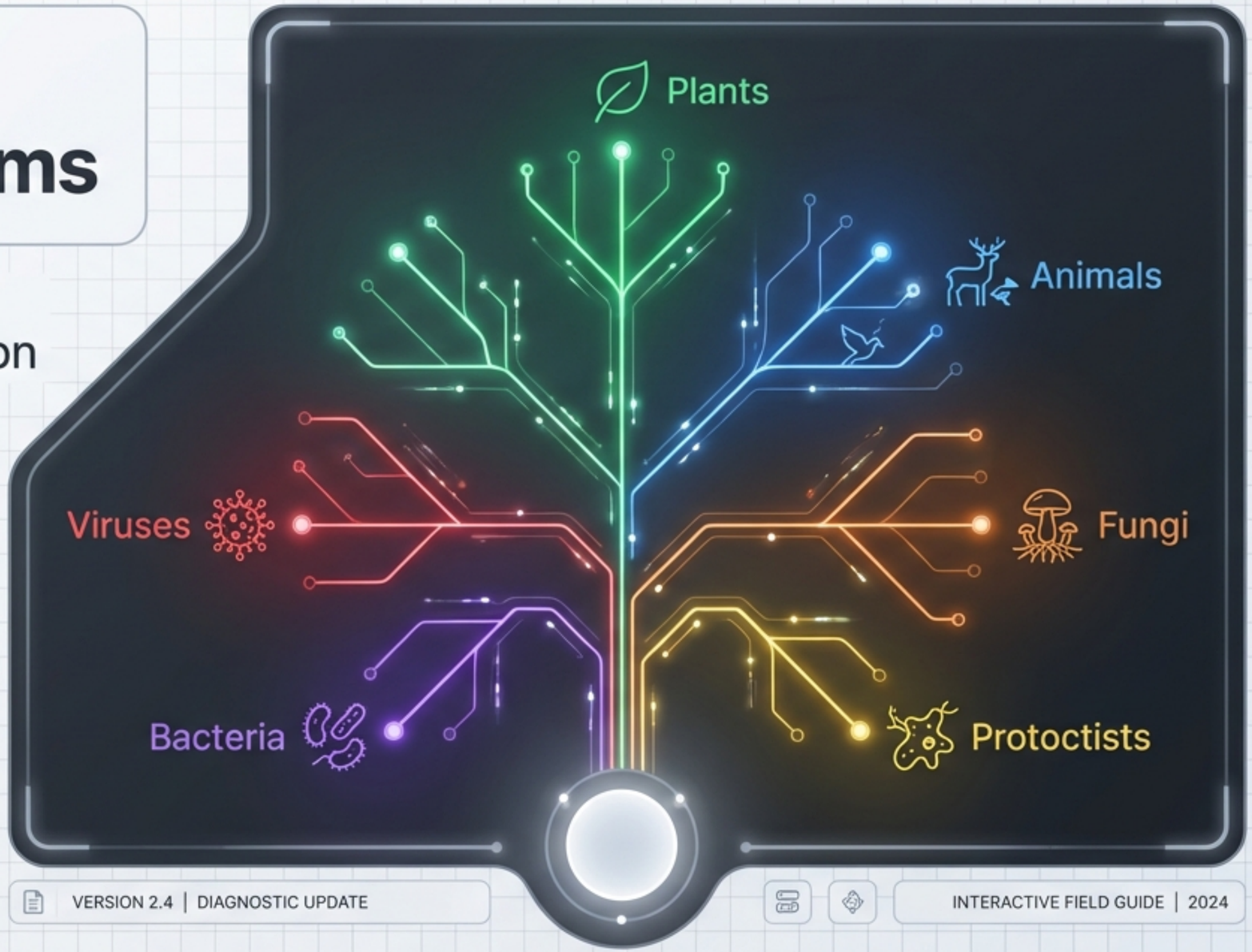
The Variety of Living Organisms

A Diagnostic Framework for Biological Classification



VERSION 2.4 | DIAGNOSTIC UPDATE

INTERACTIVE FIELD GUIDE | 2024

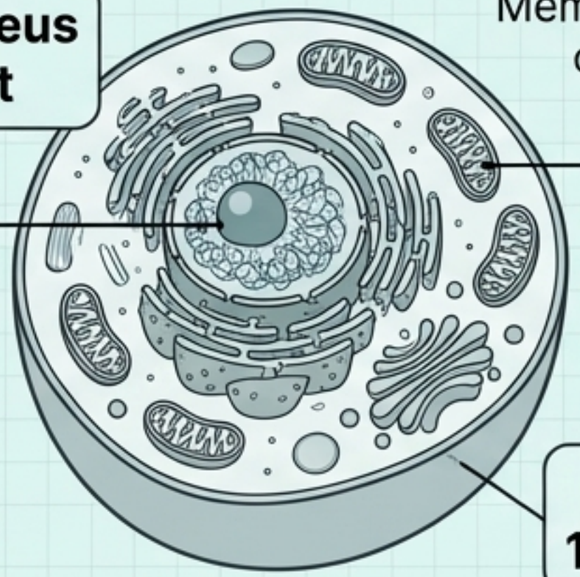
The Biological Divide: Eukaryotic vs Prokaryotic

All living organisms fall into two primary categories based on cellular complexity and the presence of a true nucleus.

Eukaryotic

True Nucleus Present

Membrane-bound organelles

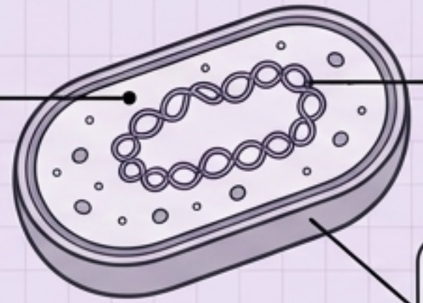


Size: 10–100 µm

Prokaryotic

No Nucleus ('Pro' = Before)

Free-floating circular DNA



Size: 1–5 µm

Diagnostic Rule: Eukaryotes form **four** of the five **kingdoms**. **Prokaryotes** represent the **fifth**. for **Bacteria**.

The Five Kingdoms Diagnostic Matrix

A structural overview of the defining features across all recognized kingdoms of life.

	Cellularity	True Nucleus	Cell Wall Material	Chloroplasts	Carbohydrate Storage
Plants	Multicellular	Yes	Cellulose	Yes	Starch
Animals	Multicellular	Yes	NONE	NONE	Glycogen
Fungi	Multi/Uni	Yes	Chitin	NONE	Glycogen
Protoctists	Mostly Uni	Yes	Variable	Variable	-
Bacteria	Unicellular	NONE	Peptidoglycan	NONE	-

