

Biology Lab Intro

What is a Biology Lab?



A biology lab is a dedicated space equipped with instruments, glassware, and safety systems where students and researchers observe, test, and experiment with living organisms and biological materials to build hands-on scientific understanding.

Why is Biology Lab Important?

The lab turns biology from a subject you read about into science you do — building skills no lecture can teach alone.



Hands-On Learning

Turns textbook concepts like cells and genetics into observable, testable reality.



Scientific Method

Builds skill in forming hypotheses, running controlled tests, and analyzing results.



Critical Thinking

Develops problem-solving as you troubleshoot procedures and interpret unexpected data.



Real-World Application

Prepares you for careers in medicine, research, biotechnology, and environmental science.

General Safety Rules in the Lab



No food or drink is ever permitted at the bench.



Wear PPE (goggles, gloves, closed-toe shoes) at all times during procedures.



Never work alone; a trained partner or instructor must be present.



Know the location and use of the eyewash and safety shower



Read the protocol fully before touching any reagent or organism.



Dispose of sharps, chemicals, and biological waste only in labeled containers.

Common Tools Used in the Lab



Compound & Dissecting Microscopes

For viewing slides and specimens at a range of magnifications.



Micropipettes

Deliver precise microliter volumes of liquid reagents or samples.



Incubators & Autoclaves

Culture organisms at set temperatures and sterilize equipment.



Analytical Balances

Weigh reagents and samples to fractions of a gram.



Glassware

Beakers, flasks, test tubes, and petri dishes for mixing, growing, and observing.



Water Baths & Thermometers

Maintain and monitor reaction and culture temperatures.

CORE INSTRUMENT

The Compound Microscope

Eyepiece (Ocular Lens)
look

Typically 10× magnification; where you to view the specimen.

Objective Lenses

Mounted on a rotating turret,

usually 4×, 10×, 40×, and

100× stage & Stage Clips
over

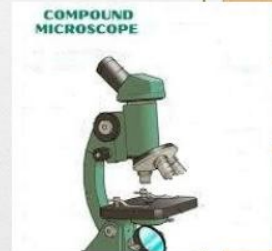
Holds the slide flat and centered the light path.

Coarse & Fine Focus

Coarse focus for large adjustments, fine focus for sharp detail.

Light Source & Diaphragm

Illuminates the specimen; the diaphragm controls light intensity.



What We Learn

- How plants and animals are grouped.
- How cells look and work.
- How life changes and grows.

Animal Classification

- We write Family – Order – Genus – Species.
- It's like a big family tree of animals.
- Helps us know which animals are alike.

Levels of Classification:

1. Kingdom – Biggest Group:

This is like saying “**All Animals**” or “**All Plants**”.

Example: Lion, dog, bird – all are in the **Animal Kingdom**.

2. Phylum – Big Groups Inside the Kingdom:

Animals are divided based on **big features** like having a backbone.

Example: **Chordata** means animals with a backbone (like cats, birds, fish).

3. Class – Smaller Groups:

Inside the phylum, animals are grouped by **special body features**.

Example: **Mammals** (like cats, humans, cows) — they have hair and feed babies with milk.

Birds (like parrots) – they have feathers and lay eggs.

4. Order – Even Smaller Groups:

We divide animals into **what they eat or how they live**.

Example: **Carnivores** – meat-eating animals like lions, tigers, cats.

5. Family – Close Relatives **Animals**: that look almost the same are put in one family. Example: Felidae (Cat Family) – lion, tiger, leopard, house cat.

6. Genus – Like a Surname: A genus is a small group of very close animals. Example: Panthera – includes lion, tiger, jaguar.

7. Species – Exact Name:

This is the **animal's personal name**.

Example: **Panthera leo** – it means Lion.

Panthera tigris – means Tiger.

Example (Lion)

Kingdom: Animalia (All animals)

Phylum: Chordata (Backbone animals)

Class: Mammalia (Mammals)

Order: Carnivora (Meat eaters)

Family: Felidae (Cat family)

Genus: Panthera

Species: Panthera leo (Lion)

What Are Vertebrates?

