

X| What Is Biology?

Standalone introduction. Defines biology as the study of life, introduces the scientific method, sets up variable-identification skills used across the 25 lessons.

Lesson Objective: You will explain what biology is, identify the steps of the scientific method, and describe how scientists use variables to design fair experiments. By the end of this lesson, you will be able to apply these foundational concepts to real-world health and science scenarios.

What Is Biology? Top 3 Core Concepts

1. Biology Is the Study of Life

Biology covers everything alive — from bacteria to blue whales to the human body. It gives you a framework for understanding health, disease, ecosystems, and the living world around you.

2. The Scientific Method Produces Reliable Answers

Scientists use a structured, repeatable process to ask questions, test ideas, and draw conclusions based on evidence. This process is what makes scientific knowledge trustworthy and verifiable.

3. Variables Keep Experiments Fair

Every experiment has an independent variable (what is changed), a dependent variable (what is measured), and controlled variables (what stays the same). This structure ensures that results are meaningful, not accidental.

Why This Topic Matters

Biology is personal — it is happening in your body right now. Understanding how life works, how scientists test ideas, and how to read evidence critically prepares you for health decisions, science careers, and a world full of information that requires careful thinking.



Your body contains approximately 37 trillion cells, each one carrying out life processes right now — and biology is the science that explains all of it.

Life, Questions, and the Science That Connects Them

Every time a doctor figures out why you are sick, every time a farmer grows food for thousands of people, and every time a scientist develops a new vaccine — **biology** is at work. Biology is the study of life, and life is everywhere. It is in the soil under your feet, the food on your plate, and the 37 trillion cells that make up your body. Most people think of biology as something that happens in a lab or a textbook. It does not. It is happening inside you right now, and understanding it gives you real power over your own health and your future. This is not a subject you study from the outside looking in. You are already part of it.

Biology Starts With Living Things

Biology is the scientific study of living **organisms** — from single-celled bacteria too small to see with the naked eye, to blue whales stretching over 27 metres (about 90 feet) long. What makes something “living”? Living things share a set of characteristics: they are made of **cells**, they use energy, they grow and develop, they respond to their environment, and they **reproduce**. Cells are the smallest unit of life — every function your body carries out, from breathing to healing a cut, begins at the cellular level. Every organism on Earth — including you — fits this description.

Not every living thing looks the same or behaves the same way, but all of them share these qualities. A mushroom reproduces. A bacterium uses energy. A tree responds to sunlight. Your own body is doing all of these things at once, right now.

These shared characteristics are not just a checklist — they are the reason biologists can study something as small as a virus and something as large as a whale using the same foundational ideas. Biology covers everything from how your



Biology is the scientific study of living organisms — from microscopic bacteria to 27-metre (90-foot) blue whales.

muscles contract when you lift something heavy, to how a virus spreads through a school, to how an entire forest ecosystem recovers after a wildfire. All of those questions belong to the same discipline — one that treats every living thing as worth understanding.

The Scientific Method: A System That Actually Works

Curiosity alone is not enough. Without a reliable way to test ideas, any conclusion is just an opinion. That is where the **scientific method** comes in — a structured, repeatable process that scientists use to investigate questions and reach trustworthy conclusions based on evidence. It is the same process used by researchers in every country, in every field of science, and it has been refined over hundreds of years to be as reliable as possible.

All living things share six characteristics: made of cells, use energy, grow, respond to their environment, and reproduce.

Life, Questions, and the Science That Connects Them

It works like this: A scientist notices something and asks a focused question. They form a **hypothesis** — not a guess, but a specific, testable prediction backed by prior knowledge or observation. Prior knowledge means the scientist already understands enough about the topic to make an informed prediction, not just a random one. A guess is random; a hypothesis gives a reason. Then they design an experiment, collect data, and analyze the results. Finally, they draw a **conclusion**: did the evidence support the hypothesis or not?

If results are unexpected, the process does not stop — it runs again. Each new round of testing adds to what is already known, building a more complete picture over time.

What makes this system powerful is consistency. A researcher in Brazil running the same experiment as one in Japan should reach the same results. If they do not, that difference becomes its own investigation. Science is not about being right the first time — it is about getting closer to the truth through repeated, honest testing. Every step in the process builds on the one before it, which is why skipping steps or rushing to a conclusion weakens the entire investigation. That disciplined approach has produced antibiotics, cancer treatments, clean water systems, and weather forecasting, among thousands of other advances that keep people alive.

