Introducing Biology

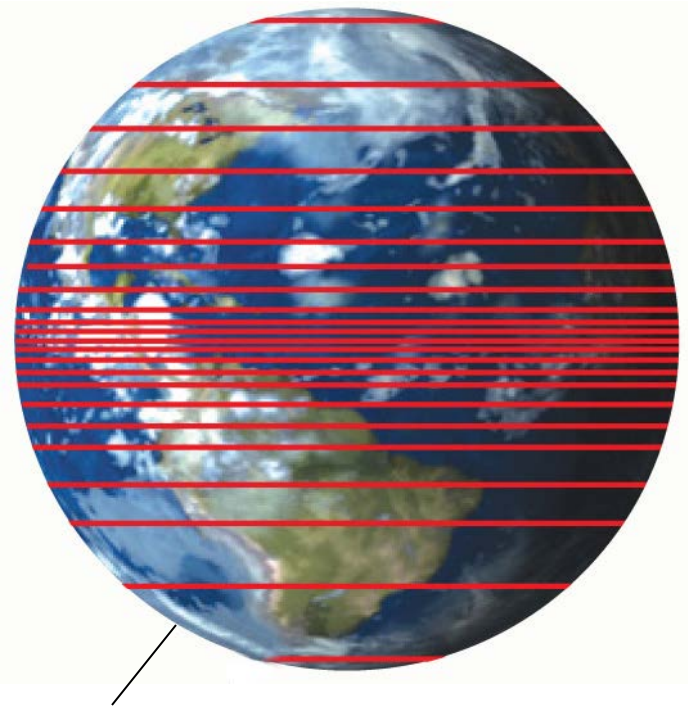
KEY CONCEPT

Biology is the study of all forms of life.

Mosquito

Introducing Biology

- **Earth is home to an incredible diversity of life.**
  - The biosphere includes all living things and all the places they are found.



biosphere = everywhere life exists

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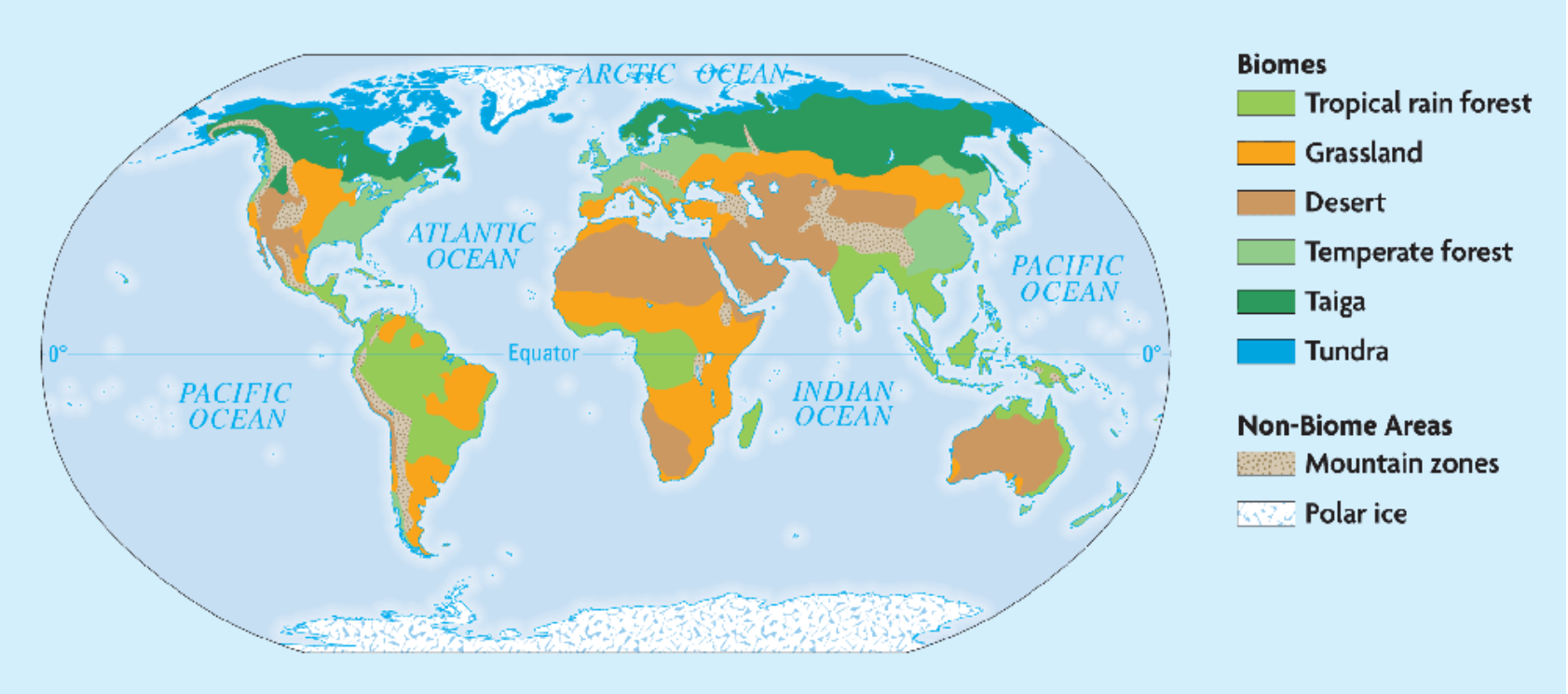
- **Earth is home to an incredible diversity of life.**
  - Every part of the biosphere is connected with every other part.
  - The biosphere includes many environments.
    - land environments



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- The biosphere includes many environments.
  - saltwater and freshwater environments

  - portions of the atmosphere

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- A species is one particular type of living thing.
  - Members of a species can interbreed to reproduce.
  - There are about 2 million different living species have been identified.