- **Vertebrates** are animals that have a **backbone or spine**.
- They are part of a group called the **Phylum Chordata**.
- The backbone protects the **spinal cord**, which is part of the nervous system.

Purpose of the Vertebrate Lab

- The vertebrate lab helps students to:
- Identify **different vertebrate groups**
- Compare their **body structures**
- Study their **adaptations, habitats, and movement**
- Understand how **vertebrates survive** in different environments

Main Characteristics of Vertebrates:

- **Have a backbone**
- **Have a skeleton** made of bone or cartilage
- **Bilateral symmetry** (same on both sides)
- **Closed circulatory system** (blood stays inside blood vessels)
- **Brain is protected by a skull**
- Most have **two pairs of limbs** (like arms and legs)

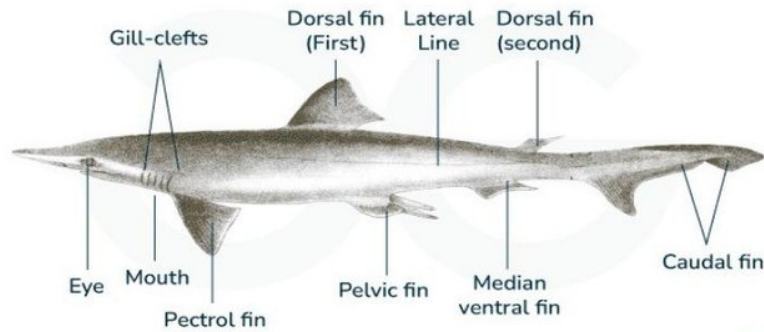
Main Groups of Vertebrates – Comparison Chart

Group	Body Covering	Reproduction	Warm/Cold Blooded	Examples
Fish	Scales	Lay eggs in water	Cold-blooded	Goldfish, Shark
Amphibians	Moist skin	Lay eggs in water	Cold-blooded	Frog, Salamander
Reptiles	Dry, scaly skin	Lay eggs on land	Cold-blooded	Lizard, Snake
Birds	Feathers	Lay eggs	Warm-blooded	Eagle, Parrot
Mammals	Hair or fur	Give birth to live young	Warm-blooded	Dog, Human

Fishes:

Scoliodon:

Labelled Diagram of Scoliodon



Scoliodon



- **Name:** Scoliodon (also called Dogfish)
- **Type:** A kind of small shark (a **fish**)
- **Lives in:** Ocean (Saltwater)

Characteristics:

- **Has a Long Body** – Looks like a mini shark
 - **Covered with Scales** – Skin is rough like sandpaper
 - **Breathes with Gills** – Gills are on the sides of the head
 - **Cartilage Skeleton** – Bones are soft like rubber (not hard bones)
 - **Has Fins** – For swimming fast
-
- **Tail is Strong** – Helps in movement
 - **Cold-Blooded** – Body temperature changes with water
 - **Lays Eggs or Gives Live Birth** – Depends on species
 - **Has Sharp Teeth** – For catching fish
 - **Swims Fast** – Very good swimmer

Important Question:

Why is a Dogfish called "Dogfish"?

- Dogfish have a **very sharp sense of smell**.
- They can **smell blood or food** in the water from far away
- Type of shark.

Amphibians

Necturus:



- Necturus is a type of amphibian.
- It's also called a mudpuppy or water dog.
- It lives in water all its life!

Characteristics:

- **Amphibian**
 - Belongs to the same group as frogs and salamanders.
- **Lives in Water Forever**
 - Unlike frogs, it **never comes on land**.
- **Has Gills All Life**
 - It keeps its **external gills** (like red feathery hairs) even when it grows up.
- **Long, Slimy Body**
 - Looks like a mix between a lizard and a fish.

- **Four Small Legs**
 - Has legs but uses its tail more for swimming.
- **Cold-Blooded**
 - Body changes with water temperature.
- **Eats Small Animals**
 - Feeds on worms, insects, and tiny fish.

Why Is It Called Necturus?