Nervous Coordination

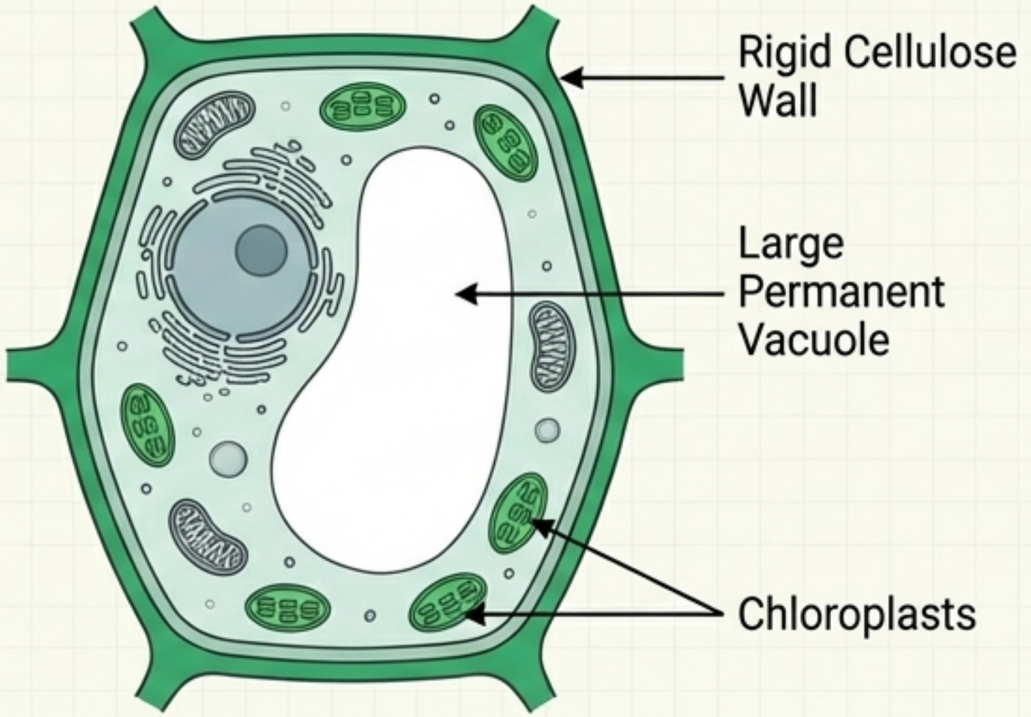
Kingdom Plantae

Multicellular organisms utilizing light energy to synthesize complex organic compounds.

The Specs

- **Cell Wall:** Cellulose
- **Nutrition:** Autotrophic
- **Storage:** Starch / Sucrose
- **Form:** Multicellular

Structure



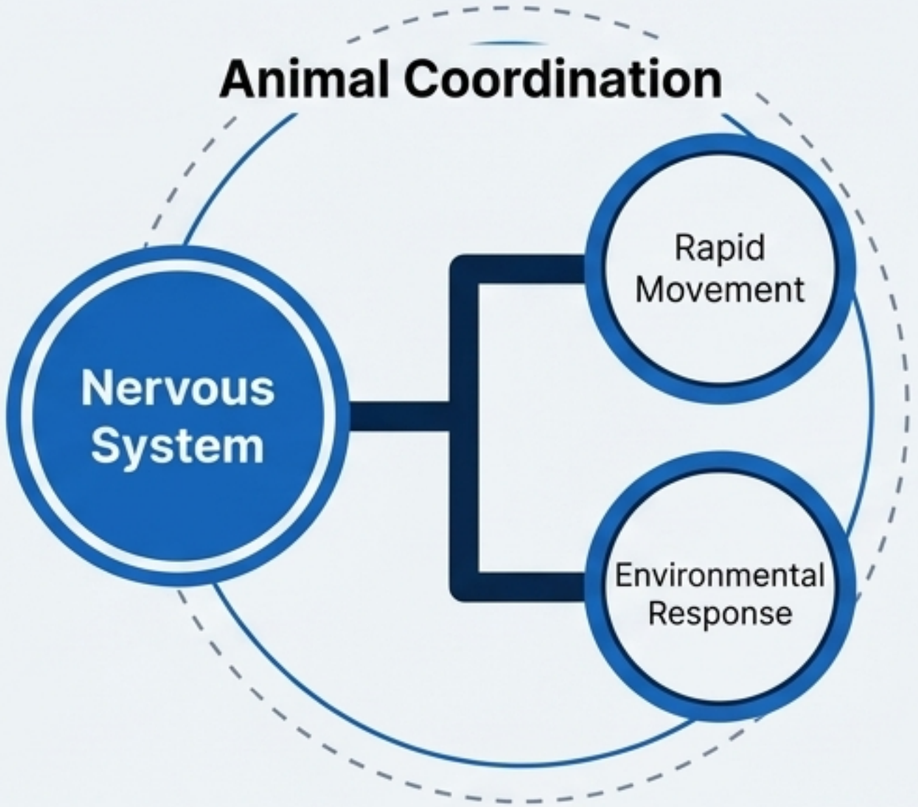
Exemplars: Maize, Peas, Beans

Kingdom Animalia

Highly coordinated multicellular organisms requiring organic consumption for energy.

- **Cell Wall:** NONE
- **Nutrition:** Heterotrophic
- **Storage:** Glycogen
- **Form:** Multicellular

Unique Features



Major Division: Vertebrates (backbone) vs. Invertebrates (no backbone).
Exemplars: Humans, Houseflies, Mosquitoes.