Variables: The Key to a Fair Test

Inside every experiment is a structure that keeps the test fair. That structure is built around **variables**. A variable is anything in an experiment that can change. Understanding the three types of variables is one of the most practical skills in biology.

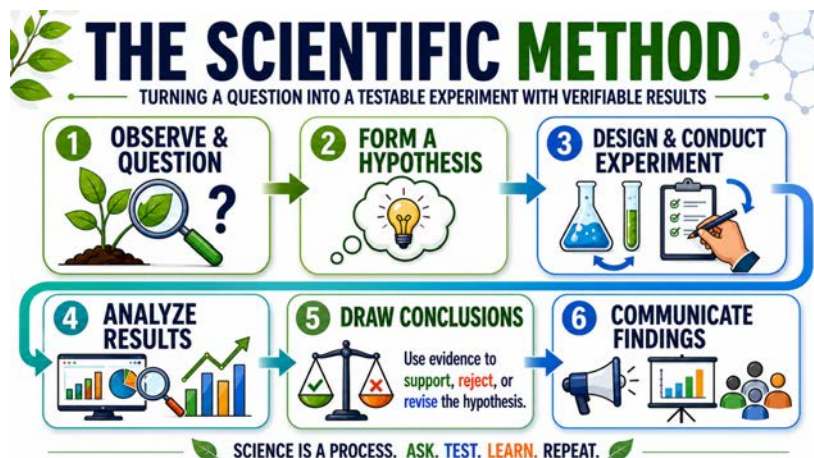
The **independent variable** is what the scientist deliberately changes — the one factor being tested. If a scientist wants to know

how temperature affects plant growth, temperature is the independent variable.

The **dependent variable** is what gets measured as a result. In that same experiment, plant growth is the dependent variable — it depends on what the temperature does.

Finally, **controlled variables** are everything else held constant: the amount of water, the type of soil, the amount of light. Change any of those, and the experiment is no longer a fair test.

Think of it this way: the **independent variable** is the cause being tested, and the **dependent variable** is the effect being measured. **Controlled variables** make sure nothing else sneaks in and muddles the result. Without that structure, you cannot know whether your conclusion is real or just a coincidence. This is exactly



*Every fair experiment has three variable types:
what is changed (IV), measured (DV), and kept the same (CV).*

Life, Questions, and the Science That Connects Them

why scientists take variable identification seriously before a single data point is ever collected.

This skill matters far beyond the lab. When you read a headline claiming “Study shows coffee improves memory,” variable thinking kicks in immediately: what did they change, and what did they measure? Were other factors controlled? That kind of critical reading protects you from bad science, misleading advertising, and misinformation that affects real health decisions.

Case Study:

A Doctor Who Changed Medicine

In the 1840s, a Hungarian doctor named **Ignaz Semmelweis** observed something troubling: women giving birth in hospitals were dying at far higher rates than those giving birth at home. At the time, no one understood why — but Semmelweis refused to accept the pattern without investigating it.

He formed a **hypothesis** — that doctors were transferring something harmful between patients on unwashed hands. He tested it by requiring one ward’s doctors to wash with a chlorine solution before treating patients. Death rates in that ward dropped sharply.

His **independent variable** was handwashing, his **dependent variable** was patient mortality, and all other conditions remained **controlled**. The other ward, where nothing changed, served as a comparison — confirming that handwashing alone made the difference. That structured approach laid the groundwork for modern germ theory — and proved that asking the right question, then testing it carefully, can change everything.

A HYPOTHESIS: WHAT IT IS AND IS NOT



How to Apply

- **Biology** is the study of all living things — including your own body and health.
- The **scientific method** turns questions into reliable, testable answers.
- **Independent, dependent, and controlled variables** keep experiments fair.
- Variable thinking helps you evaluate health claims and news in everyday life.
- A **hypothesis** is only as strong as the evidence and reasoning behind it — not the confidence of the person making it.
- Science is a process, not a destination — unexpected results are opportunities to learn, not failures.

*Living things respond to their environment
— from plants growing toward light to hearts
adapting to exercise.*

X| What Is Biology? - Guided Notes

Three Most Important Concepts

Write each concept in your own words using what you learned from the article.

