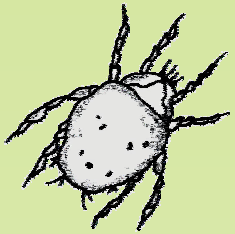
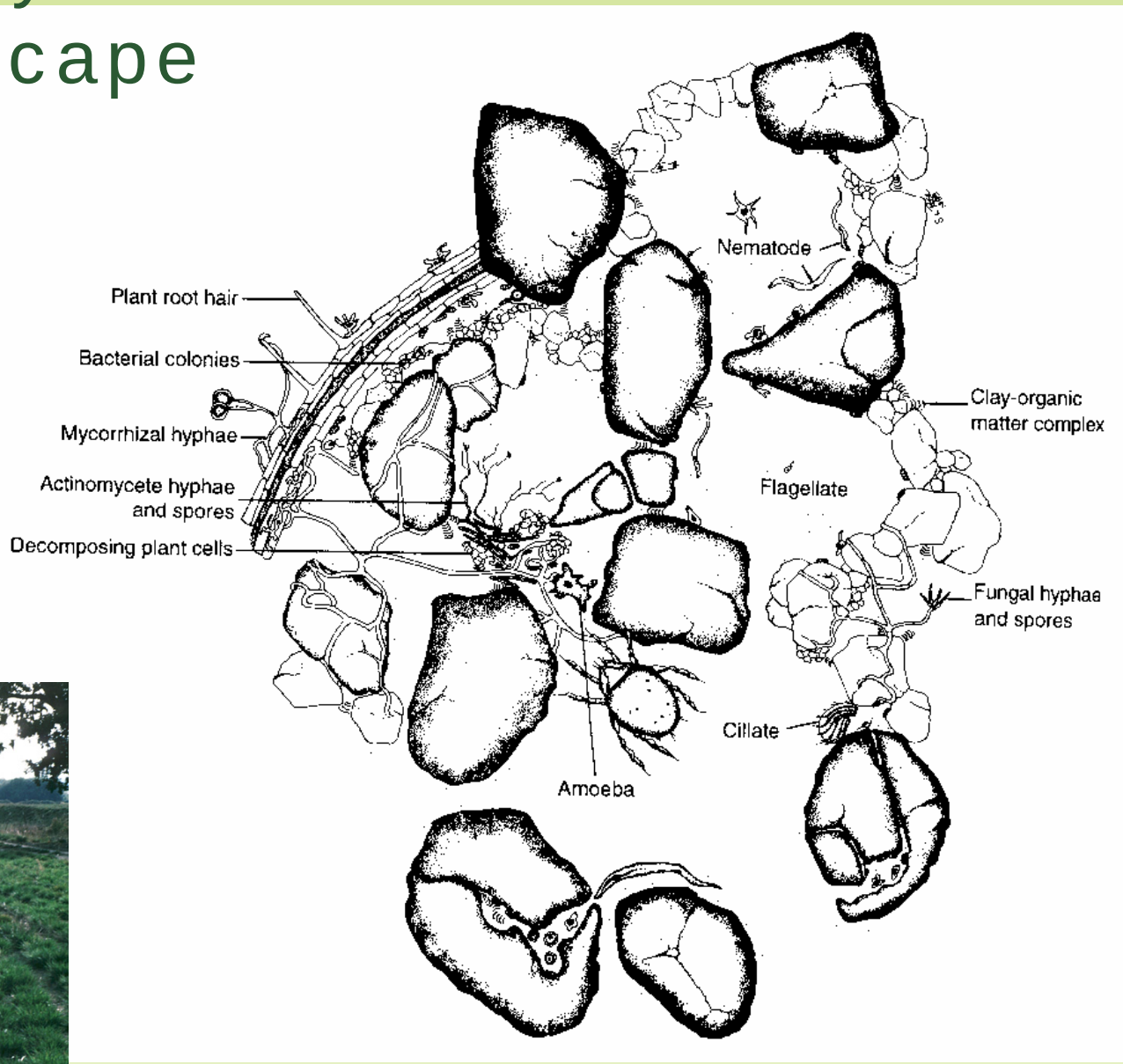
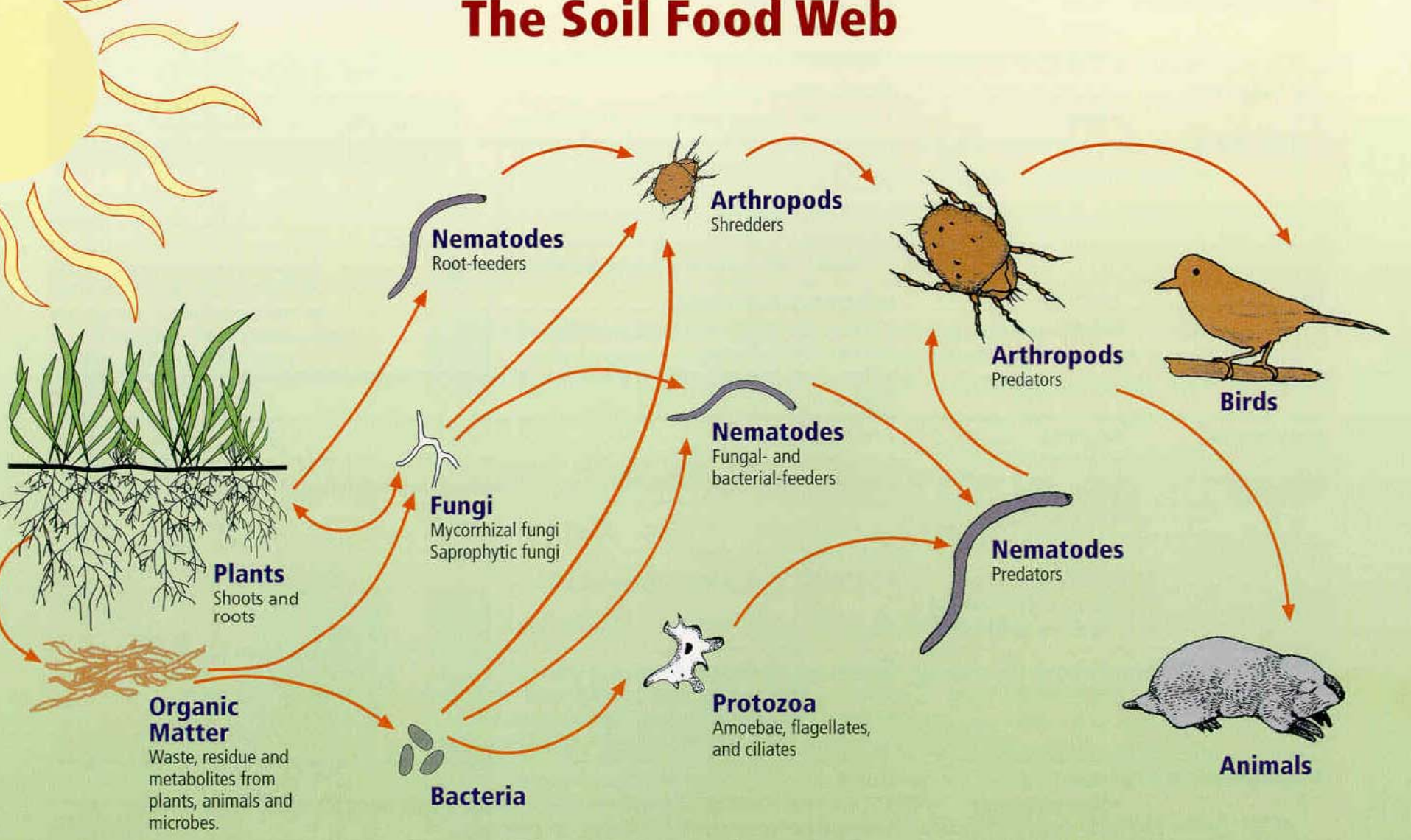


THE SOIL FOOD WEB

Soil Biology and the Landscape



The Soil Food Web



First trophic level:
Photosynthesizers

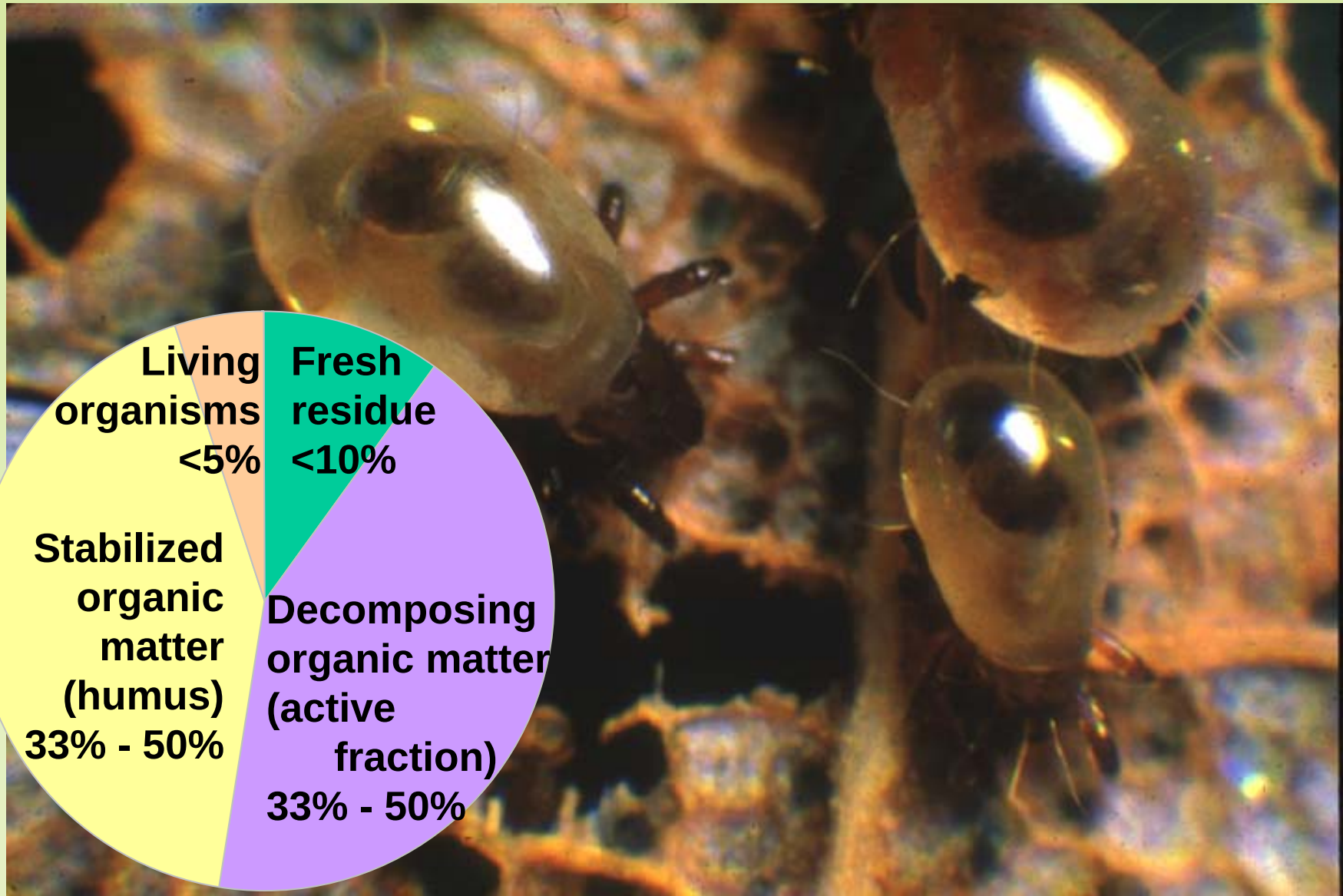
Second trophic level:
Decomposers
Mutualists
Pathogens, parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