Honeypot Ants

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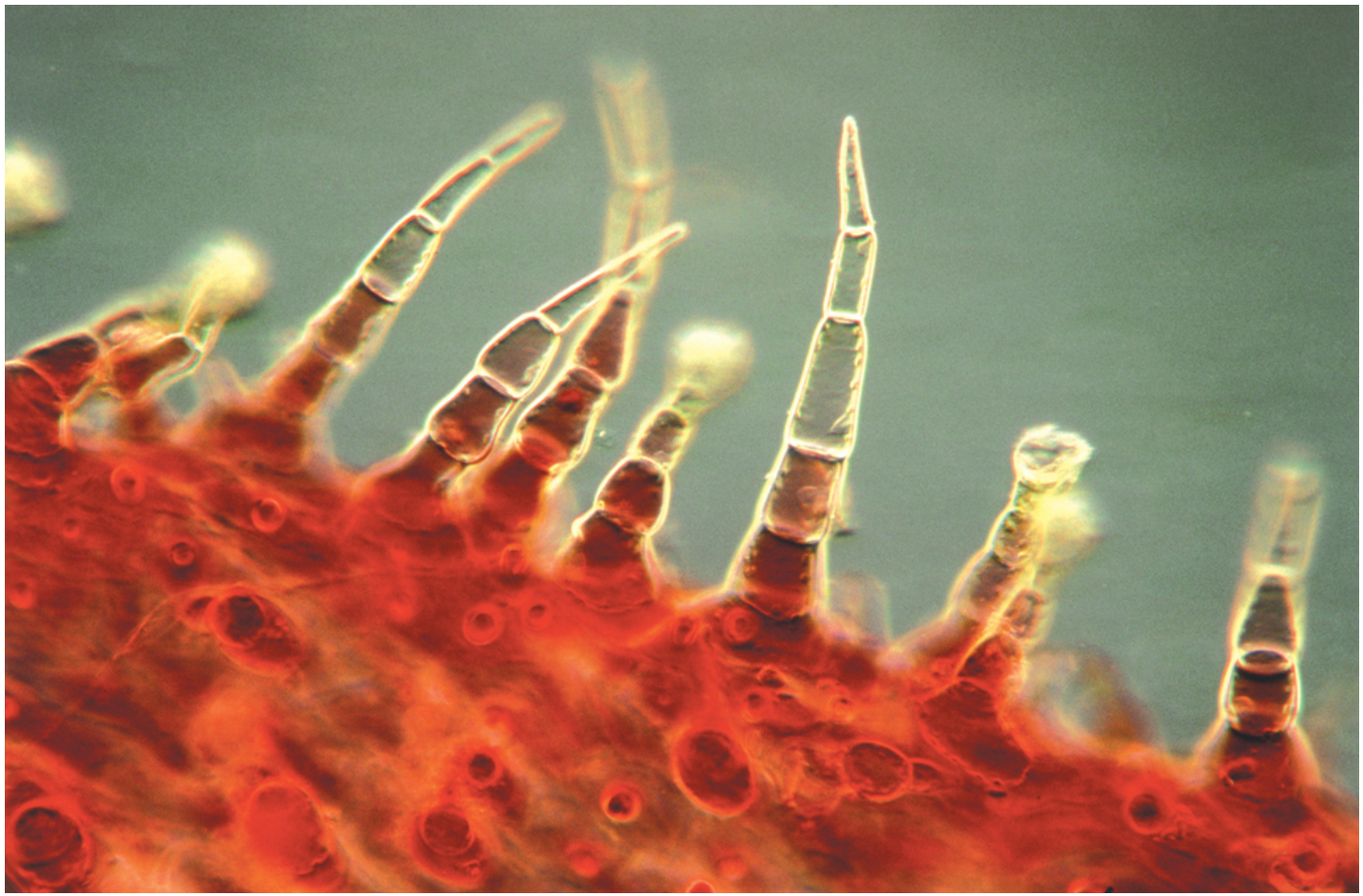
- **All organisms share certain characteristics.**
  - Biology is the scientific study of all forms of life.

Introducing Biology

- An organism is any individual living thing.
  - All are made of one or more cells.



Leaf hairs

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- An organism is any individual living thing.
  - All are made of one or more cells.
  - All need energy for metabolism.
  - All respond to their environment.
  - All have DNA that they pass on to offspring.

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KEY CONCEPT

Unifying themes connect concepts from many fields of biology.

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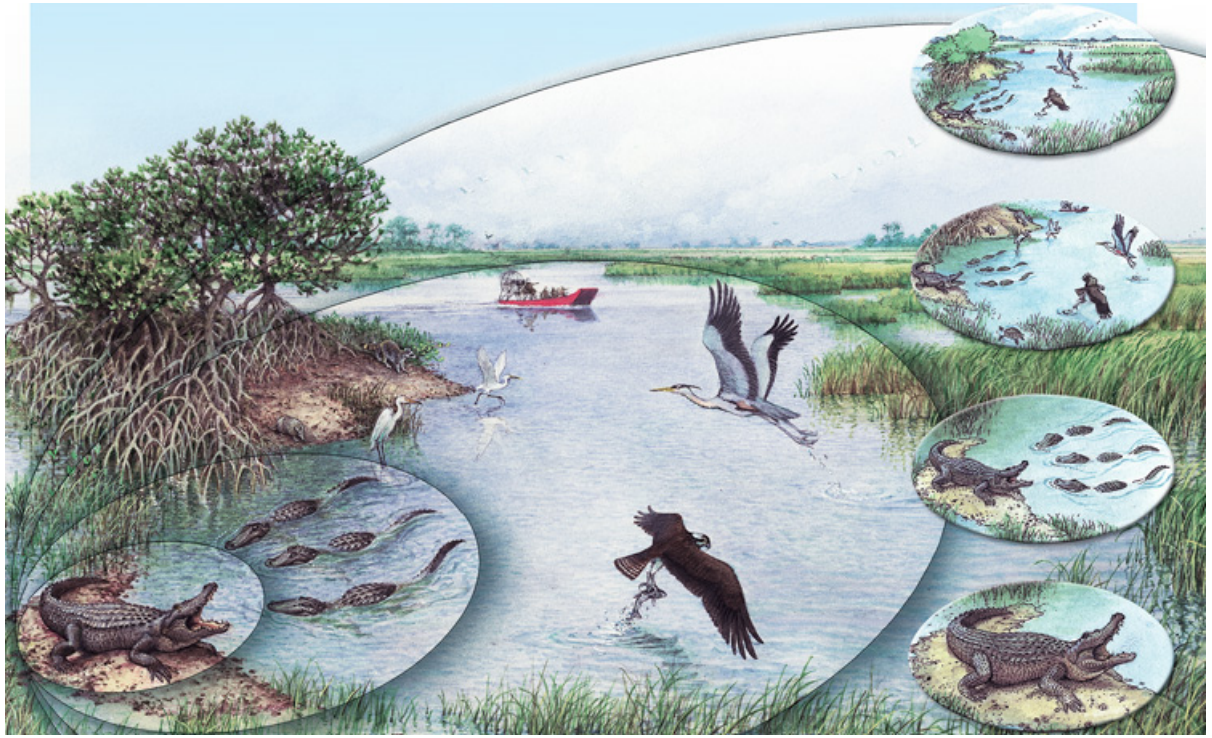
- **All levels of life have systems of related parts.**
  - A system is an organized group of interacting parts.
    - A cell is a system of chemicals and processes.
    - A body system includes organs that interact.
    - An ecosystem includes living and nonliving things that interact.



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- Biologists study many different systems.

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- **Structure and function are related in biology.**
  - Structure determines function.
    - Proteins with different structures perform different functions.
    - Heart muscle cells have a different structure and function than stomach muscle cells.
    - Different species have different anatomical structures with different functions.

