

Flatworms Fact Sheet

An Ancient Body Plan

Like their ancient ancestors, modern flatworms are soft-bodied, ribbon-shaped animals. Around 20,000 species alive today have the same basic body plan that appeared roughly 500 million years ago. They include marine flatworms and freshwater planaria, and **parasites** like tapeworms and flukes.

Flatworms live in fresh and saltwater habitats, as well as other wet areas like soil and human bodies! The flatworm phylum is called **Platyhelminthes**. This comes from the Greek meaning “flat worm.”

A Body Blueprint for Success

The evolution of flatworms represented a dramatic change in the animal world. Until flatworms evolved, animals were rooted in place like sponges. Or, they drifted with the currents in search of food like jellies. Flatworms were the first organisms to develop bilateral symmetry and a head with a centralized nervous system. They also developed sensory organs. With these tools, flatworms could move in a purposeful direction in search of prey. They became the first predators!

This breakthrough in body design gave flatworms a huge advantage over other animals. As soon as bilateral animals with heads appeared in the sea, they became the dominant life form on Earth.

Built for Sensing and Motion

Flatworms share the following characteristics:

- **Bilateral symmetry with a head, a tail, and stereo senses**

Flatworms are bilaterally symmetrical. This means the left and right sides of their body are mirror images of each other.

Stereo senses are paired senses (like eyes), which are on both sides of the head. Flatworms’ other sensors for smell, touch, and taste are also paired.

- **A centralized nervous system**

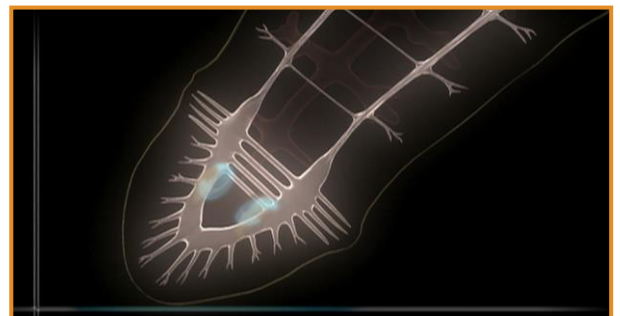
Flatworms have a **centralized nervous system** with two nerve cords running down the body. A bundle of nerves transmits impulses to and from sensors such as eyes, as well as smell and taste receptors. This allows the animal to know where it is and where its food and enemies are located.



Look for planaria like this one (*Dugesia subtentaculata*) in clean freshwater. Like other aquatic invertebrates, they can be good indicators of water quality.
Eduard Solà, Wikimedia Commons



Marine flatworms like this one can be especially beautiful. Note its striking bilateral symmetry.



A model of a flatworm centralized nervous system (brain) with nerve cords:
shapeoflife.org/video/flatworm-animation-body-plan

- **No coelom (body cavity)**

Flatworm bodies do not have a central cavity like most other animals. Instead, they have a layer of tissue in which their organs, nerves, and sensors are embedded in separate pockets.

Their bodies have only a single opening, which serves as a mouth and also ejects waste. Many flatworms eat by extending a tube called a **pharynx** out of the opening and into their prey. The lining of the pharynx secretes enzymes, which soften the bits of food that the pharynx then passes into the flatworm's body. The meal passes through its body in a gut that is not a central channel, but more like a network of branches. The branches distribute food directly to the rest of the body.

- **No circulatory system**

Why are flatworms so flat? They lack specialized organs (circulatory and respiratory organs) to move blood and gases, especially oxygen and carbon dioxide. Instead, gases pass through their bodies by **diffusion**. Diffusion is the movement of a substance from an area of higher concentration to an area of lower concentration. A flattened shape allows oxygen to diffuse to all parts of the body and carbon dioxide to exit.

- **Cilia for movement**

Some flatworms have **cilia**, which are hair-like growths on the outside of their body. When cilia are present in large numbers, they can produce currents to move water. Small flatworms use waves of ciliary action to move over surfaces. Larger species use muscular movements of their entire body to move along a surface or swim.



A flatworm extends its pharynx to feed.



What are advantages of being flat?



Screenshot from "Flatworms: The First Hunter": shapeoflife.org/video/flatworms-first-hunter

Regeneration + Reproduction

Flatworms have an amazing "superpower"—**regeneration!** They can regrow body parts and some, like planarians, can even grow an entire new body when they are wounded or cut in pieces. During regeneration, special cells quickly begin to move toward the site of the damage. The regeneration cells are called **neoblasts**, which means "cells of newness."

Flatworms reproduce through regeneration (**asexually**) and also **sexually**. Like sponges, they are **hermaphrodites**. This means an organism produces both female and male sex cells. When flatworms mate, the worm that first receives sperm carries the fertilized eggs. They were the first animals with internal fertilization. In most species, "miniature adults" emerge when the eggs hatch. A few large species produce larvae, which then grow into the adult form.

Learn More with Shape of Life Videos

- "Flatworms: The First Hunter": shapeoflife.org/video/flatworms-first-hunter
- "Flatworm Animation: Body Plan": shapeoflife.org/video/flatworm-animation-body-plan
- "Flatworm Animation: Reproduction": shapeoflife.org/video/flatworm-animation-reproduction
- "Flatworm Animation: Tapeworm": shapeoflife.org/video/flatworm-animation-tapeworm
- "Flatworms: An Invasive Flatworm Hunts Earthworms": shapeoflife.org/video/flatworms-invasive-flatworm-hunts-earthworms



Penis-fencing flatworms!
Three-headed planarians!
Learn more with Shape of Life resources.