Concept 1: _____

Concept 2: _____

Concept 3: _____

Main Concept Overview

Fill in each blank using the word bank below.

Word Bank: reproduce — independent — organisms — testable — same

1. Biology is the scientific study of living _____.
2. Living things share characteristics — they are made of cells, use energy, grow, respond to their environment, and _____.
3. A hypothesis is not a guess — it is a specific, _____ prediction based on prior knowledge or observation.
4. The _____ variable is the one factor a scientist deliberately changes in an experiment.
5. Controlled variables are kept the _____ throughout an experiment so the test stays fair.

Matching

Match each term on the left to its correct description on the right. Write the letter in the blank.

- | | |
|----------------------------|--|
| _____ Independent Variable | A. The step-by-step process scientists use to investigate questions and reach reliable conclusions |
| _____ Scientific Method | B. Everything in an experiment that is kept constant to ensure a fair test |
| _____ Hypothesis | C. What a scientist measures as the result of an experiment |
| _____ Dependent Variable | D. The one factor a scientist deliberately changes in an experiment |
| _____ Controlled Variables | E. A specific, testable prediction backed by prior knowledge or observation |

X| What Is Biology? - Guided Notes

True / False

Write **T** for True or **F** for False on the line provided.

1. _____ Biology only studies large, visible organisms like animals and plants.
2. _____ A hypothesis is different from a guess because it is specific and testable.
3. _____ The dependent variable is what a scientist changes on purpose in an experiment.
4. _____ Controlled variables are kept the same throughout an experiment.
5. _____ The scientific method produces consistent results that any scientist can repeat.

Fill in the Table

Using what you learned from the article, complete the right column for each variable type.

Variable Type	What It Means in an Experiment
Independent Variable	
Dependent Variable	
Controlled Variable	
Hypothesis	
Scientific Method	

Application Question

Why is it important that controlled variables stay the same throughout an experiment?
Use an example from the article or your own example to explain your answer.

X| What Is Biology? - Independent / Dependent Variable Analysis

Independent / Dependent Variable Analysis Sheet
Chapter X: What Is Biology?

Directions: Read the Quick Reference box below. Then read each scenario carefully and identify the variables listed. Write your answers on the lines provided. For each scenario, write one sentence predicting what you think will happen based on what you know about biology.

Quick Reference

Term	What It Means
Independent Variable (IV)	The one factor the scientist deliberately changes in an experiment.
Dependent Variable (DV)	What the scientist measures — the outcome that results from the change.
Controlled Variable (CV)	Everything kept the same throughout the experiment so the test stays fair.

Scenario 1 — Handwashing and Patient Health

In the 1840s, Dr. Ignaz Semmelweis noticed that patients in one hospital ward were dying at much higher rates than in another. He suspected doctors were carrying something harmful on their hands from patient to patient. He required doctors in one ward to wash their hands with a chlorine solution before treating patients. Doctors in the other ward continued without handwashing. All other hospital procedures stayed the same.

IV: _____

DV: _____

CV 1: _____

CV 2: _____

Predicted Outcome (1 sentence): _____

X| What Is Biology? - Independent / Dependent Variable Analysis

Scenario 2 — Sunlight and Plant Growth

A scientist sets up two identical plants in the same size pots with the same soil. One plant receives 6 hours of sunlight per day; the other receives 1 hour. Both plants get the same amount of water daily. The scientist wants to know whether the difference in sunlight is enough to cause a measurable difference in how tall each plant grows. After two weeks, the scientist measures each plant's height in centimetres (inches).

IV: _____

DV: _____

CV 1: _____

CV 2: _____

Predicted Outcome (1 sentence): _____

Design Your Own Experiment

Biology Question: Does the amount of sleep a person gets affect how well they concentrate the next day?

Think about what you would need to change, what you would measure, and what you would keep the same to make this a fair test. Using what you have learned about variables and the scientific method, design a simple experiment to test this question. Fill in each section below.

Hypothesis — Write your prediction using the format: **If... then... because...**

IV: _____

DV: _____

CV 1: _____

CV 2: _____

How would you measure the DV?

(Write 1 sentence describing what you would observe or record.)

X| What Is Biology? - Reflection Questions

01

How does knowing that biology includes the study of your own body change the way you think about your daily health habits?

Think about one habit in your life — sleep, food, or exercise. The article describes what all living things need to survive and function. What connection can you make?