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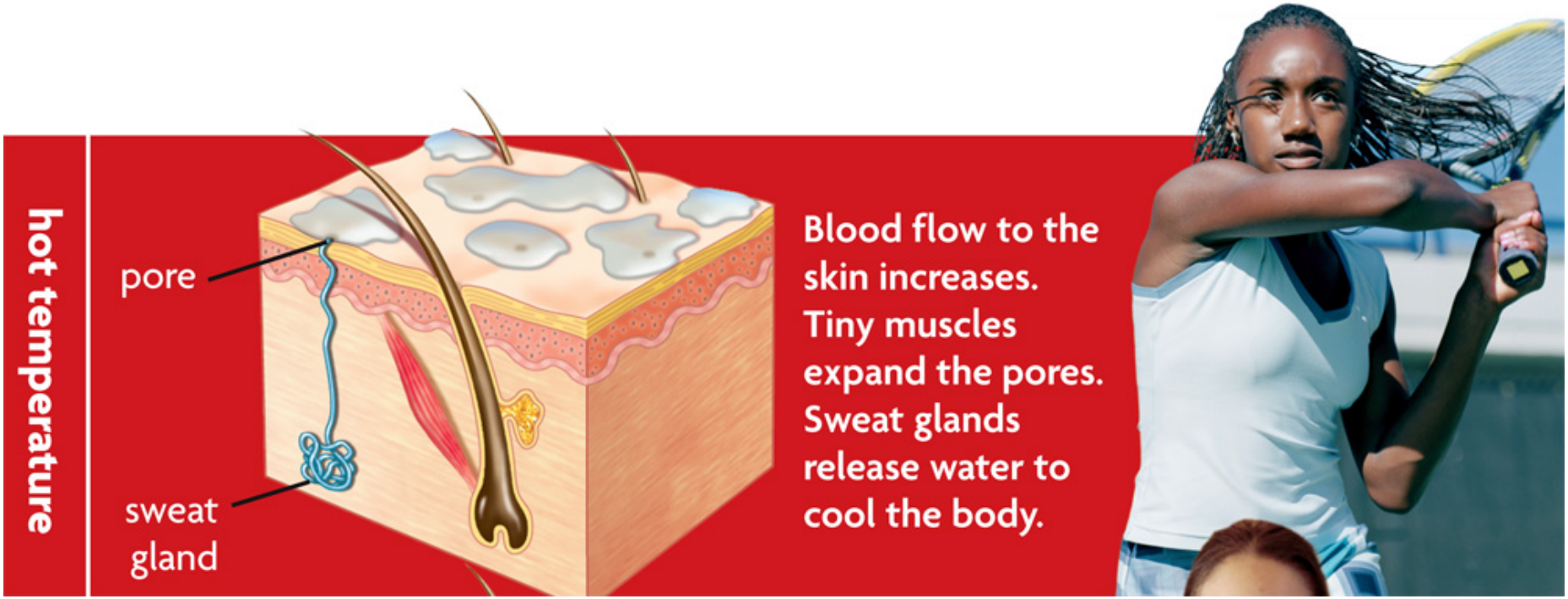
- **Organisms must maintain homeostasis to survive in diverse environments.**
  - Homeostasis is the maintenance of constant internal conditions.



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- Behaviors and adaptations can help maintain homeostasis.

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Evolution explains the unity and diversity of life.

- Evolution is the change in living things over time.
  - The genetic makeup of a population of a species changes.
  - Evolution can occur through natural selection of adaptations.
  - Adaptations are beneficial inherited traits that are passed to future generations.

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- Evolution accounts for both the diversity and the unity of life.

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KEY CONCEPT

Science is a way of thinking, questioning, and gathering evidence.

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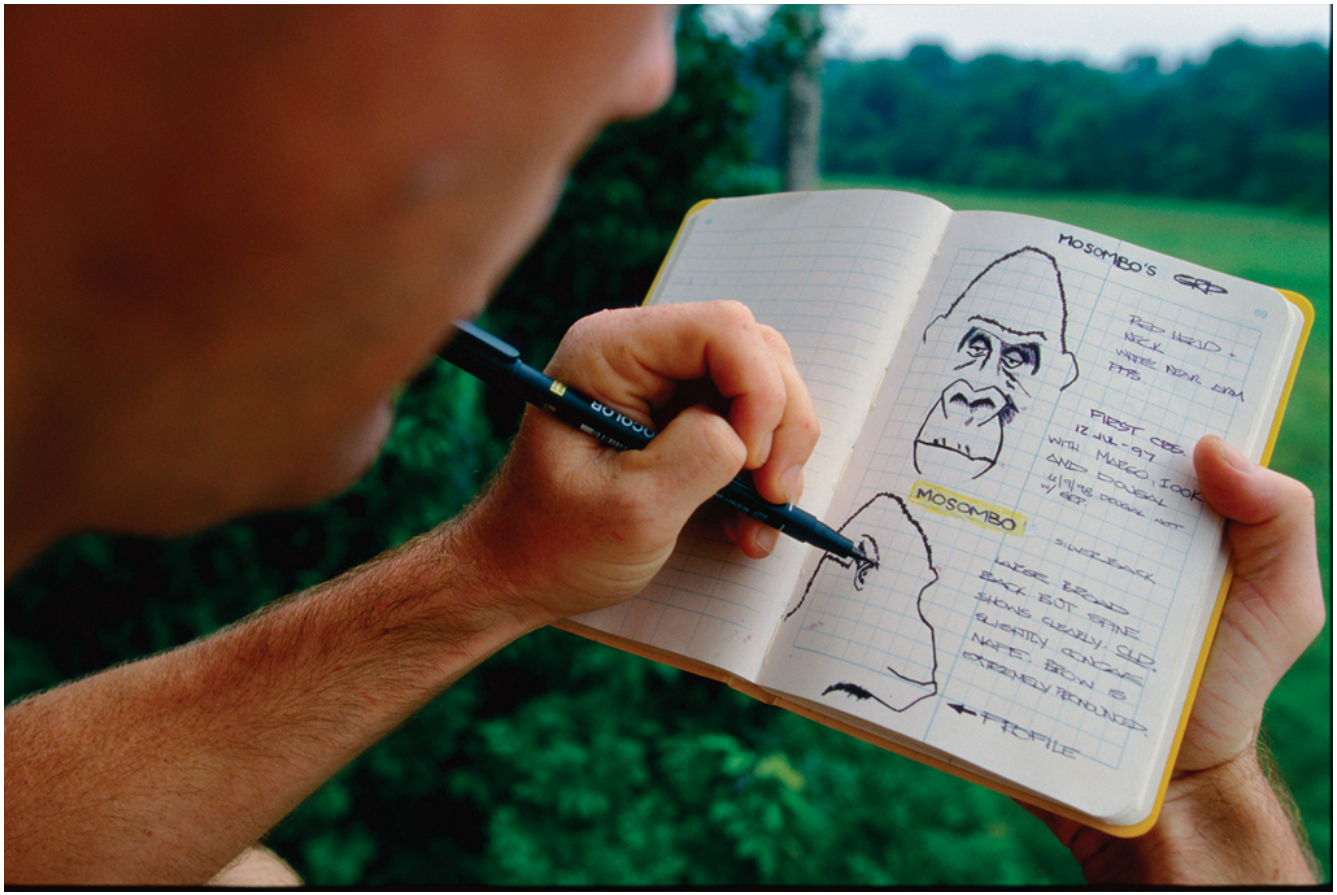
- **Biologists use experiments to test hypotheses.**
  - Observational studies allow scientists to describe a phenomenon.



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- Experiments allow scientists to determine what causes a phenomenon.