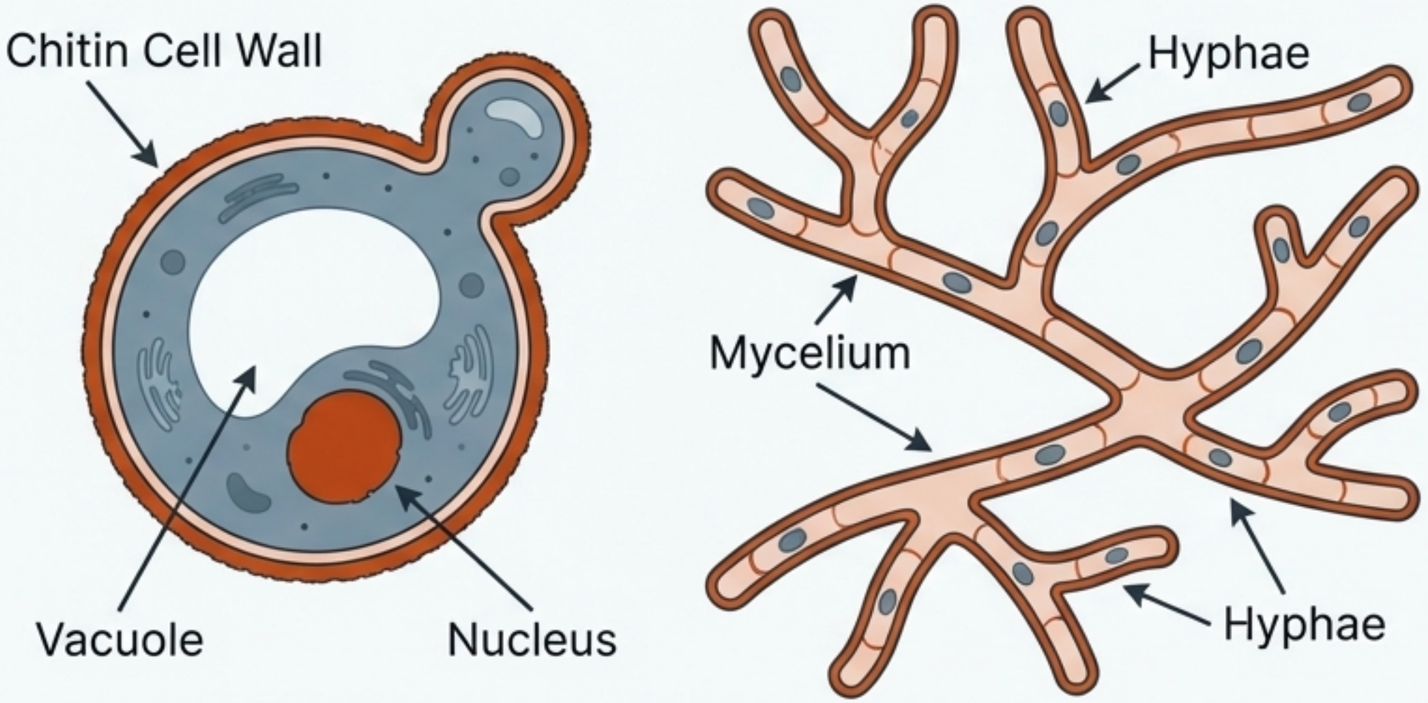
Kingdom Fungi

Non-photosynthetic organisms characterized by specialized cell walls and thread-like network structures.