02

How might understanding the scientific method help you in a future job — even if that job has nothing to do with a science lab?

Think about what the scientific method is really doing — it is a way of testing an idea before acting on it. Where else in life might that approach be useful?

X| What Is Biology? - Data Analysis

Effect of Daily Exercise on Resting Heart Rate in Teenagers (6-Week Study)

Week	Group A: Exercise 30 min/day (beats/min)	Group B: No Exercise Routine (beats/min)
Week 1 (Baseline)	82	81
Week 2	79	81
Week 3	76	82
Week 4	73	82
Week 5	70	83
Week 6	67	83
Independent Variable: Whether participants exercised 30 minutes daily or not Dependent Variable: Resting heart rate (beats per minute)		

Directions: Study the data table above, then answer the three questions that follow. Use only the information in the table and what you learned in the article. Write your answers in complete sentences.

Question 1 — Basic Interpretation

What was Group A’s resting heart rate at Week 1, and what was it at Week 6?

Question 2 — Pattern Identification

Describe how Group A’s heart rate changed from Week 1 to Week 6. What happened to Group B over the same period?

Question 3 — Application

Based on the data, what conclusion can you draw about daily exercise and resting heart rate? How does this connect to the article’s idea that living things respond to their environment?

X| What Is Biology? - Hypotheticals

Scenario 1: The Energy Supplement

A company claims a new vitamin supplement boosts energy in teenagers. They tested it on 200 students — half took the supplement, half did not — and tracked energy levels over 30 days. Both groups slept the same hours and followed similar diets.

- a) What is the independent variable in this study?
- b) What characteristic of living things makes energy use a meaningful thing to measure?
- c) Why does keeping the two groups otherwise identical matter for the results?

Scenario 2: Is It Really Science?

A friend tells you they tried drinking about 3.8 litres (1 gallon) of water every day for a week and their skin looked better. They changed nothing else and are convinced it is scientific proof that water improves skin.

- a) What is missing from your friend's claim that keeps it from being scientific?
- b) How would a proper hypothesis for this question be written?
- c) What variable would be hardest to control in a real experiment testing this idea?

X| What Is Biology? - Vocabulary

TERM	DEFINITION
Biology	
Conclusion	
Controlled Variable	
Dependent Variable	
Experiment	
Hypothesis	
Independent Variable	
Organism	
Reproduce	
Scientific Method	

What Is Biology?

C A E V I E E T J V M W Z E A U N J B R L C M W
C O E S J D Z J O X C N Y O S W S C I N J K F S
B Y N A Z T F B Z R M K Z E A B C O M X W C C H
A I A C Y Z D R O L G T O T W V I Z V O A Y U C
L N B W L U G E Y D F A T B U K E F U S F X B J
P D H V P U Y A Y A H K N P C S N P A F U A C N
S E D M F Z S N O E L G V I T Y T H I V O V O A
J P B E H T S I H J W E P Y S V I L W T Q L N Z
H E D I P R T H O P R U K I P M F X I V T H T Q
G N H F O E A W Y N I S M W B Z I K I R A M R O
W D I R G L N Y F P G G F T N K C C R V F Z O S
T E D K S H O D I P O E K K E R M A H Z L U L P
J N L O Y I C G E J R T V V Y N E P D I M O L S
O T F M Z O O V Y N S S H Q D N T L N Y G Z E M
O V R R I I B C N G T N F E G V H I V V C E D J
Y A P E E S V D Y X Z V U H S E O R F P N J V L
W R X Z S P O K L C H P A Q S I D X O D U V A L
L I D Z I C R F J Y A T D R I E S W K Y P C R I
O A O U Y W U O L O I T P Q I R K H E F O Y I L
Y B C H E A S J D A Q Z W D C A R C F P J I A D
P L B Z K B V P A U W P V Y U Z B W X O L R B K
Y E E M E K A T E K C Q N E K U I L O S L E L G
S M E L E U M L B F N E K G X J N H E J B L E I
F I V Y B E G Y N V R E X P E R I M E N T D Q A

Independent Variable	Dependent Variable	Controlled Variable
Scientific Method	Reproduce	Organism
Hypothesis	Experiment	Conclusion
Biology		

What Is Biology?

