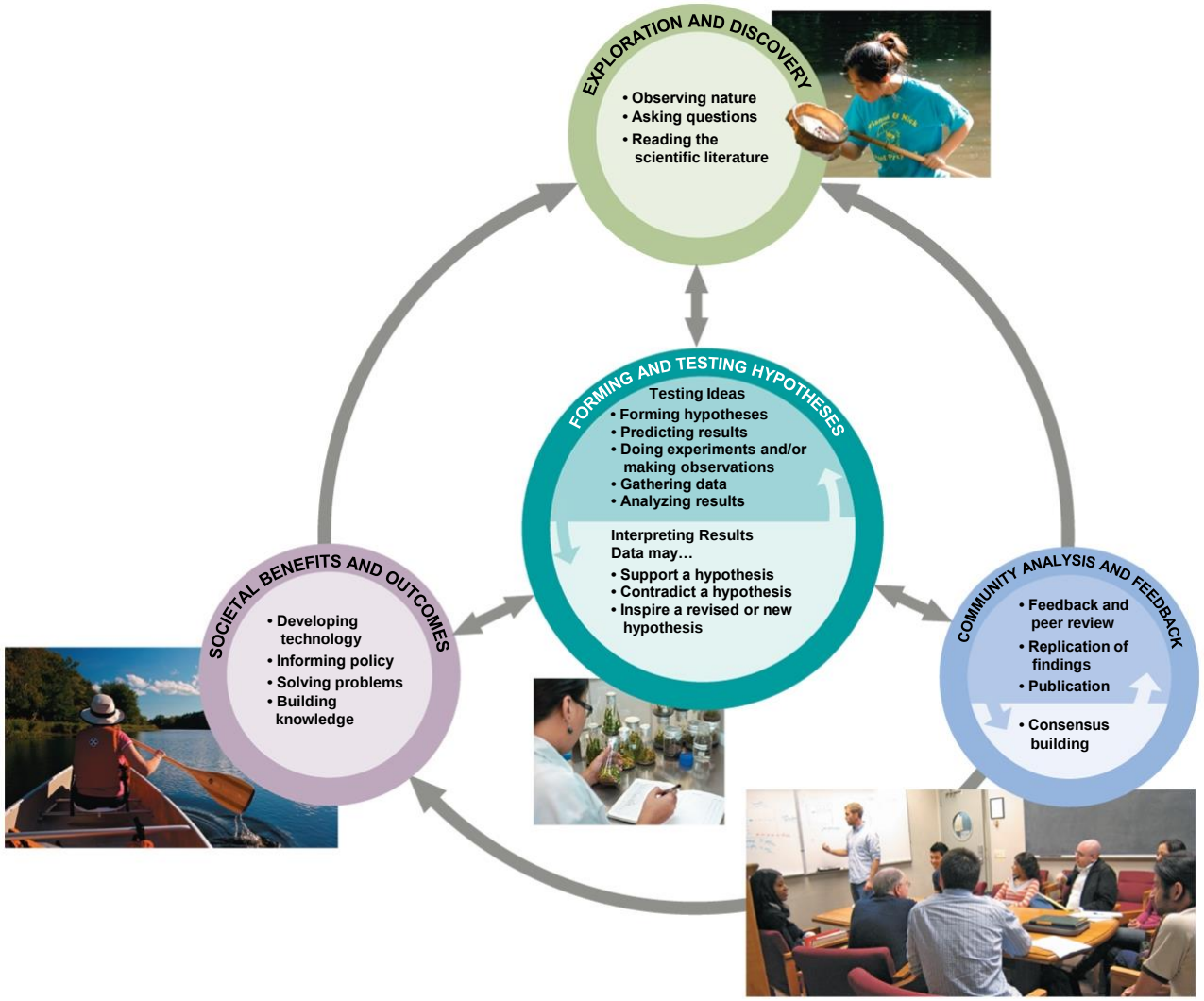
- In science, a **hypothesis** is an explanation based on observations and assumptions that leads to a testable prediction
- It is an explanation on trial
  - *The pig farm is releasing a chemical into the water that causes mutation*
- A scientific hypothesis must lead to predictions that can be tested with additional observations or an experiment
  - We would predict a higher concentration of chemical agent
- An **experiment** is a scientific test, often carried out under controlled conditions

Hypothesis

Questions That Can and Cannot Be Addressed by Science

- A hypothesis must be testable and falsifiable
  - For example, hypotheses involving supernatural explanations cannot be tested
- Such explanations are outside the bounds of science

Figure 1.19 The Process of Science: A Realistic Model



Experimental Variables and Controls (1 of 2)

- A **controlled experiment** compares an experimental group (the non-camouflaged mice) with a control group (the camouflaged mice)
- The factor that is manipulated and the effect of the factor on the system are both experimental **variables**
- The factor manipulated by the researchers—color—is called the **independent variable**
- The effect of the manipulated factor—amount of predation—is called the **dependent variable**

Experimental Variables and Controls (2 of 2)

- Researchers usually control unwanted variables not by eliminating them but by canceling them out using control groups

Theories in Science

- In the context of science, a **theory** is
  - Broader in scope than a hypothesis
  - General enough to lead to many new testable hypotheses
  - Supported by a large body of evidence in comparison to a hypothesis
- **Inference –** making assumptions