The Specs

Cell Wall:	Chitin
Nutrition:	Saprotrophic
Storage:	Glycogen
Form:	Multicellular & Unicellular

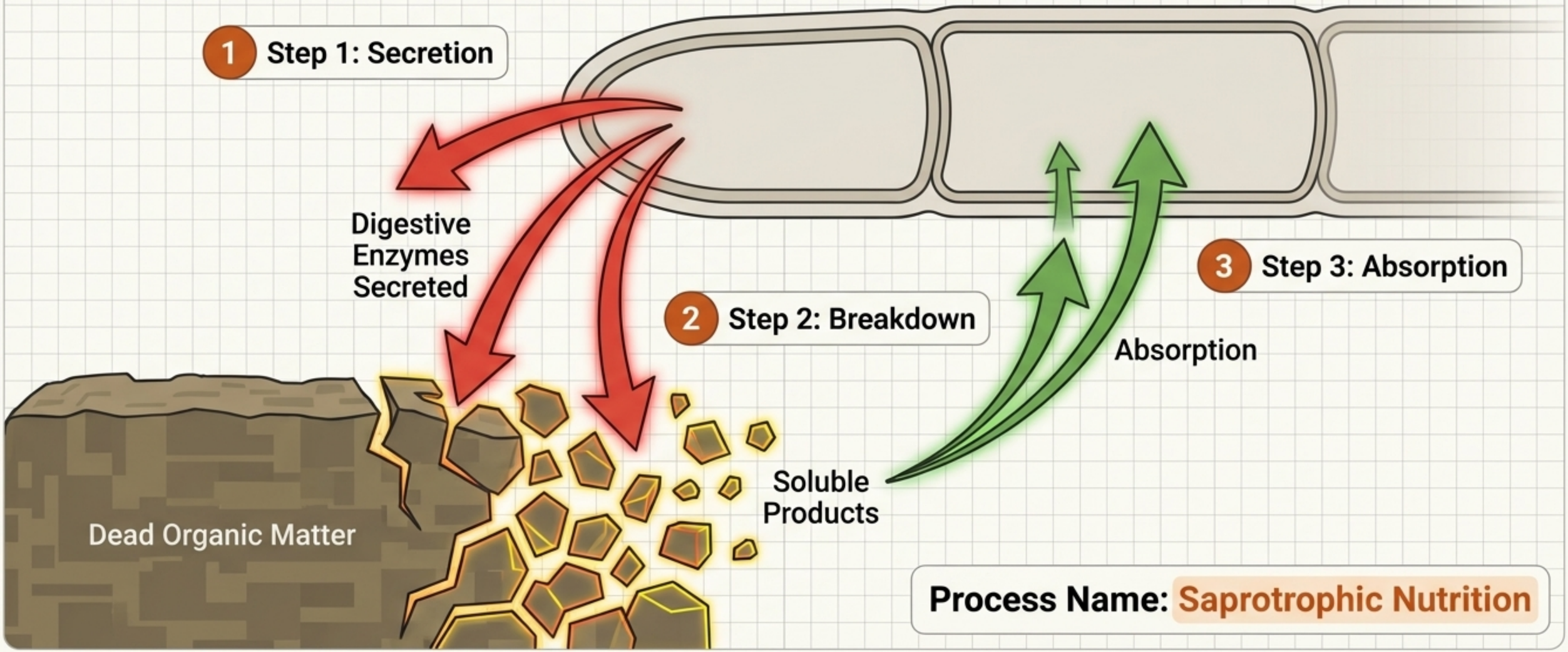
Structural Duality



Exemplars: Yeast, Mucor, Mushrooms.

Mechanism: Extracellular Digestion

Fungi do not ingest food. Instead, they digest organic matter outside their bodies and absorb the resulting soluble nutrients.



Process Name: Saprotrophic Nutrition

Kingdom Protoctista

The microscopic mosaic: a diverse collection of single-celled organisms that exhibit both plant-like and animal-like characteristics.