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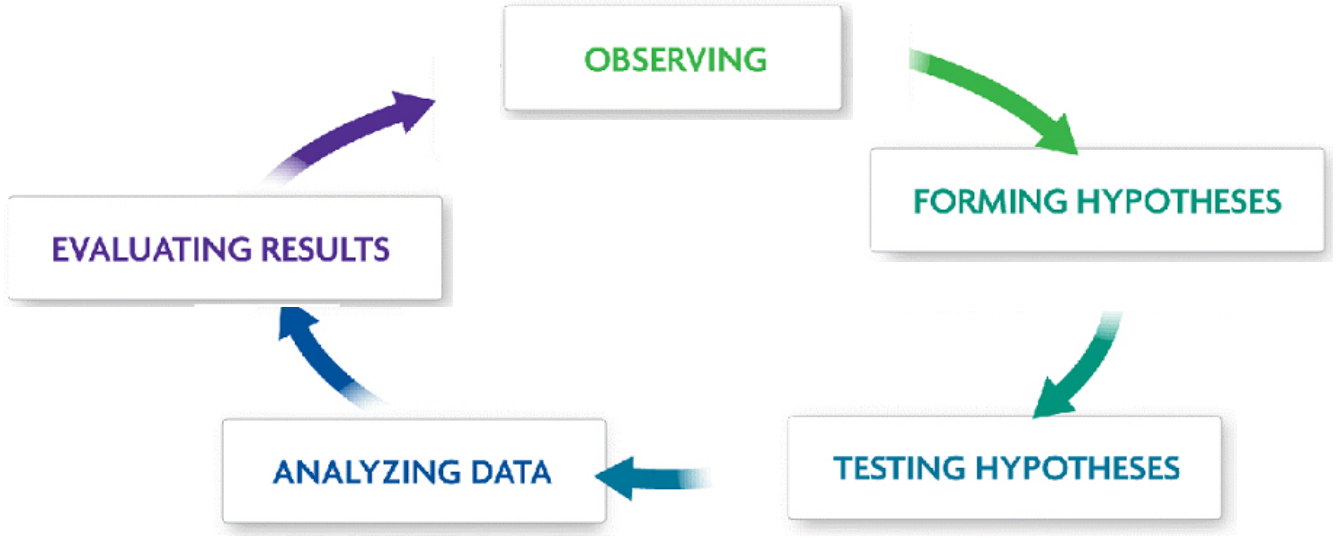
- **Like all science, biology is a process of inquiry.**
  - Scientists make careful and systematic observations.
  - Scientists record observations as data.
  - Scientists form a hypothesis as a possible answer to a question.
  - Scientists test their hypotheses and analyze their data.



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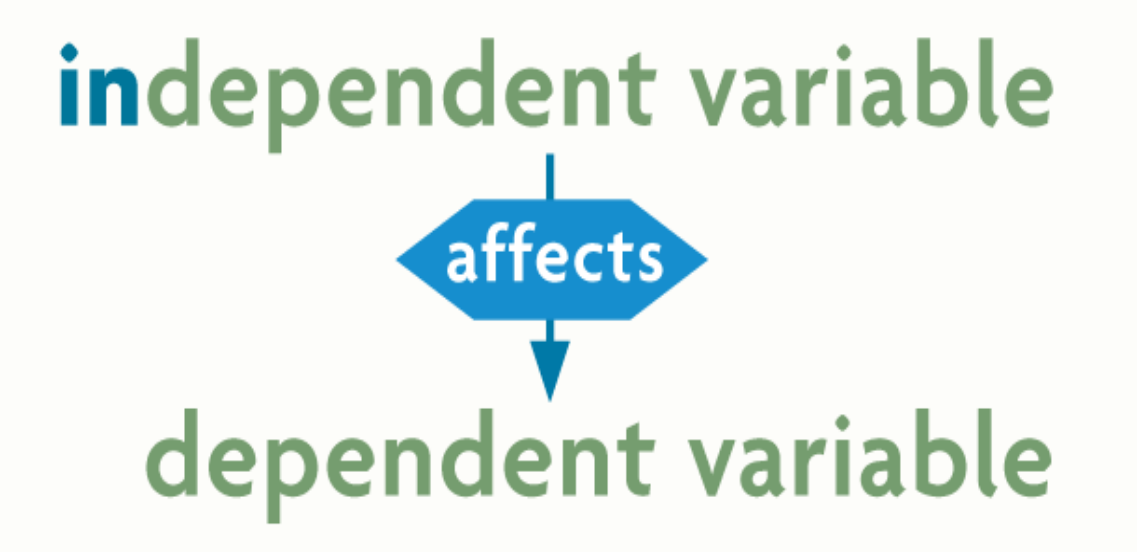
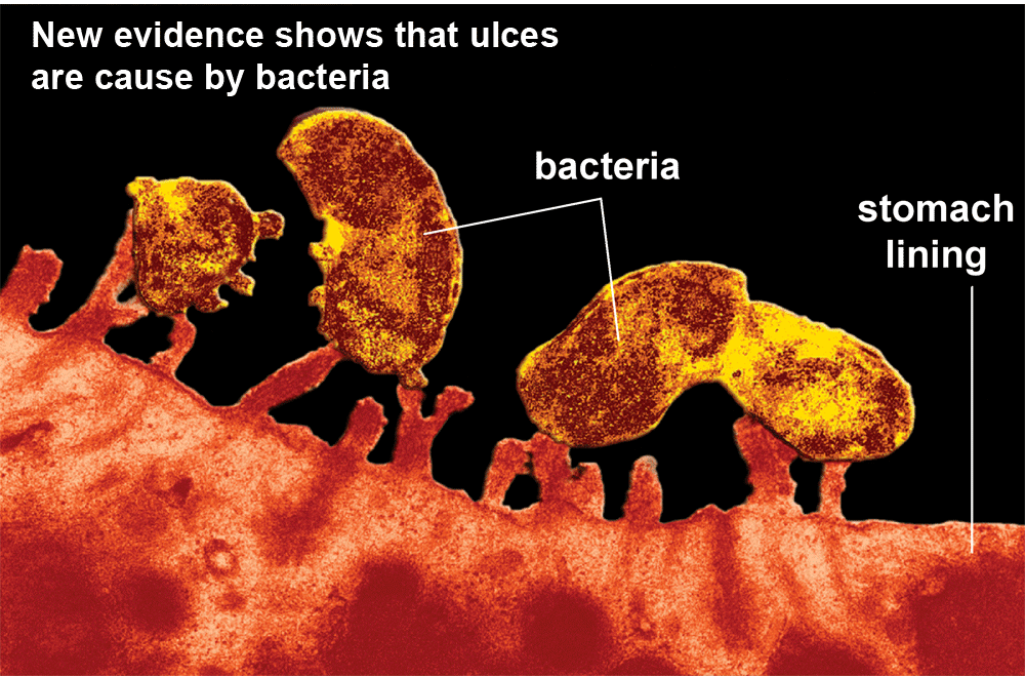
- Experimental studies allow scientists to determine what causes a phenomenon.
  - Independent variables are manipulated.
  - Dependent variables are observed and measured.

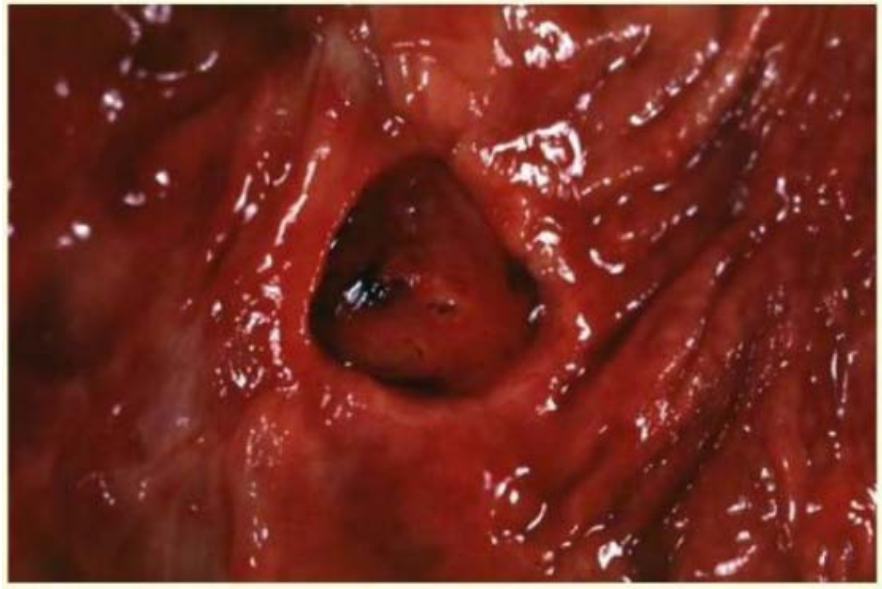


  - Constants are conditions that are kept the same.