Across

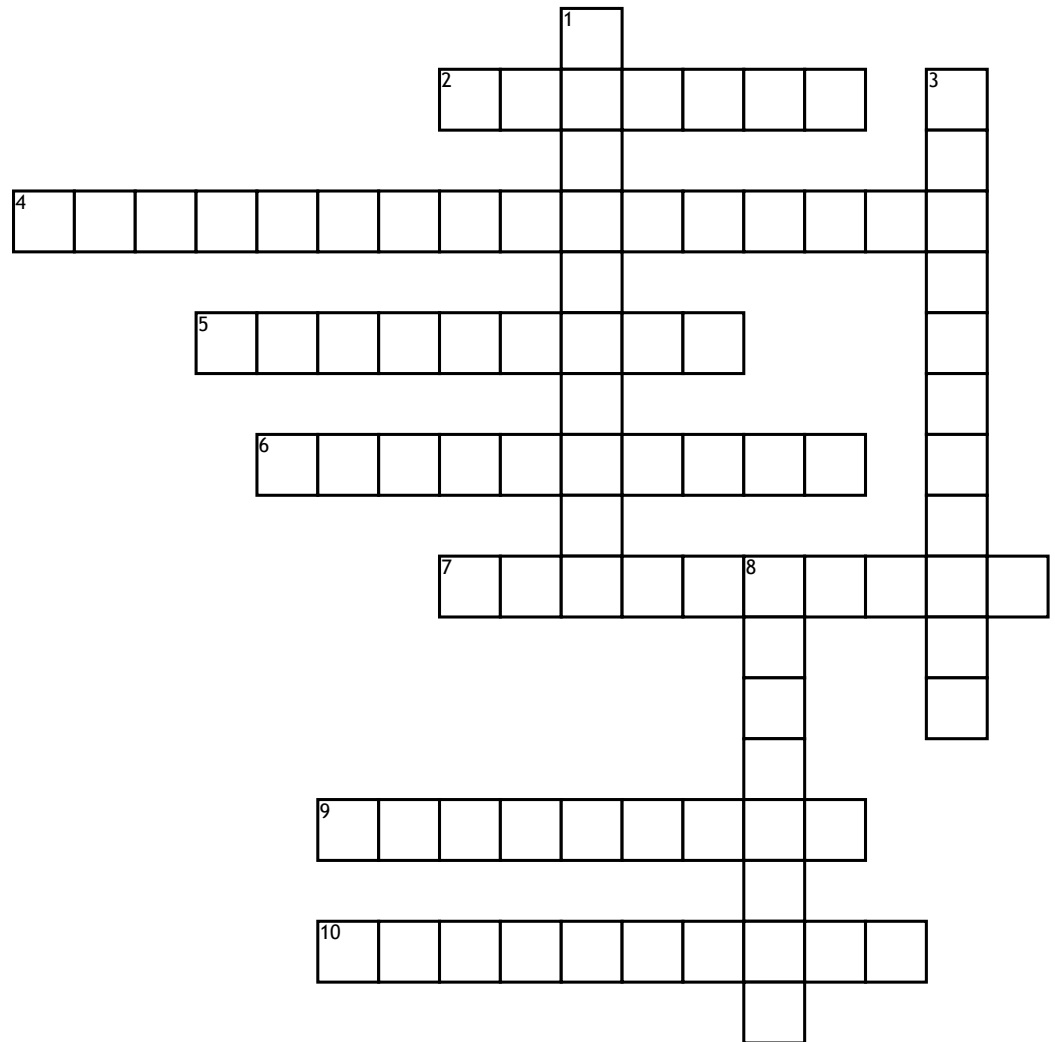
2. The scientific study of living organisms and the processes that sustain life.

4. A structured, repeatable process used by scientists to ask questions, test hypotheses, and draw conclusions based on evidence. (Two words)

5. To produce offspring; one of the key characteristics shared by all living things.

6. A test designed to investigate a hypothesis by changing one variable while keeping all others constant.

7. A factor that is kept the same throughout an experiment so it does not affect the outcome. ____
Variable



9. The factor that is measured in an experiment; it changes in response to the independent variable. ____
Variable

10. A specific, testable prediction about the expected outcome of an experiment, based on prior knowledge or observation.

Down

1. A judgment or decision reached after analyzing the results of an experiment.

3. The one factor a scientist deliberately changes in an experiment. ____
Variable

8. Any living thing, from a single-celled bacterium to a complex multicellular animal.