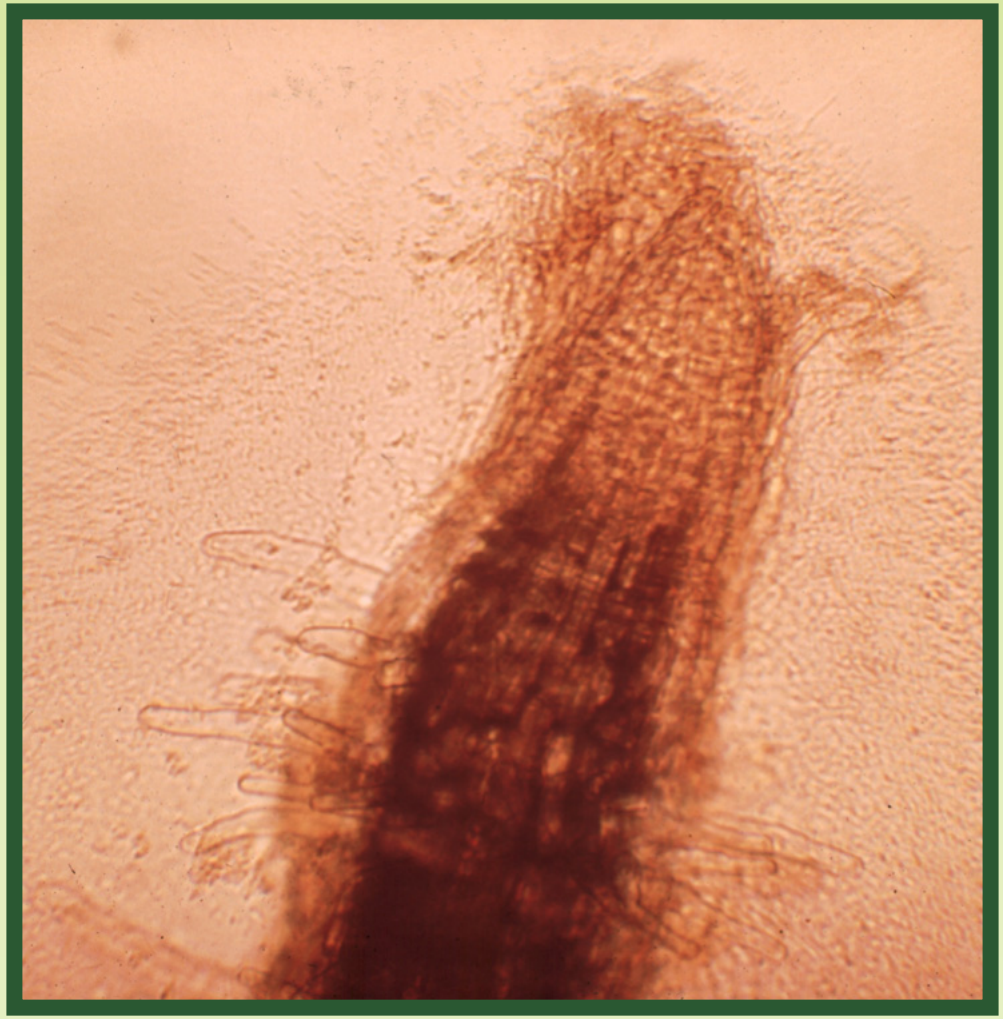
Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators

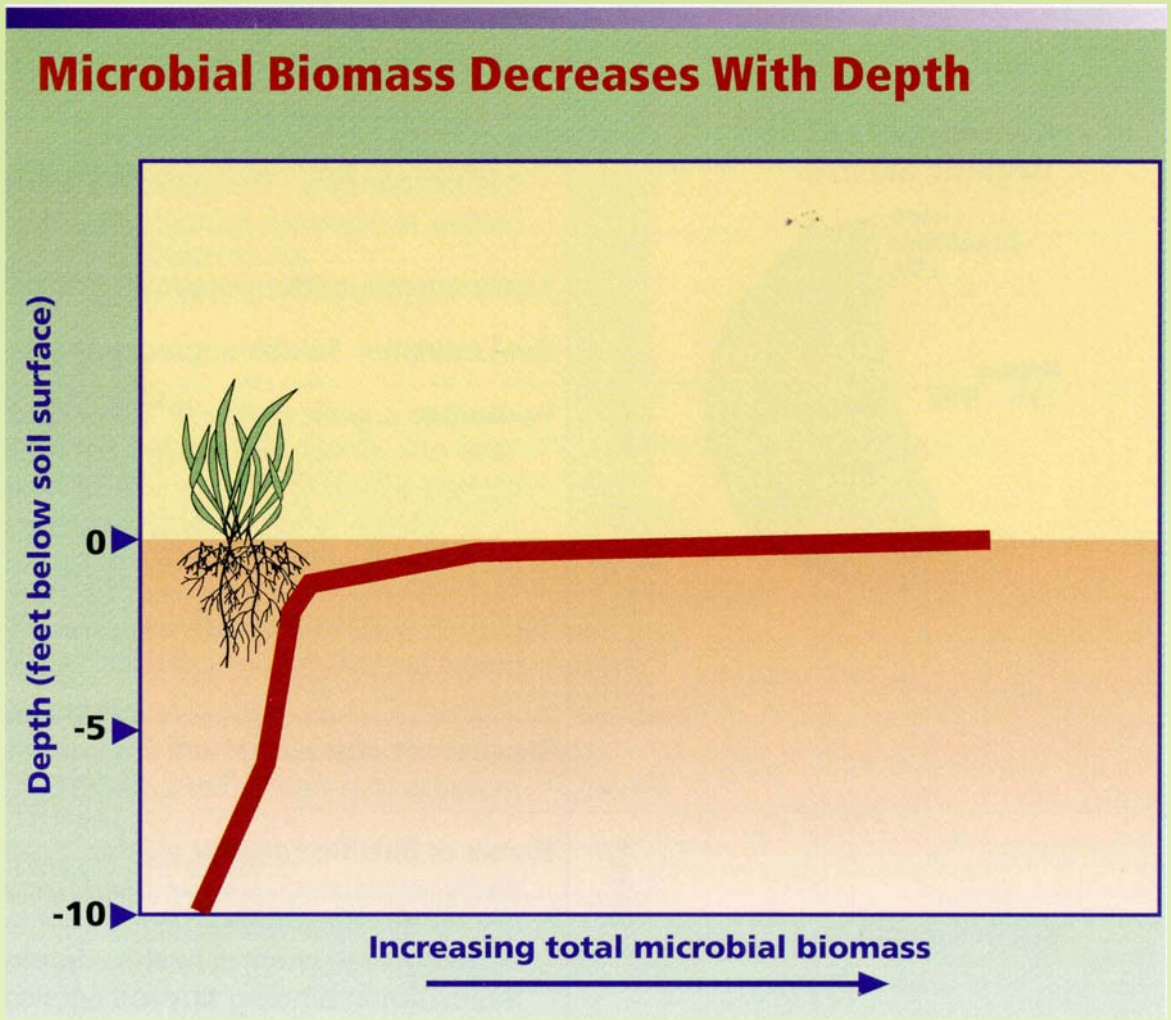
Components of Soil Organic Matter



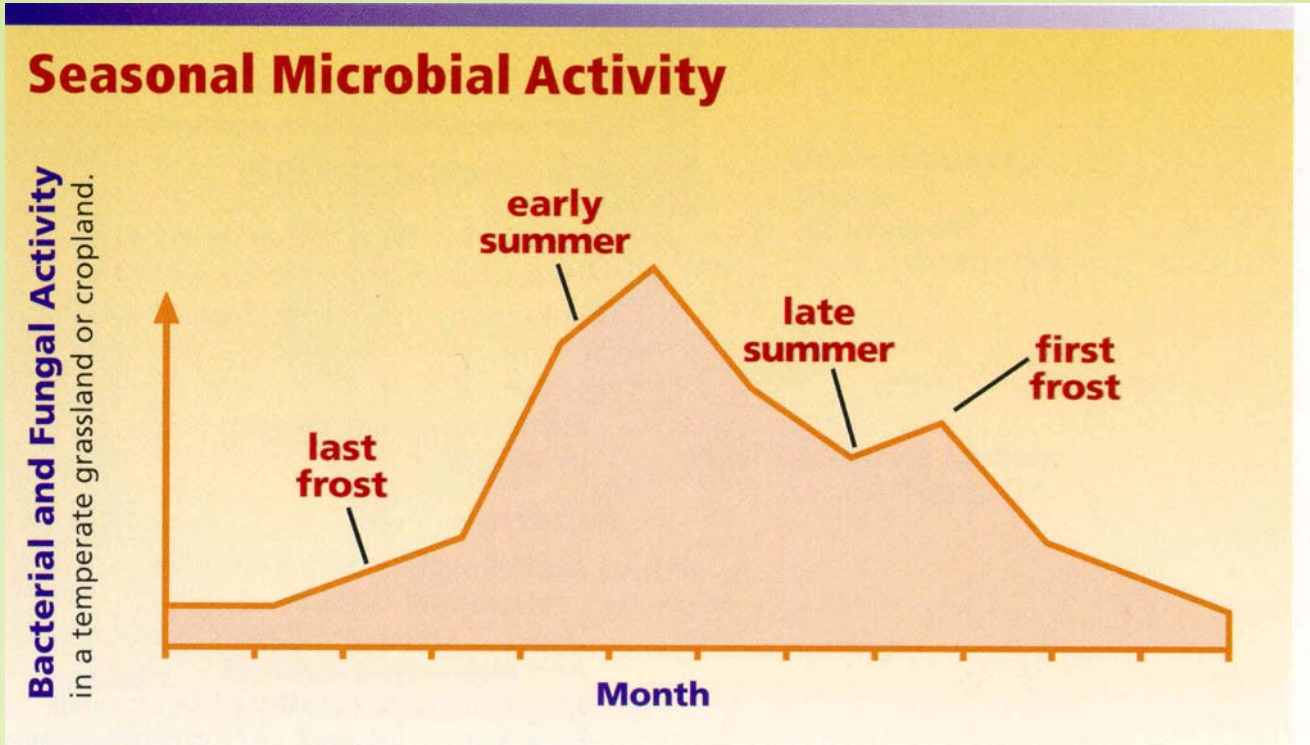
Rhizosphere



Microbial Biomass with Depth

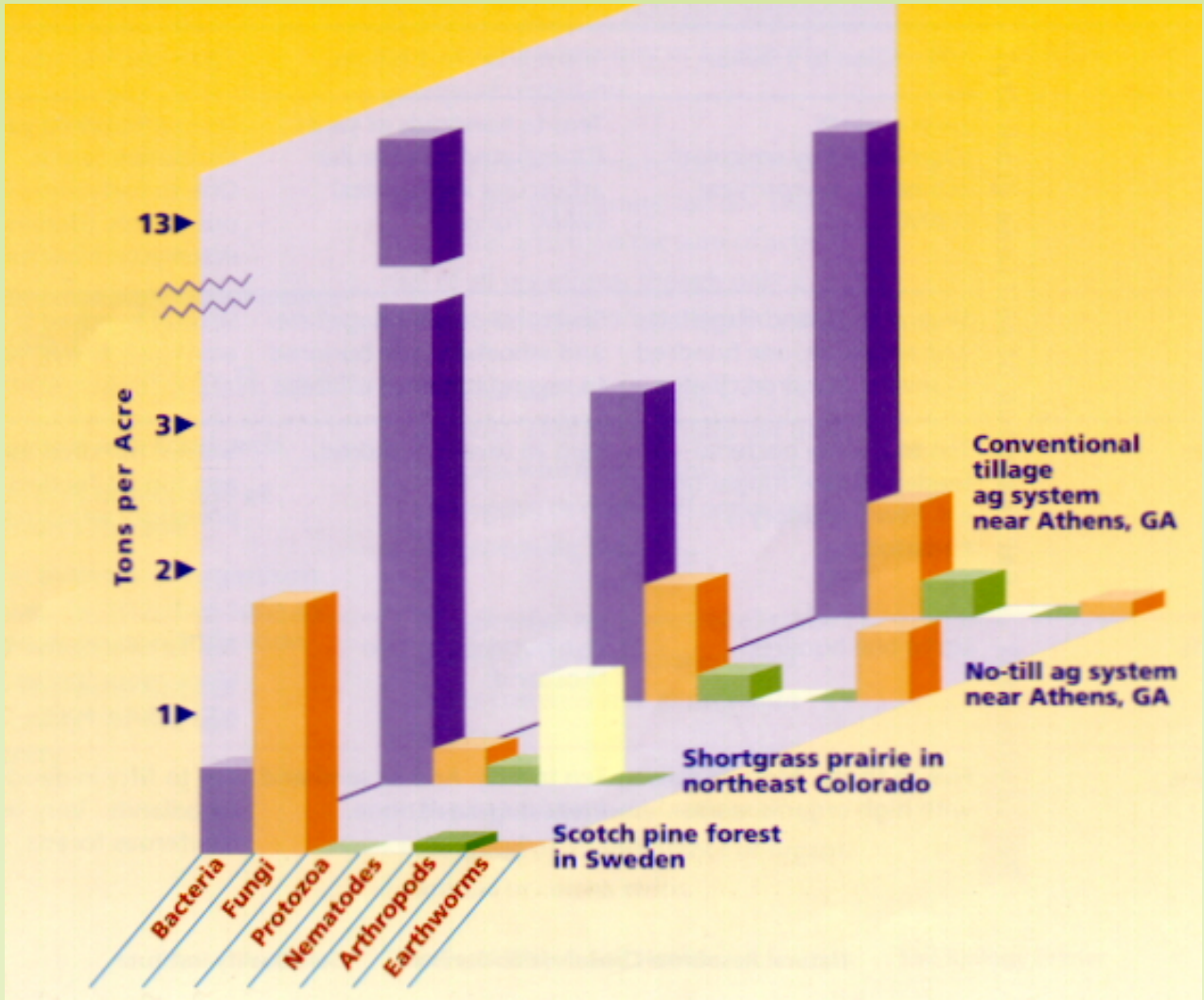


Seasonal Microbial Activity



FOOD WEB & SOIL HEALTH

Biomass of Soil Organisms in Four Ecosystems



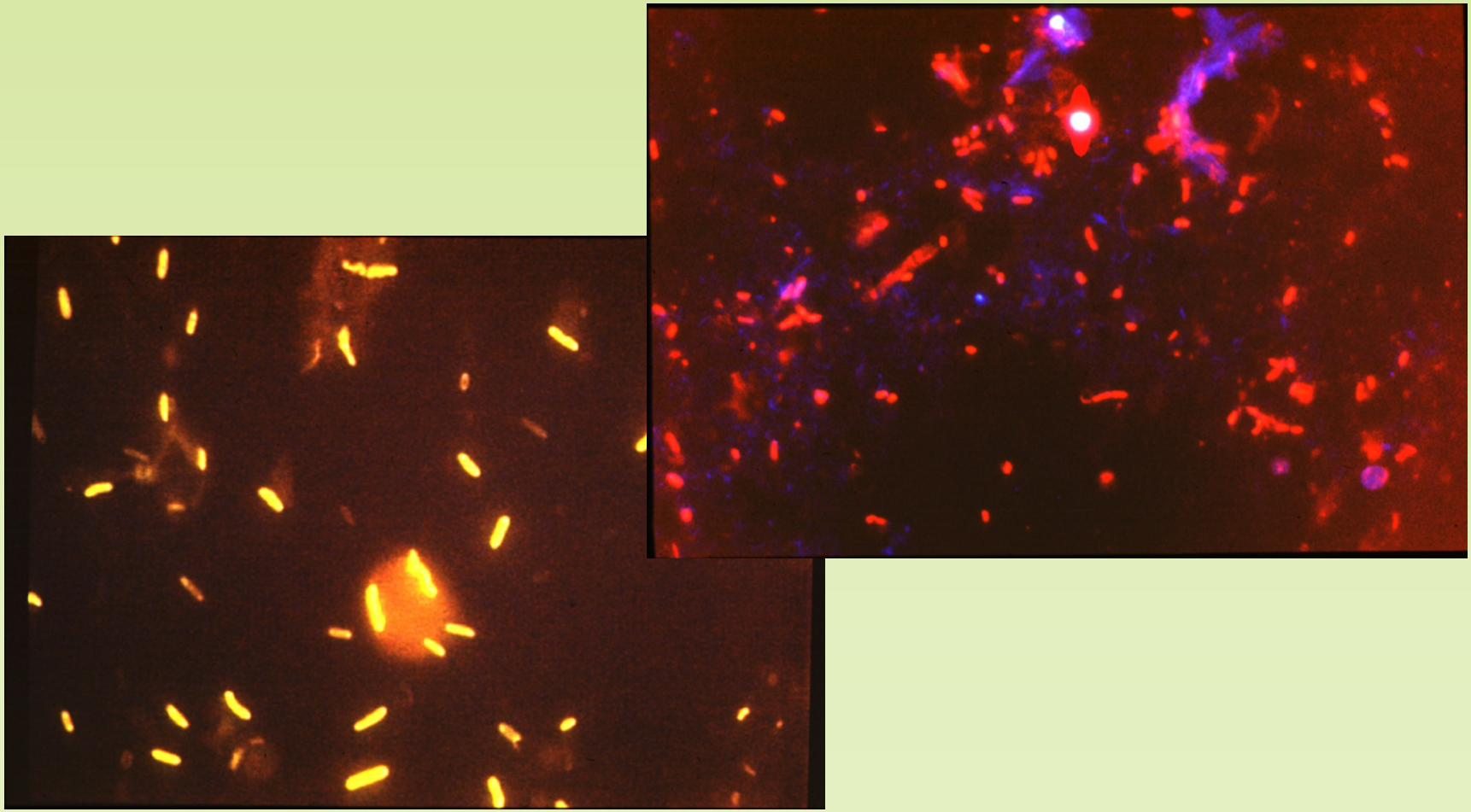
Typical Numbers of Soil Organisms in Healthy Ecosystems

	Ag Land	Prairie	Forest
	Organisms per gram (teaspoon) of soil		
Bacteria	**100 mil. -1 bil.**	**100 mil. -1 bil.**	**100 mil. -1 bil.**
Fungi	**Several yards**	**10s – 100's of yds**	**1-40 miles (in conifers)**
Protozoa	**1000's**	**1000's**	**100,000's**
Nematodes	**10-20**	**10's – 100's**	**100's**
	Organisms per square foot		
Arthropods	**< 100**	**500-2000**	**10,000-25,000**
Earthworms	**5-30**	**10-50**	**10-50 (0 in conifers)**