- The name **Necturus** comes from **Greek words**:
- “**Nekto**” (νέκτω) means “**to swim**”
- “**Oura**” (οὐρά) means “**tail**”

Biology Lab 03

Reptile – Testudo (Tortoise)

- Belongs to order Testudines.
- Has a hard bony shell for protection.
- Herbivorous, feeds on grass and leafy plants.
- Cold-blooded and lays eggs on land.
- Long lifespan, can live over 100 years.



Bird – *Columba livia* (Pigeon)

- Commonly known as rock pigeon.
- Feeds mainly on seeds and grains.
- Strong homing ability; used in message carrying historically.
- Monogamous with both parents caring for young.
- Found worldwide in cities and rural areas.



Bird – Bubo bubo (Eurasian Eagle-Owl)

- One of the largest owl species.
- Carnivorous, hunts mammals and birds at night.
- Large orange eyes adapted for night vision.
- Nests in cliffs, caves, or old nests of other birds.
- Widespread in Europe and Asia.



Mammal – Loris

- Small, nocturnal primates.
- Large eyes adapted for night vision.
- Feeds on insects, fruit, and tree gum.
- Slow, deliberate movements.
- Found in South and Southeast Asia.



Biology Lab 04

Introduction

Invertebrates = Animals without backbone

Found everywhere: soil, water, air

They make up about **95% of all animals** on Earth.

Found everywhere: in soil, water, and air.

They show a wide variety of shapes and sizes.

Examples: earthworm, snail, butterfly, starfish.

Phylum Porifera (Sponges)

- Body full of pores, simple structure
- Live in water
- Example: Bath sponge (used in homes)

- Body full of **pores** (tiny holes).
- **Simplest** animals – no organs or true tissues.
- Body supported by **spicules** or spongin.
- **Sessile** (fixed in one place, don't move).
- Reproduce by both **asexual (budding)** and **sexual** methods.
 - Asexual (budding): A small part of the sponge grows on its body. When it breaks off, it becomes a new sponge.
 - Sexual: Sponges also make tiny egg and sperm cells, which join together to form baby sponges.
- Mostly found in **marine water** (some in freshwater).



Phylum Cnidaria (Jellyfish)

- Body is **soft and transparent**.
- Have **stinging cells** to catch food and for defense.
- Radial symmetry (body arranged in a circle).
- **Medusa form** = umbrella-like, free-swimming.
- Simple digestive cavity (one opening).
- Live in **marine water**.
- **Example:** Jellyfish



Phylum Platyhelminthes (Flatworms)

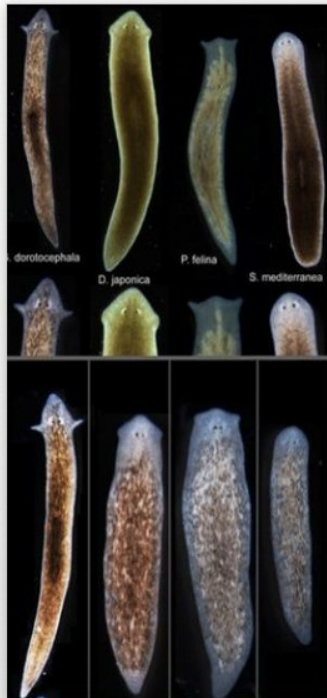
- Body is **flat and thin** (dorsoventrally flattened).
- **Bilateral symmetry** (left and right sides are same).
- **Triploblastic** (three body layers).
- when they are developing, their body is made from three layers of cells:

Ectoderm the outer layer (makes skin, nerves).

Mesoderm the **middle layer (makes muscles, organs).

Endoderm the inner layer (makes gut and digestive parts).