A theory explains a wide range of observations.

- Theories explain a wide range of observations and experimental results.
- A theory is supported by a wide range of scientific evidence.
- Theories can change based on new evidence.

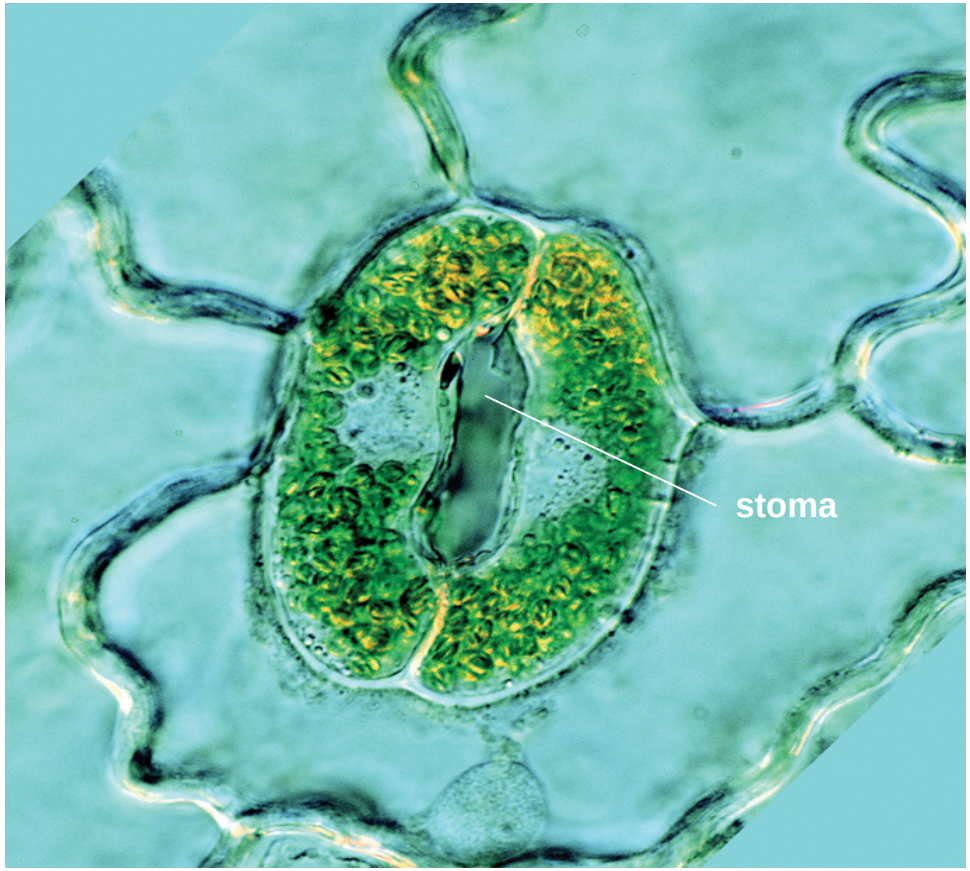




KEY CONCEPT

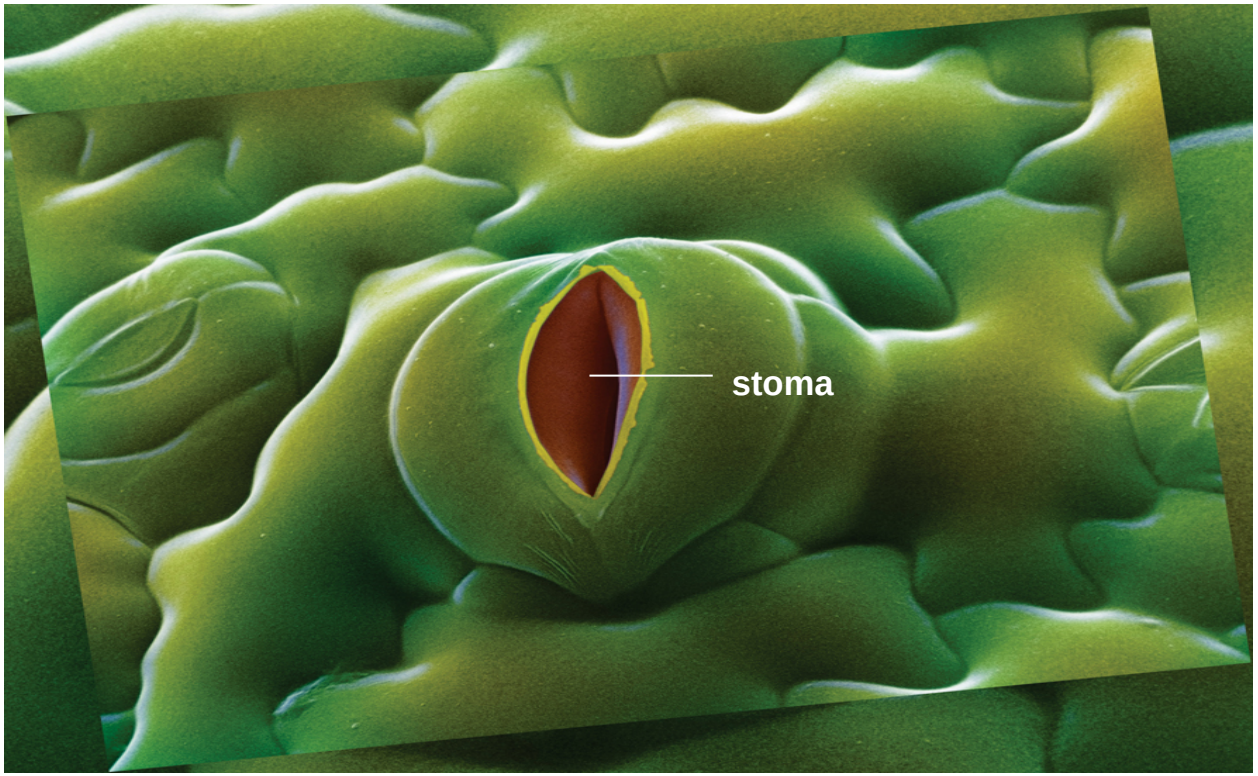
Technology continually changes the way biologists work.

- **Imaging technologies provide new views of life.**
  - A microscope provides an enlarged image of an object.
    - light microscopes (LM)



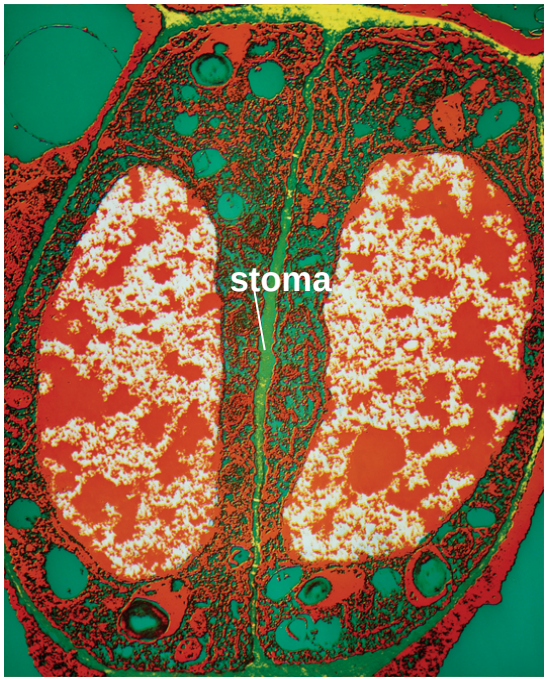
Imaging technologies provide new views of life.