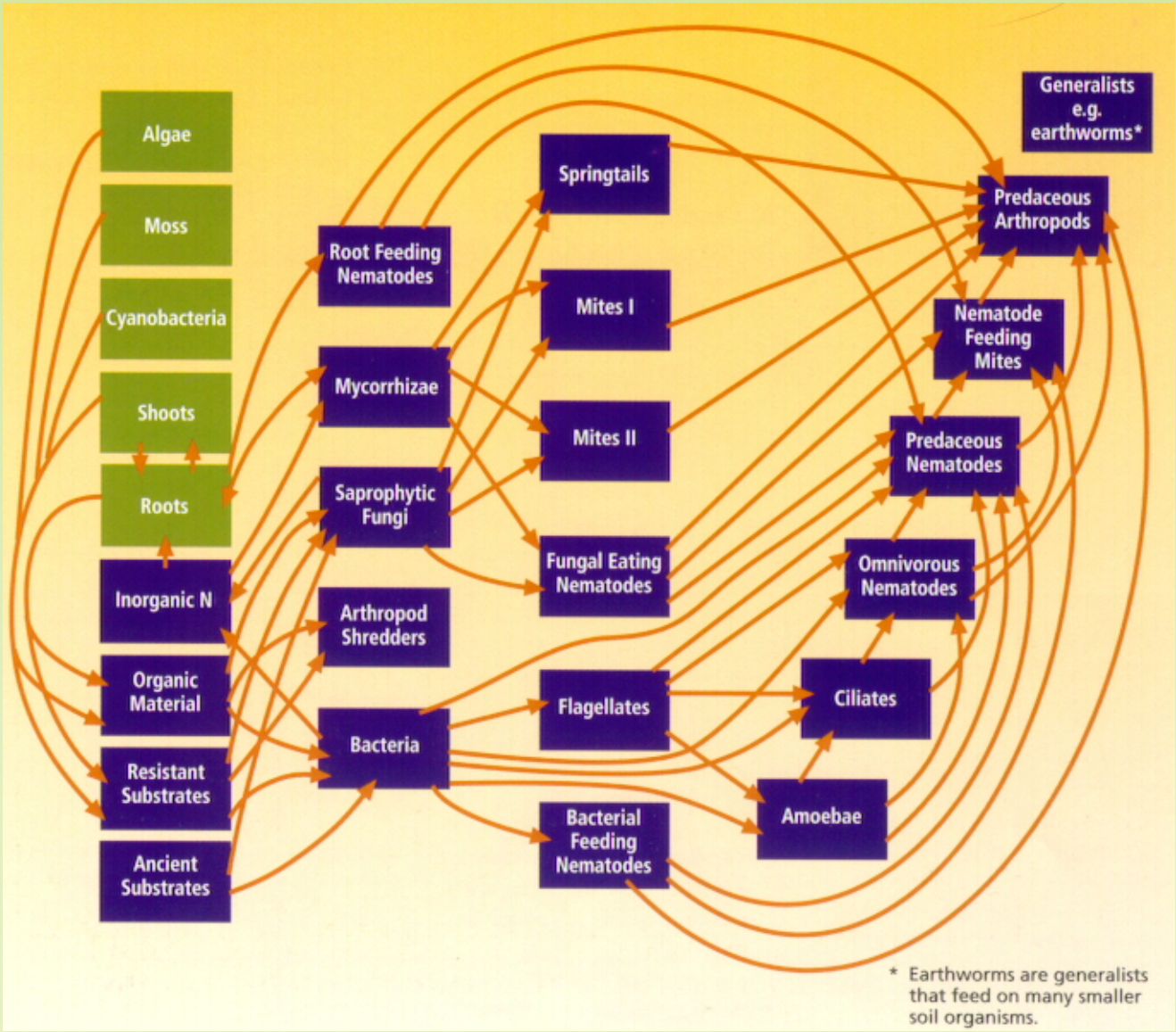
Methods for Measuring the Food Web

Counting	•Direct counts of individuals
	•Plate counts of colonies
Activity levels	•Respiration (CO_2 production)
	•Nitrification rates
	•Decomposition rates
Cellular constituents	•Biomass C, N, or P
	•Enzymes
	•Phospholipids
	•DNA and RNA

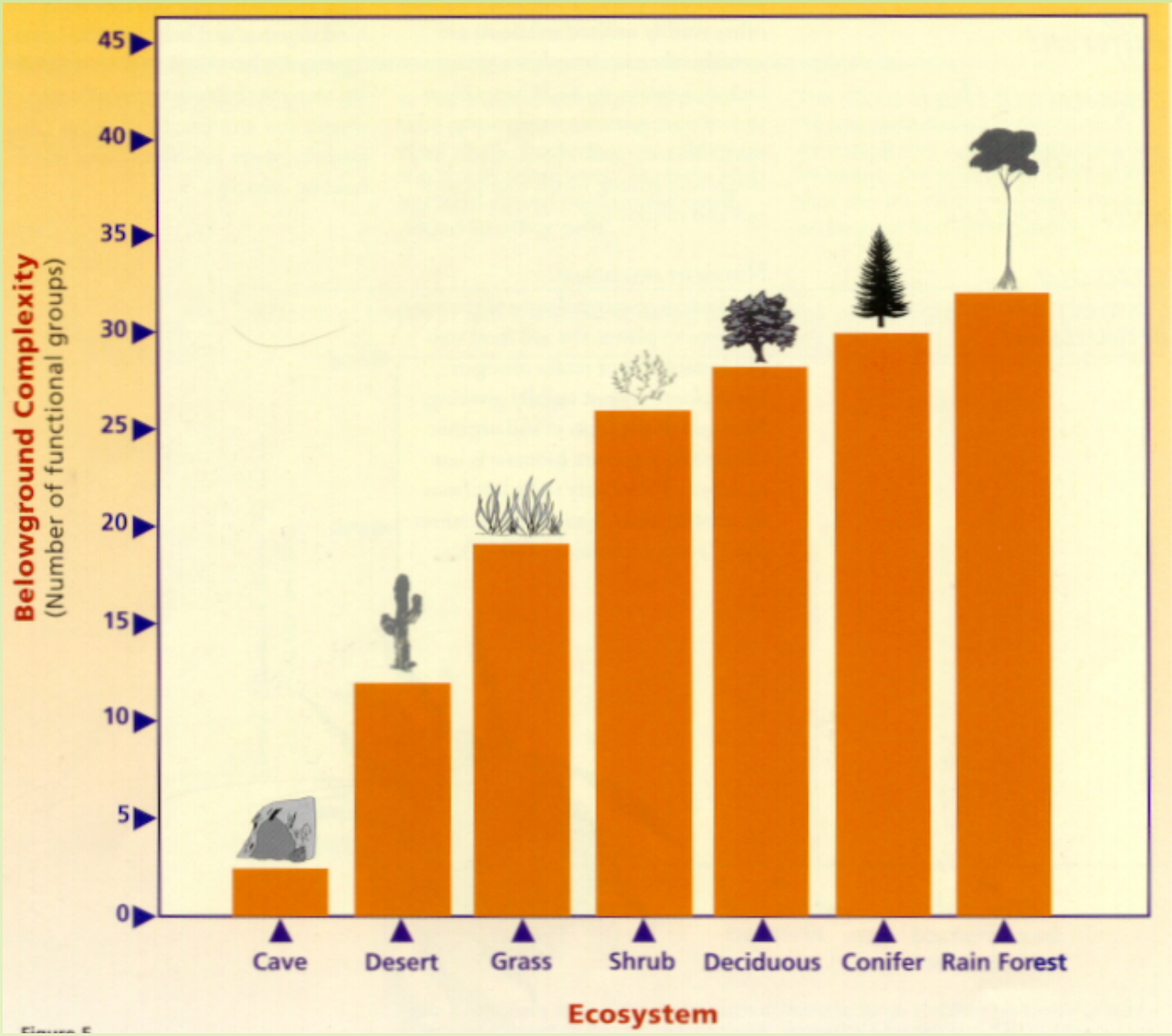
Bacteria with fluorescent stain for counting