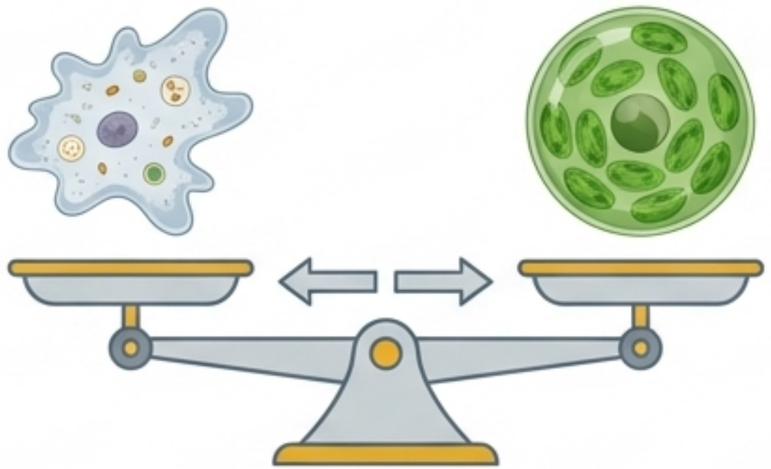
The Specs

- **Cell Wall:** Variable
- **Nutrition:** Variable (Photosynthetic or Heterotrophic)
- **Form:** Primarily Unicellular

The Two Extremes

Animal-like

- Amoeba
- No cell wall
- Consumes food (protozoa)



Plant-like

- Chlorella
- Contains chloroplasts
- Photosynthetic (algae)

The Pathogenic Protoctist: Plasmodium (Responsible for Malaria).

Kingdom Bacteria

Microscopic, single-celled prokaryotes featuring complex external envelopes but lacking internal membrane-bound organelles.

The Specs

- **Nucleus:** NONE (Prokaryotic)
- **Cell Wall:** Peptidoglycan
- **DNA:** Single circular chromosome
- **Form:** Unicellular

Bacterial Morphology

Spheres (e.g., *Pneumococcus*)

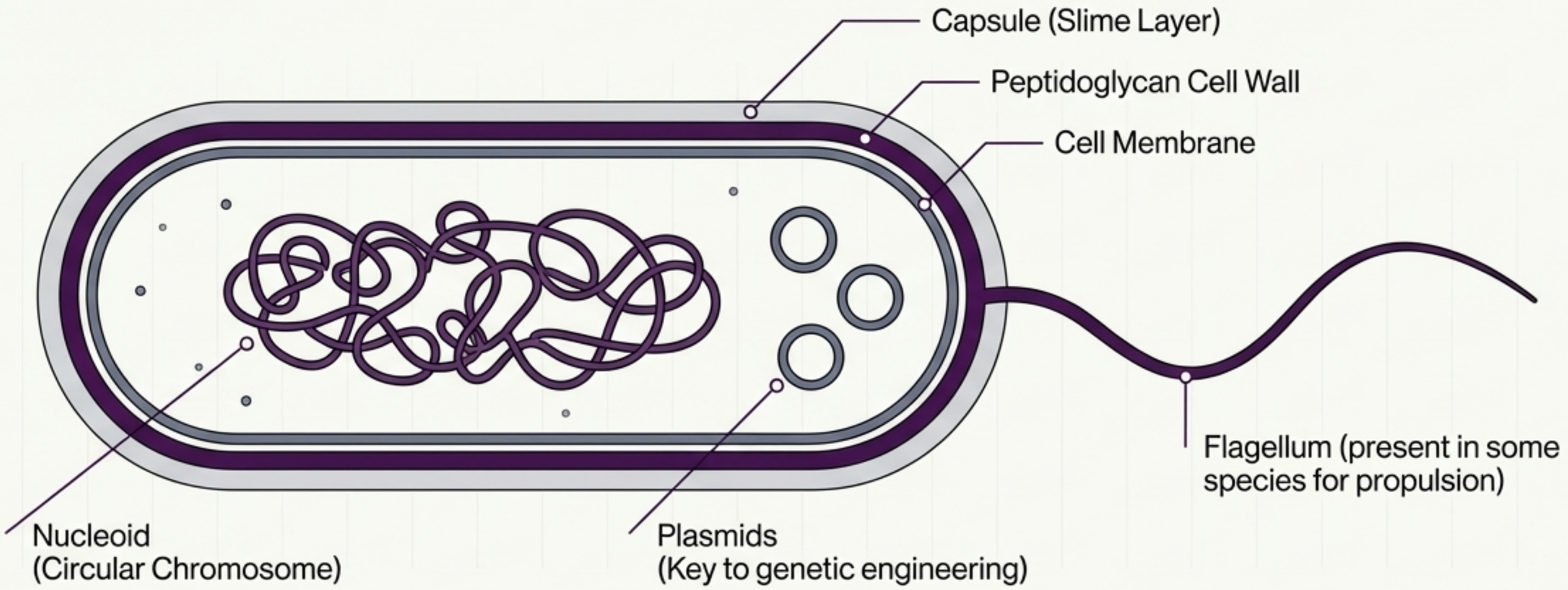
Rods
(e.g., *Lactobacillus bulgaricus*)

Spirals

Ecological roles: Decomposers, Pathogens, and Food Production (Yoghurt).