- A microscope provides an enlarged image of an object.
  - light microscopes (LM)
  - scanning electron microscopes (SEM)



Imaging technologies provide new views of life.

- A microscope provides an enlarged image of an object.
  - light microscopes (LM)
  - scanning electron microscopes (SEM)
  - transmission electron microscopes (TEM)



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- Imaging technology is used in medicine.
  - X-ray images

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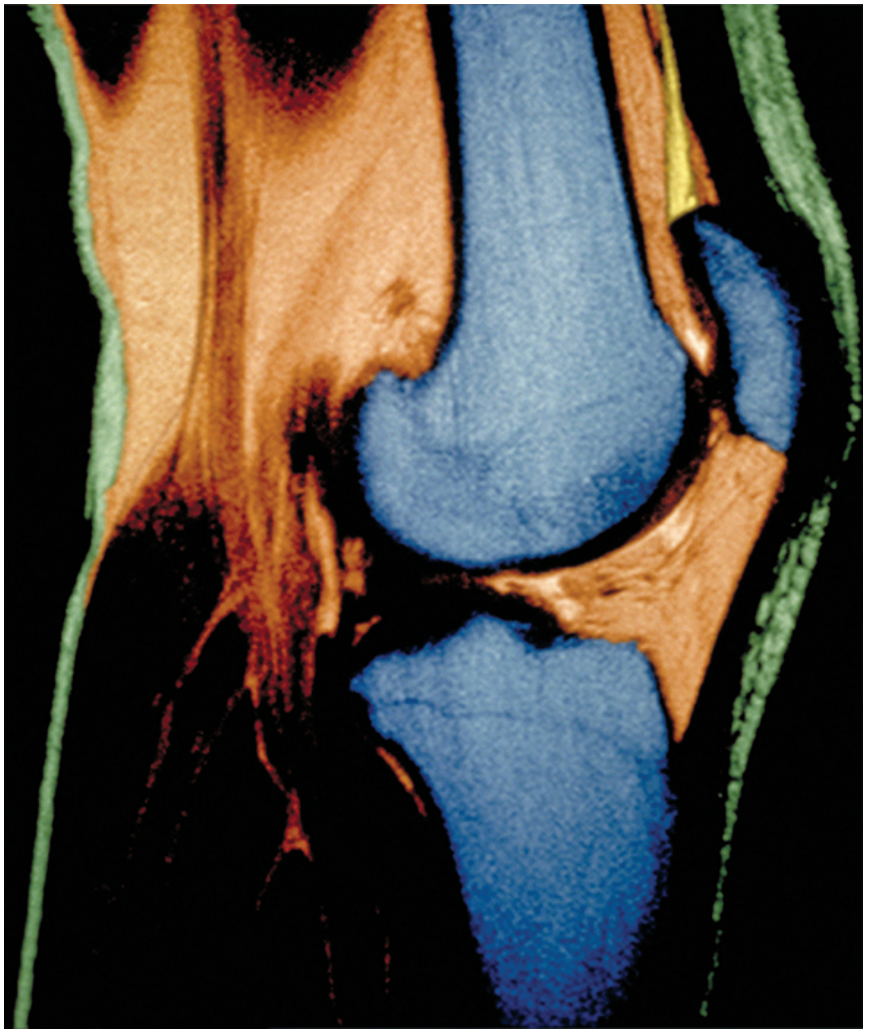
- Imaging technology is used in medicine.
  - X-ray images
  - magnetic resonance imaging (MRI)



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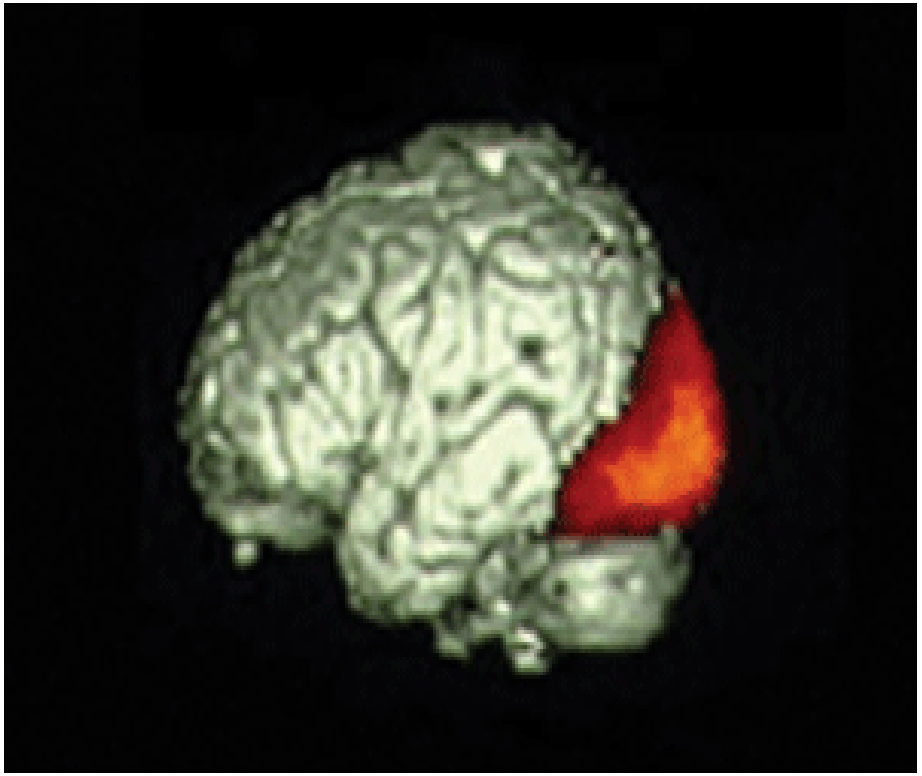
- Imaging technology is used in medicine.
  - X-ray images
  - magnetic resonance imaging (MRI)
  - functional MRI (fMRI)