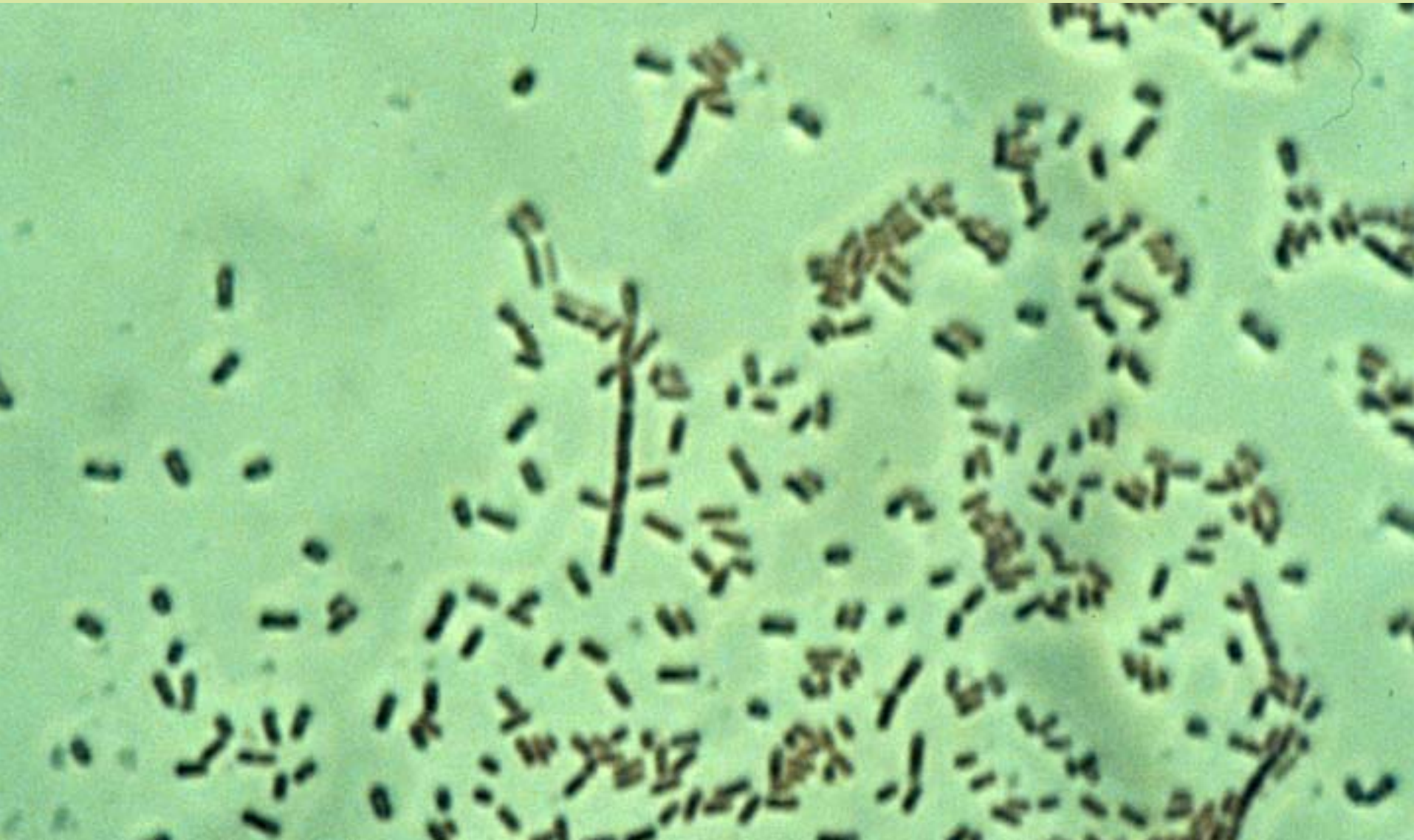
A Complex Food Web



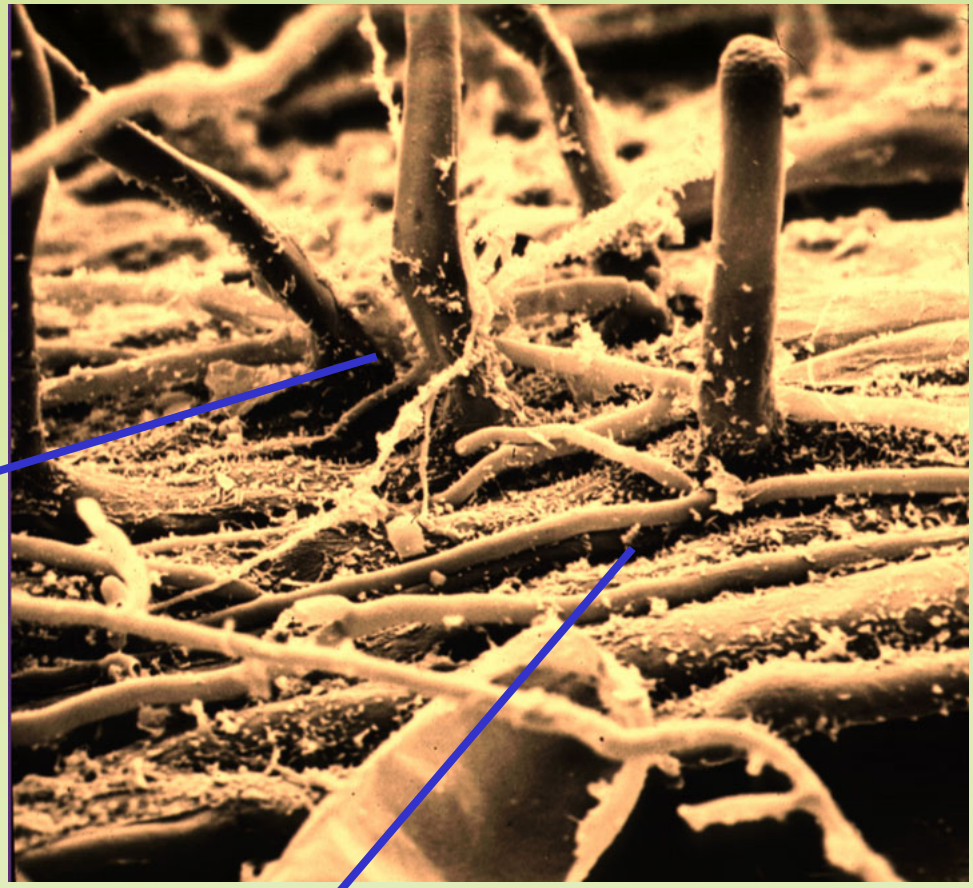
Complexity of the Soil Food Web in Several Ecosystems

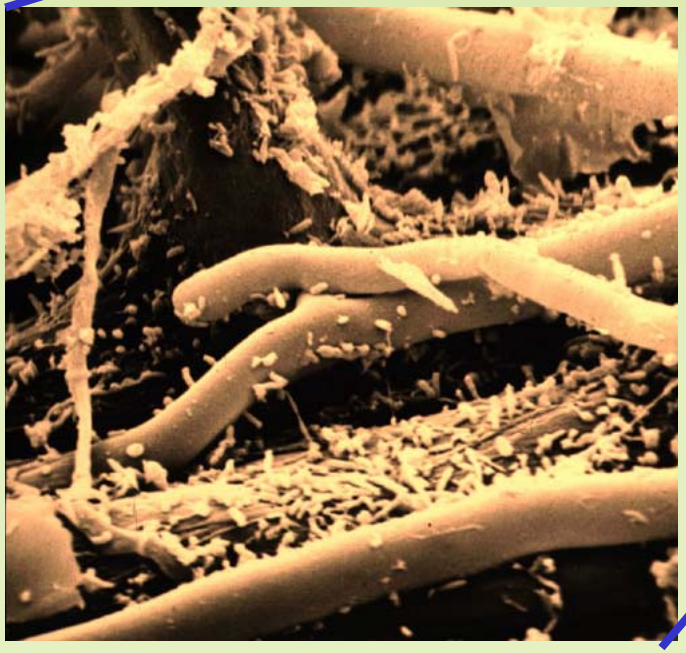


BACTERIA



Bacteria

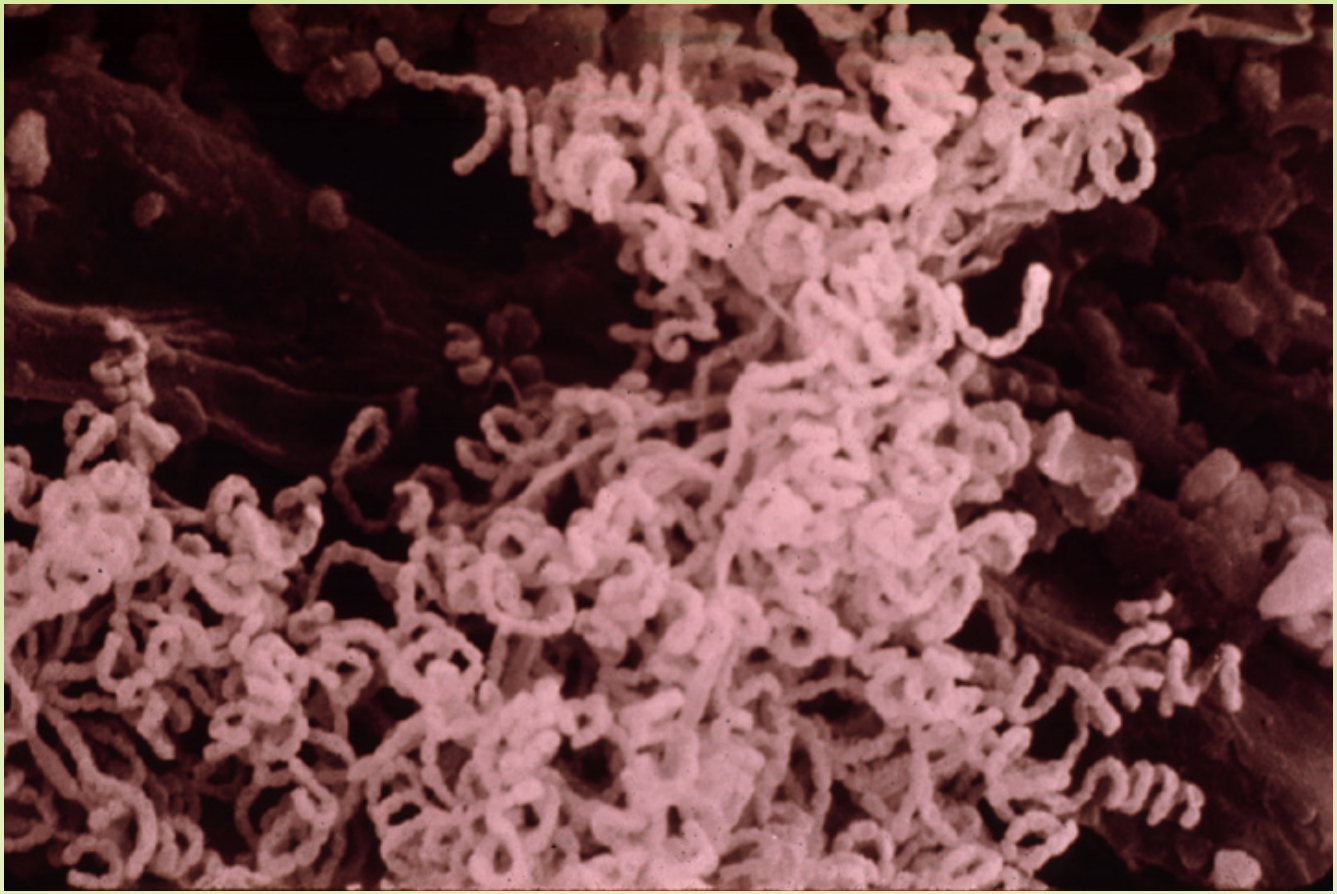




Nitrogen-fixing Bacteria

Nodules formed where *Rhizobium* bacteria infected soybean roots.