Anatomy of a Bacterium

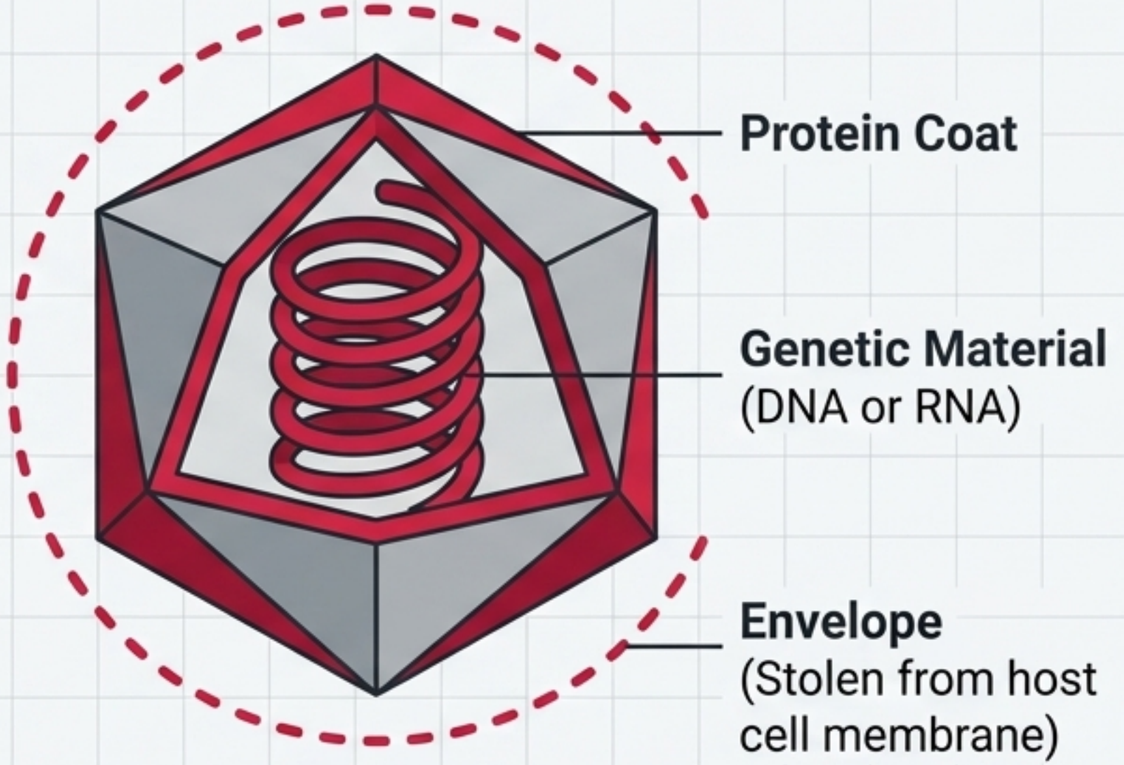
Stripped of a true nucleus, bacterial cells rely on unique structures to survive, move, and share genetic data.



Viruses: The Rule-Breakers

Non-cellular parasitic particles incapable of feeding, respiring, or reproducing outside of a living host.