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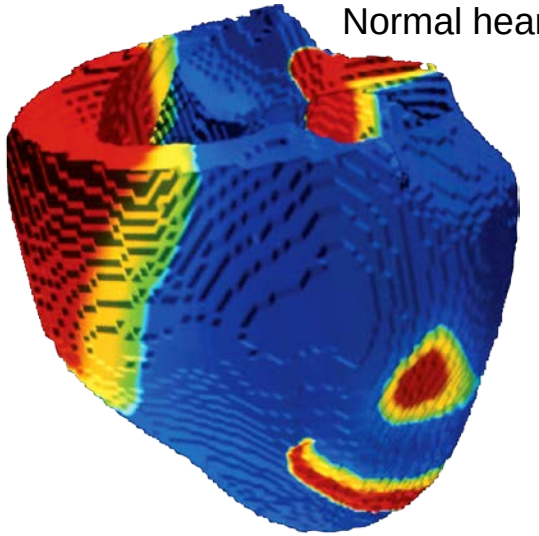
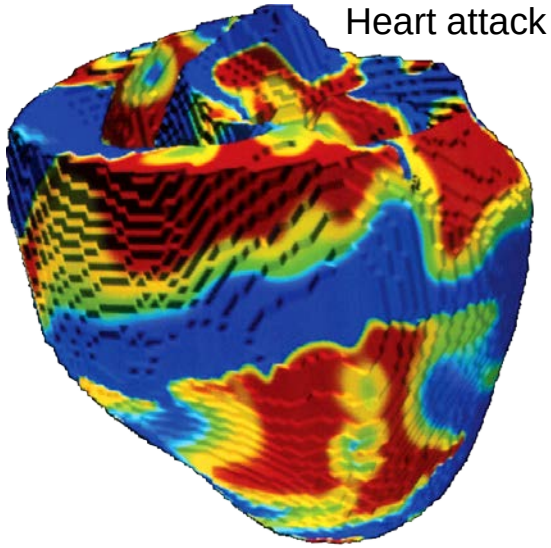
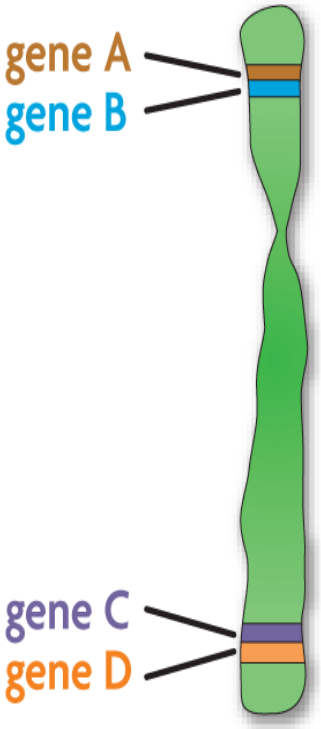
Complex systems are modeled on computers.

- Computer models are used to study systems that cannot be studied directly.
  - heart attacks
  - effect of medicines on the human body
  - movement of water molecules into and out of a cell
  - spread of a disease through a population
- Computer models are used when experiments are not safe, ethical, or practical.


Normal heartbeat


Heart attack

- **The tools of molecular genetics give rise to new biological studies.**
  - A gene is a segment of DNA that stores genetic information.



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- Through our understanding of DNA, we can study genetics on a molecular level.
  - molecular genetics
  - genomics

Introducing Biology

KEY CONCEPT

Understanding biology can help you make informed decisions.

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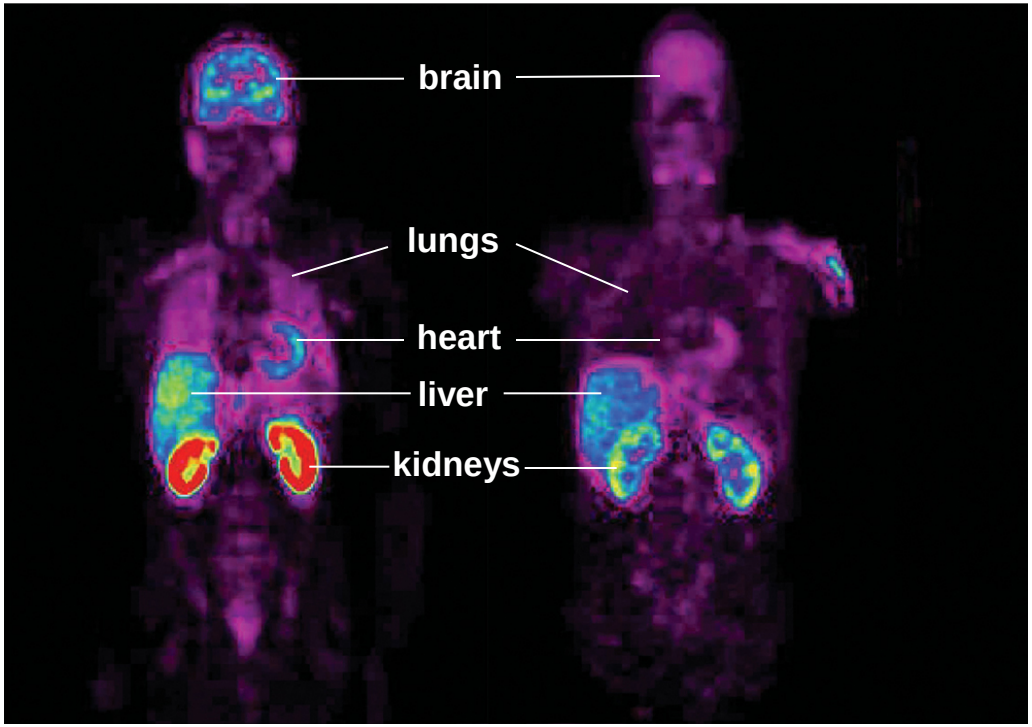
- **Your health and the health of the environment depend on your knowledge of biology.**
  - Knowledge of biology helps you understand your health.
    - food allergies
    - potential effects of obesity

Introducing Biology

- Knowledge of biology helps you understand your health.
  - food allergies
  - potential effects of obesity
  - cancer
  - effects of alcohol, tobacco, and other drugs



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- Knowledge of biology can help you understand environmental issues.
  - interactions in ecosystems
  - pollution
  - biodiversity

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- **Biotechnology offers great promise but also raises many issues.**
  - Biotechnology is the use and application of living things and biological processes.

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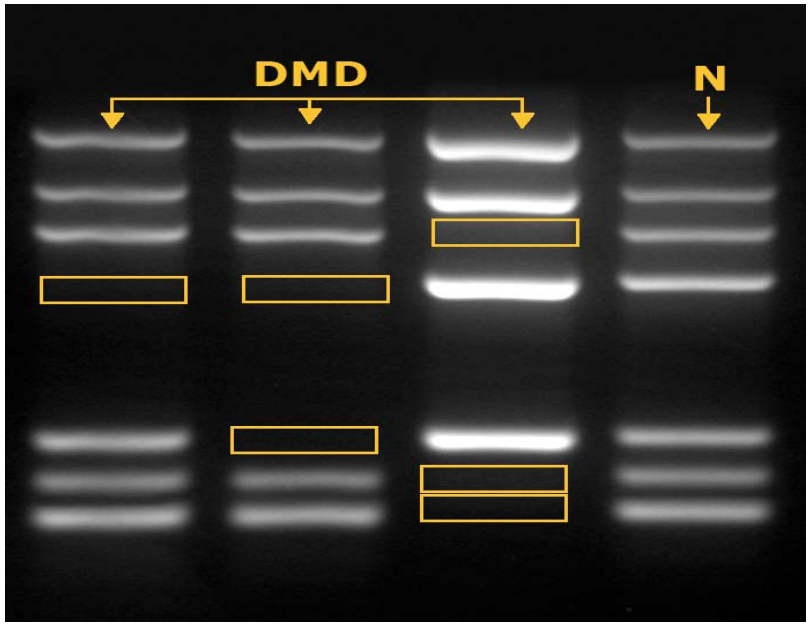
– DNA testing in medicine and forensics



– transgenic (genetically modified) crops
– transgenic bacteria

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- Questions are raised about the use of biotechnology.
  - safety of genetically modified crops

  - spread of undesirable genes
  - decrease in biodiversity
  - ethical considerations