Actinomycetes

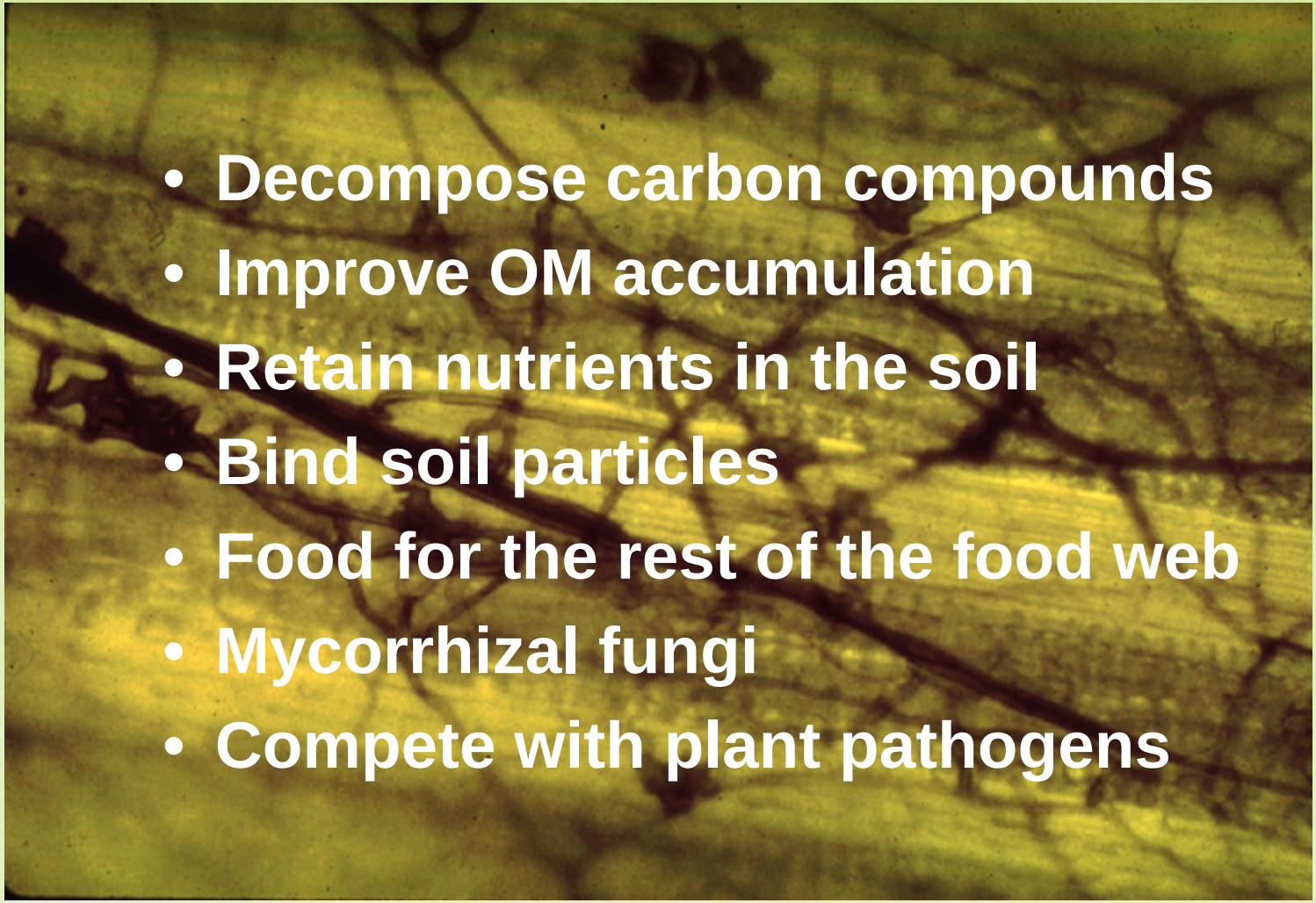


Bacterial cells that grow like fungal hyphae

Bacteria vs. fungi

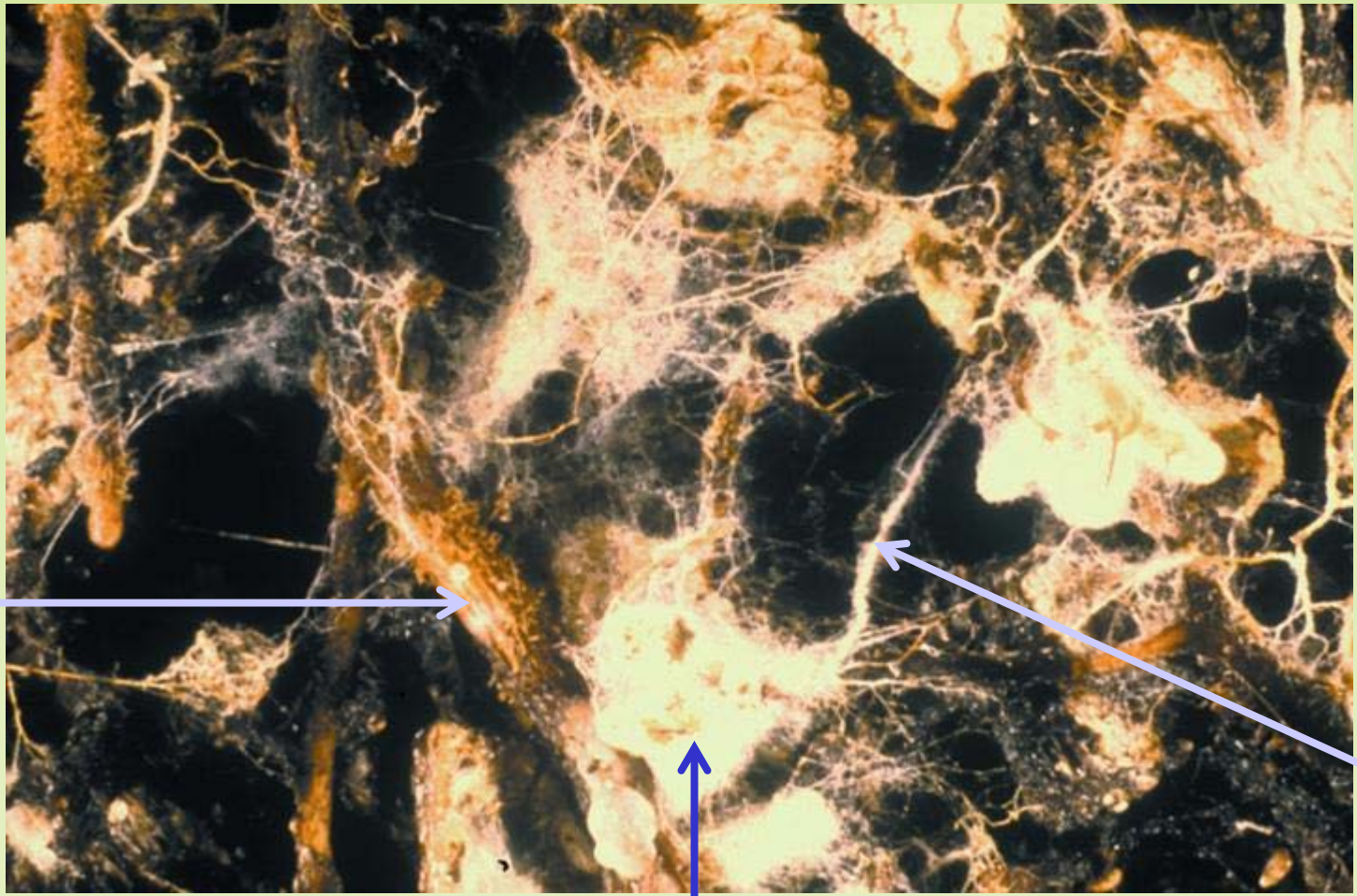
FUNGI

Fungi and Soil Quality



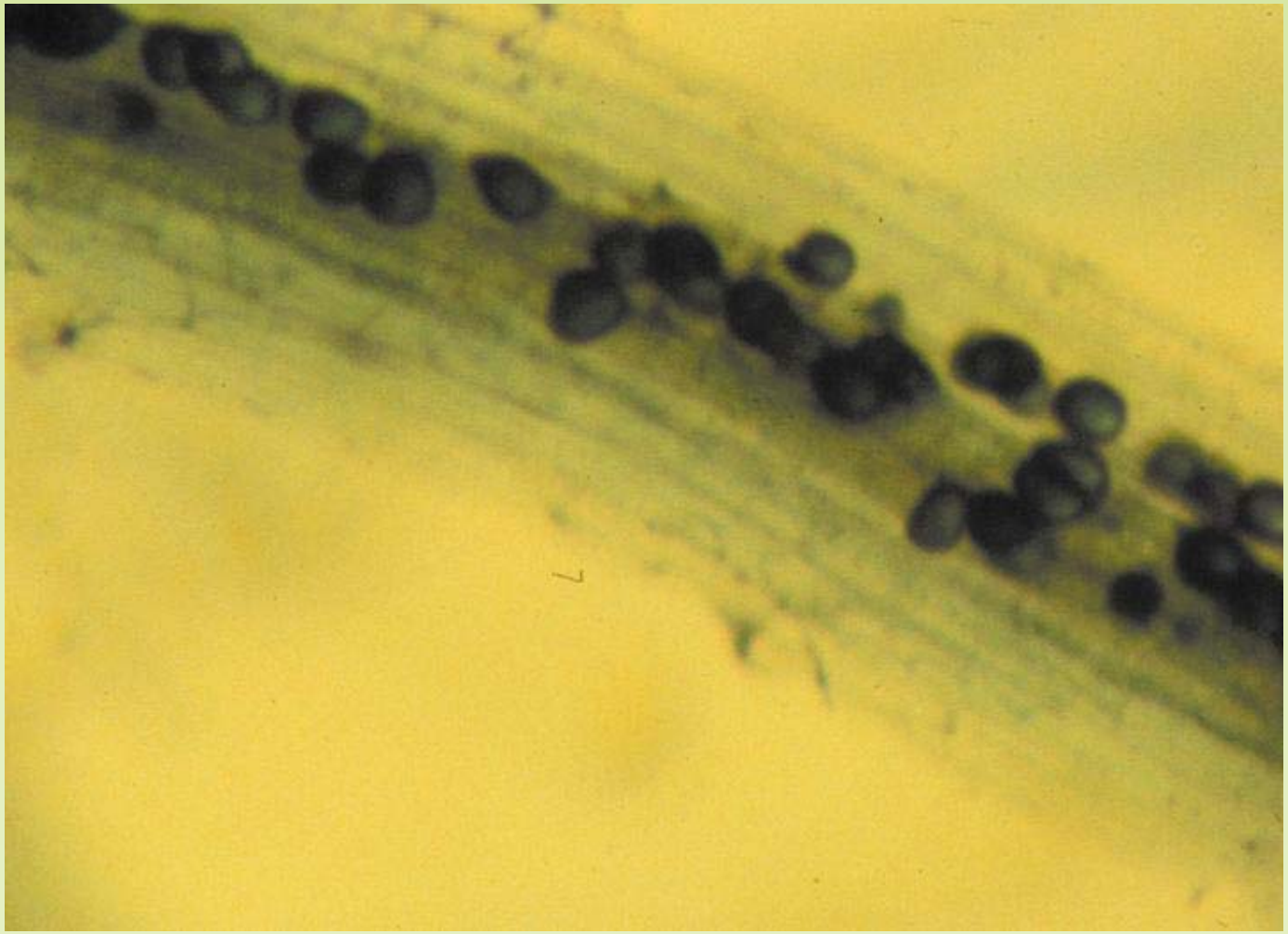
- **Decompose carbon compounds**
- **Improve OM accumulation**
- **Retain nutrients in the soil**
- **Bind soil particles**
- **Food for the rest of the food web**
- **Mycorrhizal fungi**
- **Compete with plant pathogens**

