

1.2 Why do we study Biology?

Human beings have an inborn curiosity about the natural world that leads them to study about living organisms and their habitats. Studying biology helps to understand how living things work, how they function and interact with the environment.

Biology touches our everyday life in many ways. For example, biologists have discovered drugs that are used to treat different human diseases. Many biologists are working on problems that critically affect our lives, such as how our animals and plants body work, how ecosystems work, how advancements in genetics and cell biology are transforming to medicine and agriculture, as well as the use of forensics biology to investigate crime. Furthermore, studies how ecology is helping societies evaluate environmental issues, such as global warming, how fermentation is used to produce alcoholic drinks such as beer and wine. In addition, biological studies are used in treating patients suffering from AIDS, tuberculosis, and some types of cancer.

Application of Biology in our day to day life:

- Wine-making, the brewing, the baking of bread and the production of cheese all depend on fermentation processes brought about by yeasts, other fungi and bacteria, or enzymes from these organisms.
- Antibiotics, such as penicillin, are produced by mould fungi or bacteria.
- The production of industrial chemicals such as citric acid or lactic acid needs bacteria or fungi to bring about essential chemical changes.
- Sewage disposal depends on bacteria in the filter beds to form the basis of the food chain that purifies the effluent.
- Discovery of the structure of DNA and forensic analysis of DNA samples from crime scenes.

1.3. The Scientific Method

Biology is a science of inquiry. What comes to your mind when you hear the word science? Biologists are always curious about why things happen or how things happen. By asking questions and seeking science-based responses known as the scientific method, they come up with new theories to explain new findings. The scientific method involves a series of steps that guide scientists through such scientific investigations. Biologists study the living world by posing questions about it. The general steps of the Scientific methods are:

Observation

The scientific study begins with careful observations (often a problem to solve) that leads to a question. The observations can be made either directly (e.g. using your sense organs) or indirectly using scientific tools such as microscopes.

Asking Questions

The observations usually lead the scientist to ask questions (inquiry).

Forming of a hypothesis

A hypothesis is proposed scientific explanations (possible answers) for a set of question (s). To solve a problem, one can propose several hypotheses. Scientific hypotheses should be testable.

Testing the hypothesis

Hypothesis can be tested through experimentation. Any scientific experiment must have the ability to be duplicated because the “answer” the scientist comes up with (whether it supports or rejects the original hypothesis) can’t become part of the scientific knowledge unless other scientists can perform the same experiment and achieve the similar results. If a hypothesis is not supported by experimental data, one can propose a new hypothesis.

Making conclusions about the findings

Scientists consider their original hypotheses and ask whether they could still be right in light of the new information gathered during the experiment. If so, the hypotheses can remain as possible explanations for how things work. If not, scientists reject the hypotheses and try to come up with alternate explanations (new hypotheses) that can explain what they've seen.

Communicating the findings

When scientists complete some work, they write a paper that explains exactly what they did and the results they obtained. Then, they submit the paper to a scientific journal in their field. In addition, the findings will be printed in scientific journals and assist teachers and students in the field.

Example of a hypothesis testing in everyday life

Suppose you want to use your torch (hand lamp) to find a missing pen in your bedroom. When you switch the torch on, it is not working.

The following flow chart will illustrate hypothesis testing for a torch that doesn't work.

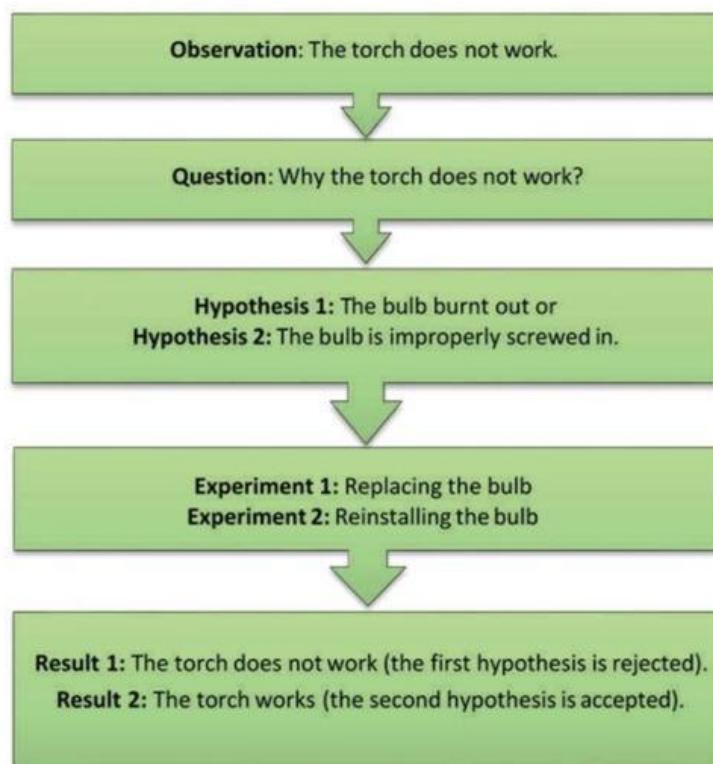


Figure 1.1. Application of the scientific method to common problems in our surroundings