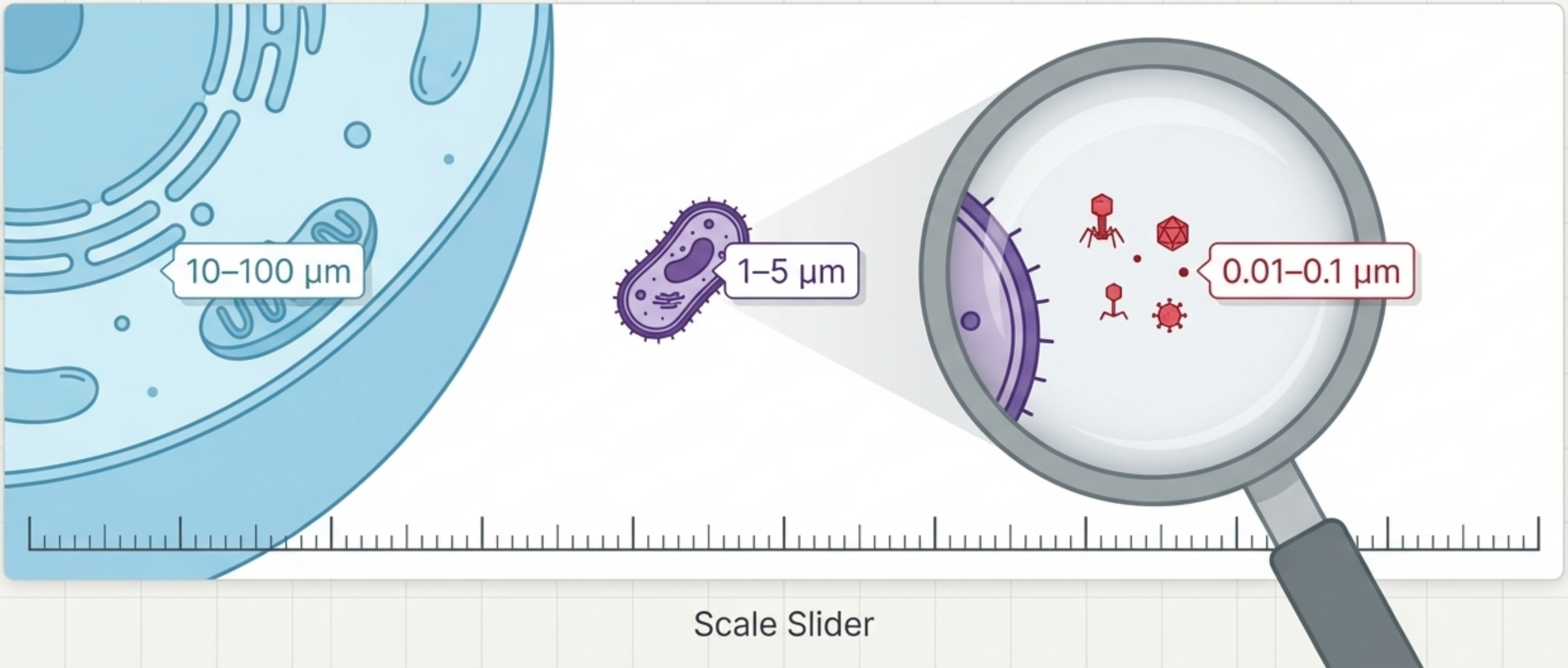
- **Cell Wall:** N/A (Non-cellular)
- **Nucleus:** N/A
- **Metabolism:** NONE
  (Does not feed, respire, or excrete)



Exemplars: Tobacco Mosaic Virus (Plants), HIV, Influenza.

The Microscopic Scale

Visualizing the vast physical discrepancies between eukaryotic cells, prokaryotic cells, and viruses.



Scale Slider

Pathogens: The Invaders

A pathogen is not a taxonomic category, but an ecological role.
Disease-causing agents span across four distinct biological groups.

PATHOGENS
(Disease-Causing Organisms)

Case Study

Viruses

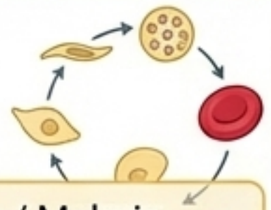
All viruses are parasitic pathogens.

Example: HIV / AIDS

Case Study

Protoctists

Parasitic single cells.



Example: Plasmodium / Malaria

Case Study

Fungi

Specifically targeting tissues.

Example: Athlete's Foot

Case Study

Bacteria

Small minority are pathogenic.

Example: Pneumococcus / Pneumonia