- Many are **parasites** in humans and animals.
- Reproduce **sexually and asexually**.
- **Examples:** Tapeworm



Phylum Nematoda (Roundworms)

- Body is **long, round, and unsegmented**.
- Covered with a **tough cuticle**.
- **Bilateral symmetry**.
- Complete digestive system (mouth & anus).
- Many are **parasites** of humans, animals, and plants.
- Found in **soil, water, and inside hosts**.
- **Examples:** Ascaris (intestinal roundworm), Hookworm

- **Examples:** Ascaris, Hookworm, Pinworm
- **General Characters:**
- **Body Shape** – Long, thin, smooth, and **round in cross-section** (not flat).
- **Symmetry** – Bilateral (left and right sides same).
- **Segmentation** – **No segments** (unlike earthworm).
- **Skeleton** – No bones, but body wall is tough (cuticle).
- **Digestive System** – Complete (mouth → intestine → anus).
- **Circulation** – No blood vessels, nutrients spread by body fluid.
- **Nervous System** – Simple nerve ring near the head.
- **Reproduction** – Sexes separate (male and female are different).
- **Habitat** – Some are **free-living in soil/water**, others are **parasites** (like Ascaris in human intestine, Hookworm in intestine sucking blood).



Phylum Annelida (Segmented worms)

- Body divided into segments
- Example: Earthworm (easily seen in soil after rain)

- **Earthworm (Phylum Annelida) – Characters**

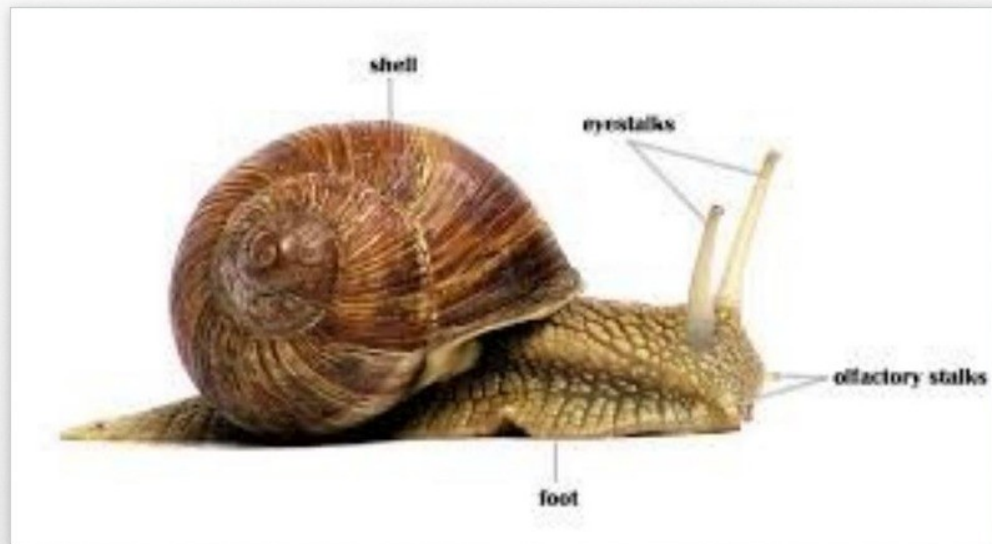
- **Body Shape** – Long, thin, and soft.
- **Segmentation** – Body is divided into many **small rings** (called segments).
- **Symmetry** – Bilateral symmetry (same on left and right side).
- **Skeleton** – No bones, only soft body.
- **Circulatory System** – Closed system (blood moves in blood vessels).
- **Nervous System** – Simple brain and nerve cord.
- **Respiration** – Breathes through **skin** (no lungs).
- **Reproduction** – Hermaphrodite (both male & female organs in one body).
- **Movement** – Moves with help of **setae** (tiny bristles) and body muscles.



Phylum Mollusca (Soft-bodied animals)

- Soft body, often with a shell
- Found on land and water
- Example: Snail (garden, near plants)

- **Snail (Garden Snail)**
- **General Characters:**
- **Body** – Soft and unsegmented (not divided into rings).
- **Symmetry** – Bilateral (left and right sides same).
- **Shell** – Usually has a **hard, coiled shell** for protection.
- **Head** – Has tentacles (feelers) with eyes at the tip.
- **Foot** – A large, flat, muscular foot used for **slow movement**.
- **Mantle** – A special skin fold that makes the shell.
- **Nervous System** – Simple, with tiny brain and nerve cords.
- **Respiration** – Breathes with a **lung or gills**, depending on type.
- **Circulatory System** – Mostly **open circulation** (blood not always in vessels).
- **Reproduction** – Usually hermaphrodite (male + female organs in one snail).