Mycorrhizae



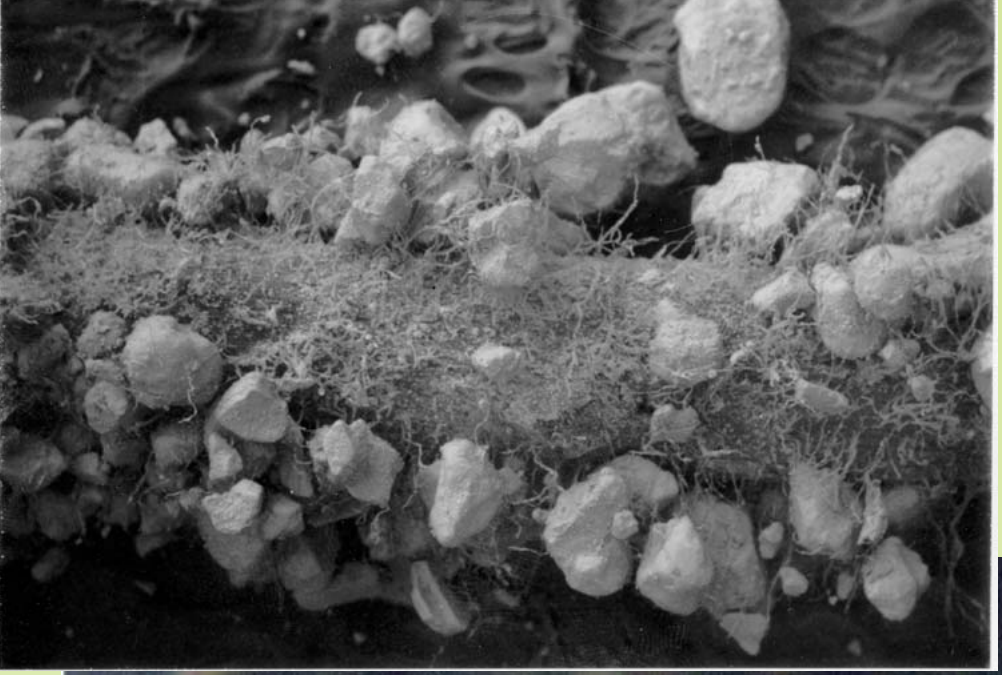
Ectomycorrhizae

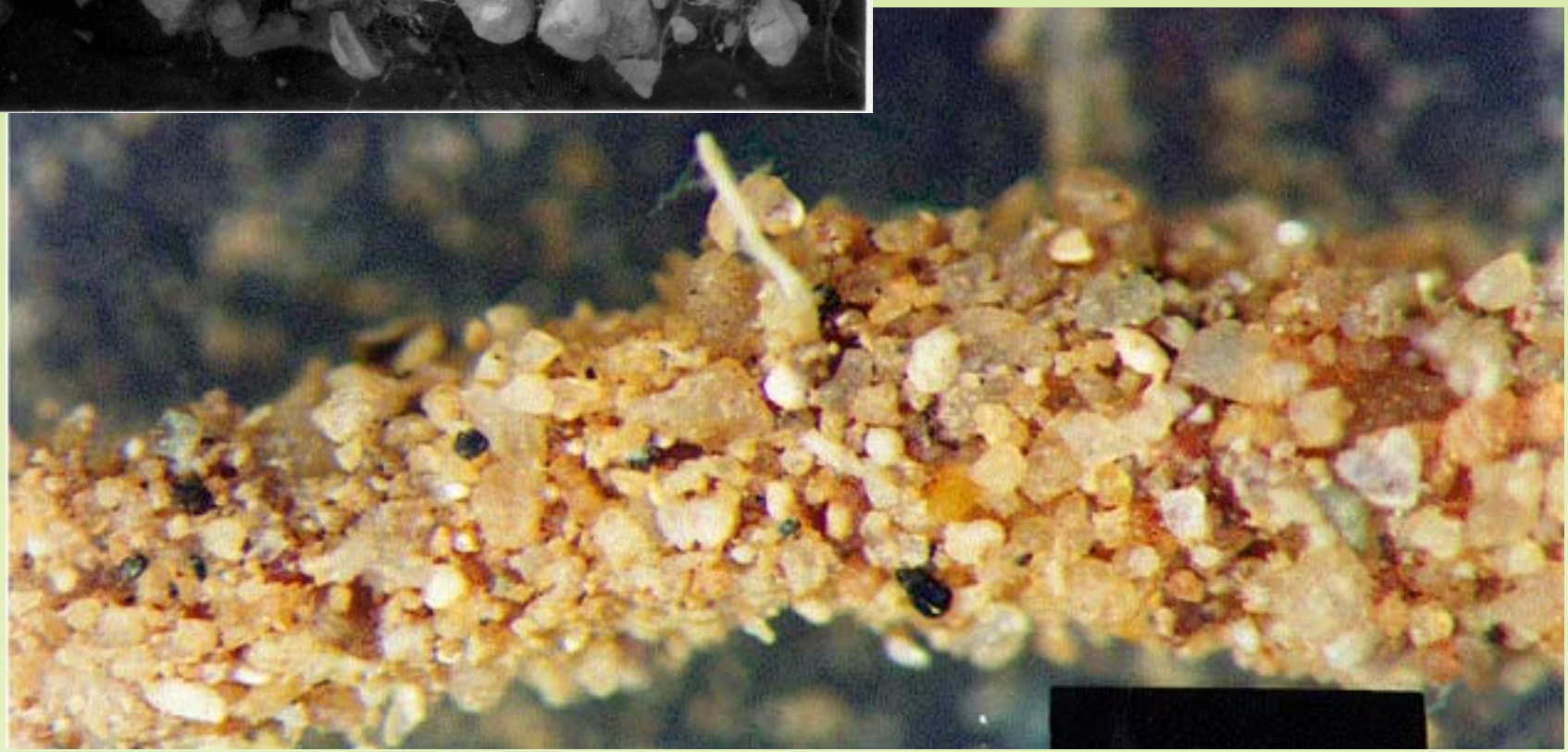
Arbuscular Mycorrhizae (AM)



Mushrooms:
The fruiting body of some fungi

Mycorrhizal Fungi





PROTOZOA

Ciliates

- Largest of the three types
- Move by means of hair-like cilia
- Eat the other protozoa and bacteria

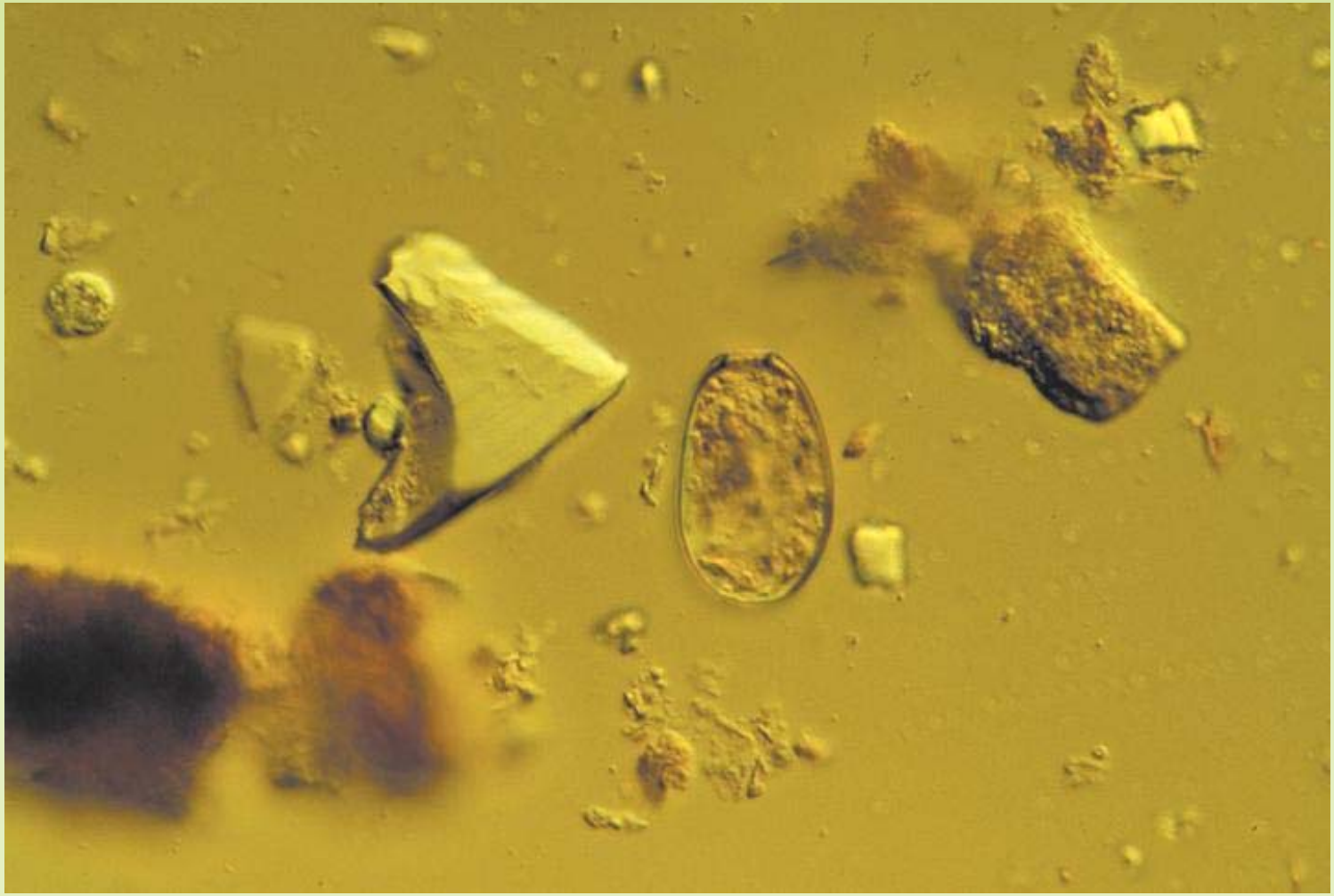
Amoebae

- Also large
- Move by means of a temporary foot (pseudopod)
- Include testate amoebae (with shell-like covering), and naked amoebae

Flagellates

- Smallest of the three
- Move by means of a few whip-like flagella.