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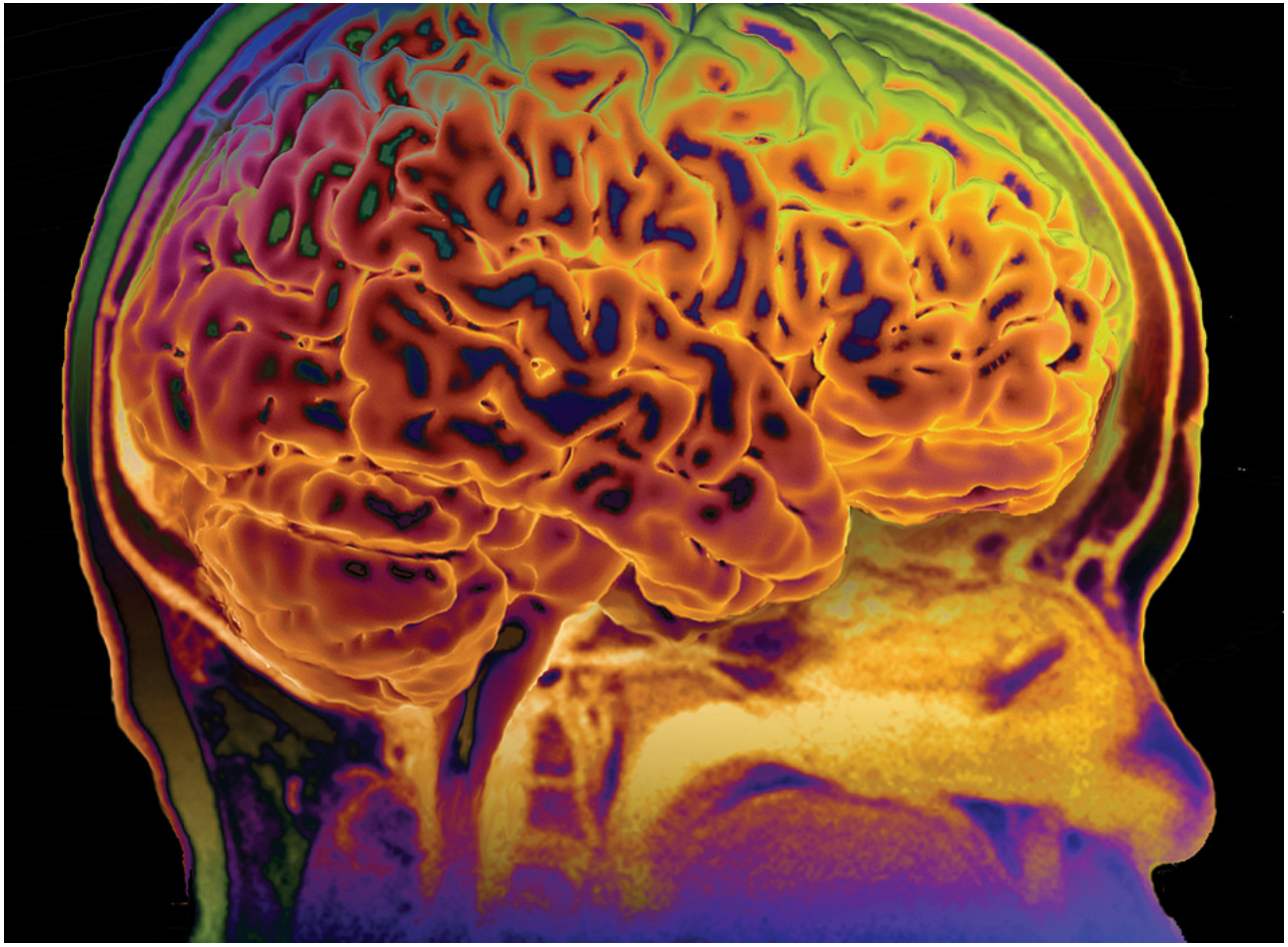
- **Biology presents many unanswered questions.**
  - Over the past 50 years, biological knowledge has greatly increased.

Methane Worm

Introducing Biology

- There are still many questions to answer in biology.
  - How are memories stored in the brain?



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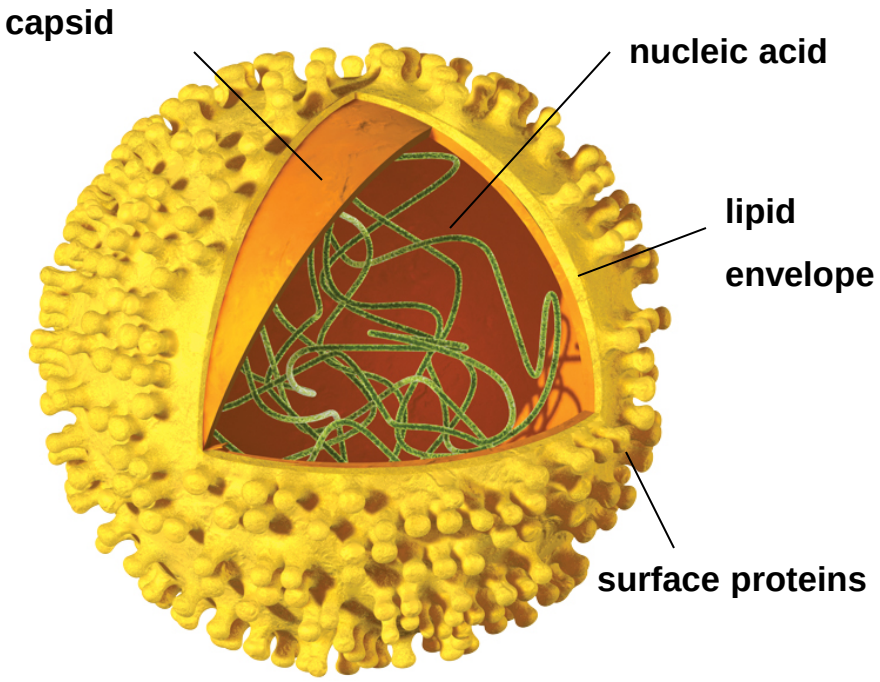
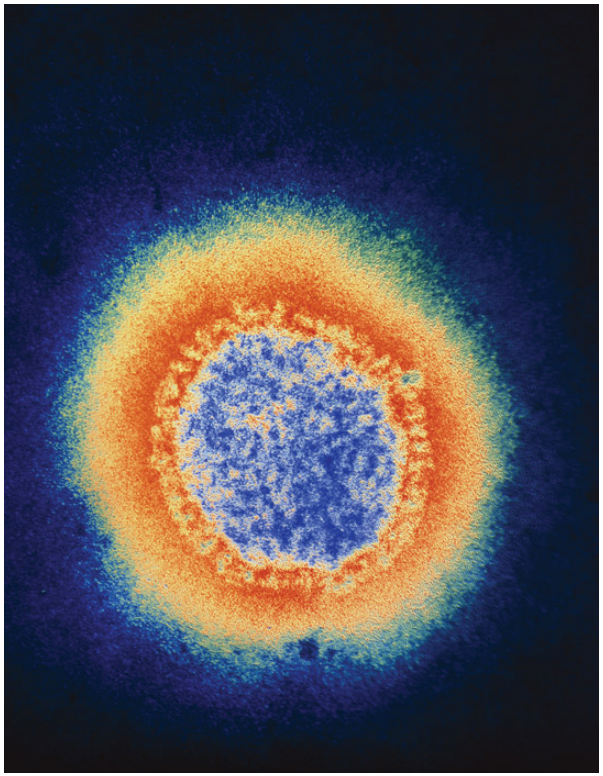
- There are still many questions to answer in biology.
  - How are memories stored in the brain?
  - How do viruses mutate?





  - Does life exist on planets other than Earth?