Octopus

- **Octopus – Phylum Mollusca (Class: Cephalopoda)**
- **General Characters:**
 - **Body** – Soft, without an external shell (unlike snails).
 - **Arms** – Has **8 long arms** with suckers to catch prey.
 - **Symmetry** – Bilateral (left and right sides same).
 - **Movement** – Very fast, swims by pushing water out
 - **Nervous System** – Very advanced, with a **big brain** and good memory.
 - **Eyes** – Large and well-developed (can see clearly).
 - **Circulatory System** – **Closed circulation** (blood always in vessels).
 - **Respiration** – Breathes through gills.
 - **Reproduction** – Male and female are separate.
 - **Defense** – Can **squirt ink** to escape from enemies and can **change skin color** to hide.



Phylum Arthropoda (Largest phylum)

- Jointed legs, segmented body, exoskeleton
- Very common everywhere
- Example: Housefly (seen daily at home)

Housefly

General Characters:

- **Body Segments** – Divided into **3 parts**:
 - Head
 - Thorax
 - Abdomen
- **Exoskeleton** – Body covered with a **hard outer covering** (chitin).
- **Symmetry** – Bilateral (same on both sides).
- **Legs** – Has **6 jointed legs**.
- **Wings** – Has **1 pair of wings** for flying.
- **Eyes** – Large **compound eyes** (can see in many directions).
- **Mouthparts** – Special mouth for **lapping up liquid food**.
- **Respiration** – Breathes through tiny holes in body called **spiracles**.
- **Circulation** – Open circulatory system (blood not always in vessels).
- **Reproduction** – Lays eggs which hatch into **larva (maggot)** → **pupa** → **adult fly** (complete metamorphosis).



Phylum Echinodermata

- Spiny skin, only marine
- Move with tube feet
- Example: Starfish (seen at beaches, aquariums)

- **Starfish – Phylum Echinodermata**
- **General Characters:**
- **Body Shape** – Star-like, usually with **5 arms**.
- **Symmetry** – **Radial symmetry** (body parts arranged around a center like a wheel).
- **Skeleton** – Hard, spiny skin made of **calcium plates** (endoskeleton).
- **Movement** – Moves slowly using **tube feet** (tiny suction feet).
- **Nervous System** – No brain, only a nerve ring.
- **Digestive System** – Has a mouth on the underside; can even push its **stomach out** to digest food outside the body.

TYPES OF STARFISH



Royal Starfish
Astropecten articulatus
Astropectinidae
Arms: Typically 5
Size: 8 inches (20 cm)



Sunflower Sea Star
Pycnopodia helianthoides
Asteriidae
Arms: 16 to 24
Size: 24 inches (61 cm)



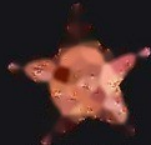
Cushion Star
Culcita novaezelandiae
Oreasteridae
Arms: 6
Size: 20 inches (50 cm)



Common Starfish
Asterias rubens
Asteriidae
Arms: 5
Size: 8 inches (16 cm)



Sand Sifting Sea Star
Archaster typicus
Archasteridae
Arms: Typically 5
Size: 6 inches (16 cm)



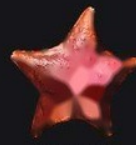
Firebrick Starfish
Asterodiscus truncatus
Asterodiscidae
Arms: 5
Size: 12 inches (30 cm)



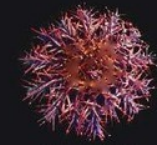
Blue Linckia
Linckia laevigata
Ophiasteridae
Arms: 5
Size: 12 inches (30 cm)



Blood Star
Henricia sanguinolenta
Echinasteridae
Arms: Typically 5
Size: 12 inches (30 cm)



Bat Sea Star
Patria miniata
Asterinidae
Arms: Typically 5
Size: 8 inches (20 cm)



Crown of Thorns
Acanthaster planci
Acanthasteridae
Arms: 10 to 21
Size: 24 inches (61 cm)

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Conclusion

- Invertebrates are diverse and found everywhere
- Each phylum has unique body structure
- Very important for environment and humans