Choose the correct answer for the following questions

1. Biology is described as a science of:

- A) Beliefs
- B) Inquiry
- C) Religion
- D) Guesswork

2. The scientific method is mainly used to:

- A) Accept traditions
- B) Provide science-based responses
- C) Replace technology
- D) Avoid experimentation

3. Which of the following products depends on the process of fermentation?

- a) Wine-making
- b) Bread
- c) Cheese
- d) All of the above

4. Antibiotics such as penicillin are produced by:

- a) Yeasts
- b) Mould fungi or bacteria
- c) Protozoa
- d) Viruses

5. Which industrial chemicals are produced with the help of bacteria or fungi?

- a) Citric acid
- b) Lactic acid
- c) Both a and b
- d) None of the above

6. The process of sewage disposal mainly depends on:

- a) Protozoa
- b) Viruses
- c) Bacteria
- d) Fungi

7. Forensic biology is particularly useful in:

- a) Treating AIDS
- b) Investigating crimes
- c) Making cheese
- d) Brewing beer

8. Which discovery revolutionized genetics and forensics?

- a) The structure of RNA
- b) The structure of DNA
- c) The role of ribosomes
- d) The function of mitochondria

9. Fermentation in beer and wine production is carried out by:

- a) Algae
- b) Yeasts
- c) Protozoa
- d) Viruses

10. Which of the following diseases can biological research help treat?

- a) Tuberculosis
- b) AIDS
- c) Cancer
- d) All of the above

11. Biology contributes to agriculture mainly through:

- a) Astronomy
- b) Genetics and cell biology
- c) Archaeology
- d) Forensic studies

12. The global issue studied under ecology is:

- a) Photosynthesis
- b) Global warming
- c) Food chains
- d) None of the above

Scientific Method

13. The first step in the scientific method is:

- a) Forming a hypothesis
- b) Asking questions
- c) Observation
- d) Communicating findings

14. A scientific hypothesis must be:

- a) Complex
- b) Testable
- c) Always correct
- d) Based on opinion

15. Which step comes after forming a hypothesis?

- a) Communicating results
- b) Testing the hypothesis
- c) Observation
- d) Asking questions

16. Why must experiments be repeatable?

- a) To save time
- b) To ensure reliability
- c) To make them shorter
- d) To avoid asking questions

17. If an experiment disproves a hypothesis, scientists should:

- a) Ignore it
- b) Reject or modify the hypothesis
- c) Stop investigating
- d) Publish it immediately

18. Which of the following is the final step in the scientific method?

- a) Asking questions
- b) Communicating findings
- c) Forming a hypothesis
- d) Making observations

19. In the torch example, if the torch does not work, what is the first scientific step?

- a) Assume it's broken
- b) Observation
- c) Testing
- d) Conclusion

20. If an experiment supports a hypothesis, the hypothesis becomes:

- a) A law
- b) A theory
- c) An observation
- d) A fact

21. Which tool may be used for indirect observation in biology?

- a) Hands
- b) Eyes
- c) Microscope
- d) Books

22. Which of the following is not part of the scientific method?

- a) Guessing
- b) Hypothesis
- c) Experiment
- d) Conclusion

General Biology Applications & Methods

23. Which of the following is NOT a product of biological fermentation?

- a) Bread
- b) Cheese
- c) Wine
- d) Plastic

24. Which branch of biology studies environmental issues like global warming?

- a) Genetics
- b) Cell biology
- c) Ecology
- d) Anatomy

25. Which biological discovery assists in crime investigation?

- a) Vaccination
- b) DNA fingerprinting
- c) Photosynthesis
- d) Blood circulation

26. In science, conclusions are made after:

- a) Observations
- b) Testing hypotheses
- c) Asking questions
- d) Communicating findings

27. The major role of curiosity in biology is to:

- a) End experiments
- b) Prevent questioning
- c) Encourage investigation
- d) Replace experiments