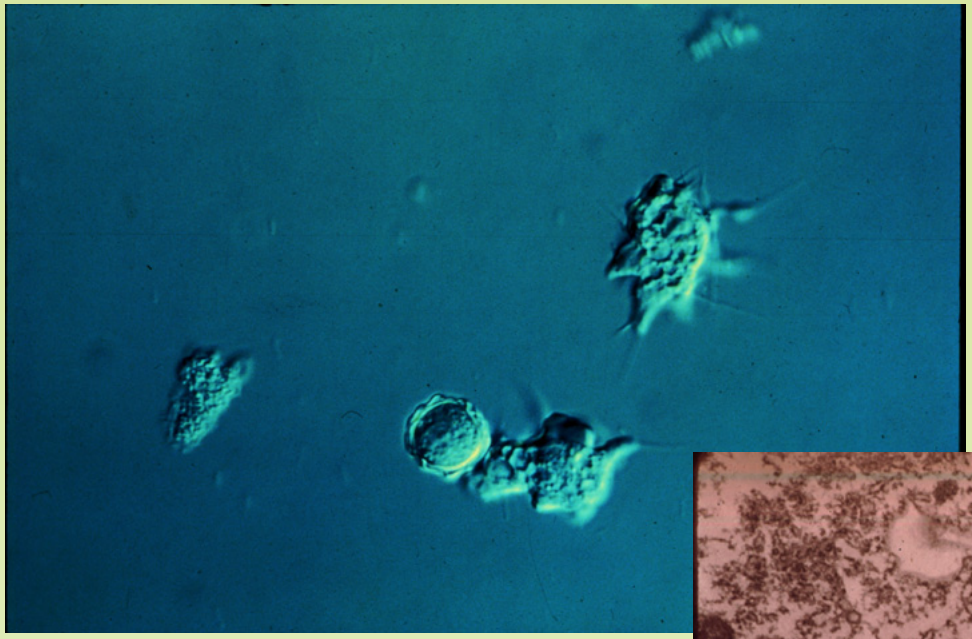
PROTOZOA

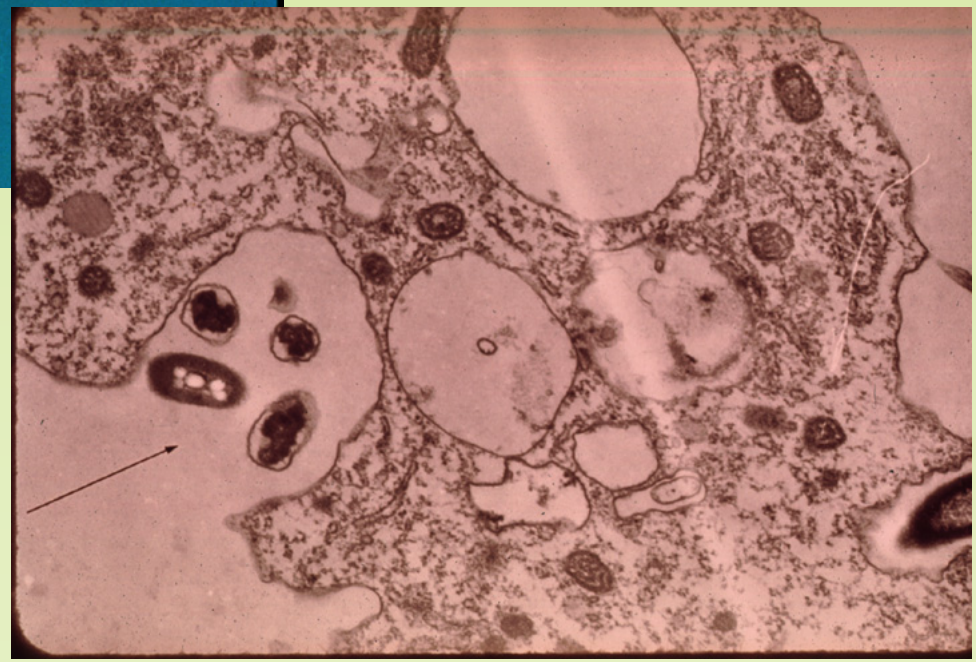


Flagellate

Ciliate

Amoebae

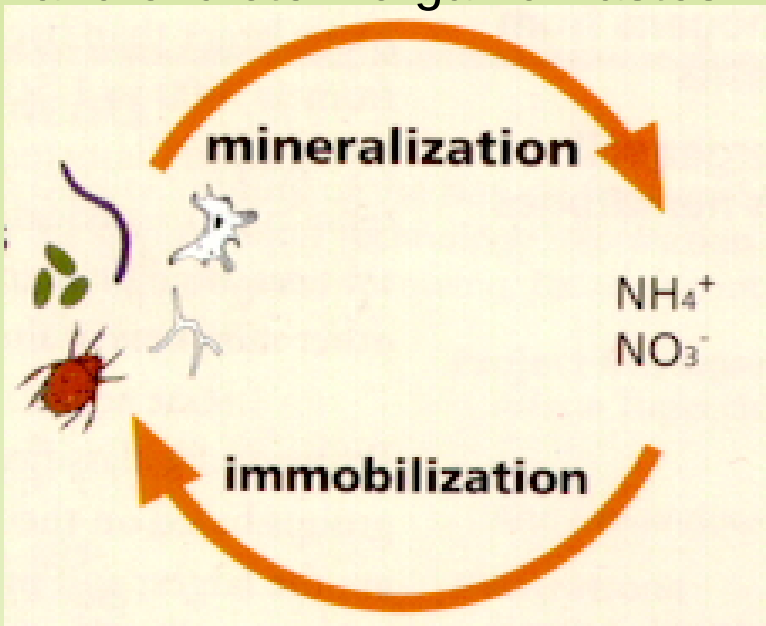




Mineralization and Immobilization

Organisms consume other organisms and excrete inorganic wastes.

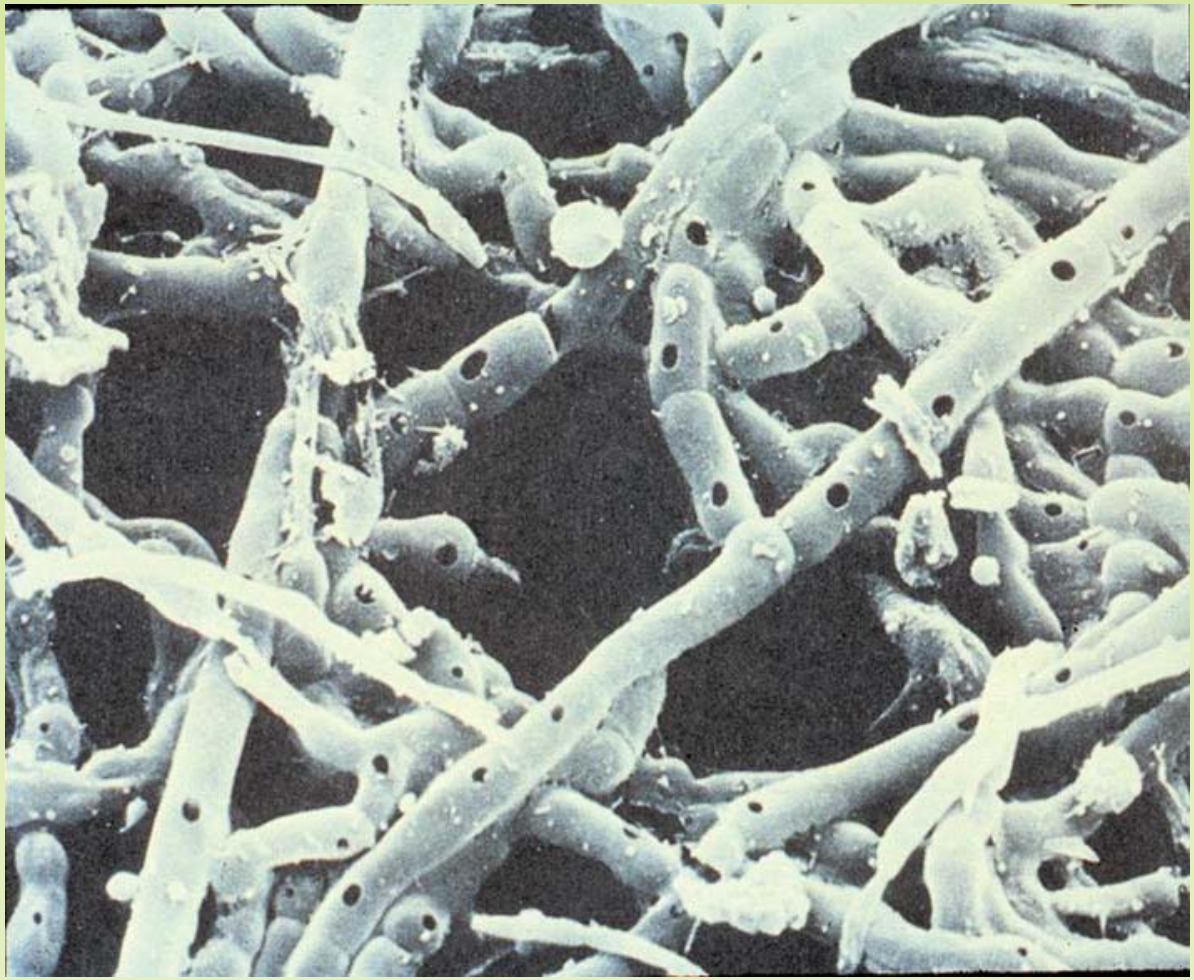
Organic nutrients are stored in soil organisms and organic matter.



Inorganic nutrients are usable by plants, and are mobile in soil.

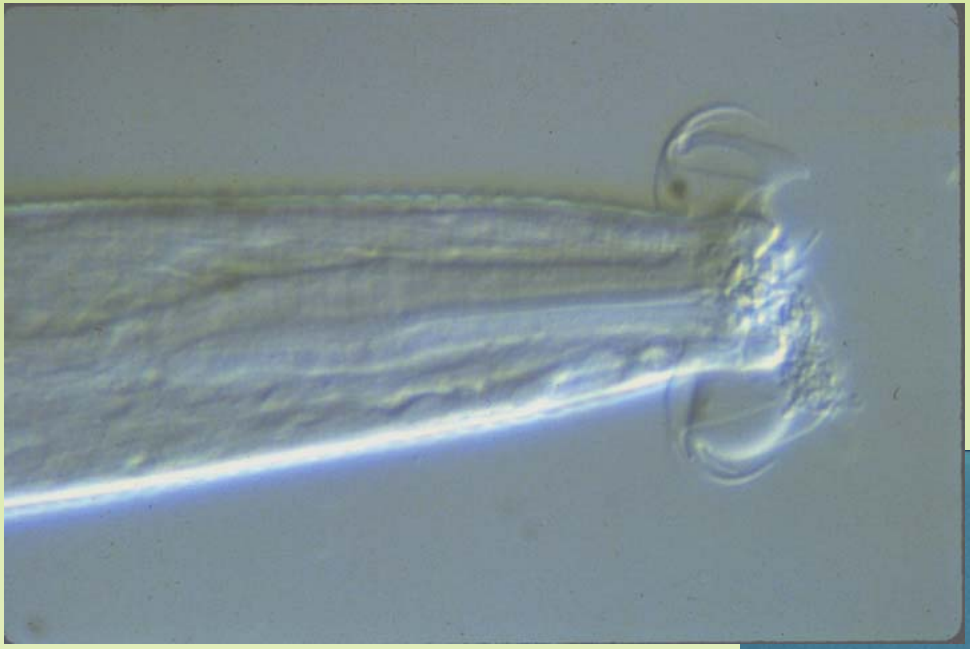
Organisms take up and retain nutrients as they grow.

Soil-Dwelling “Vampires”

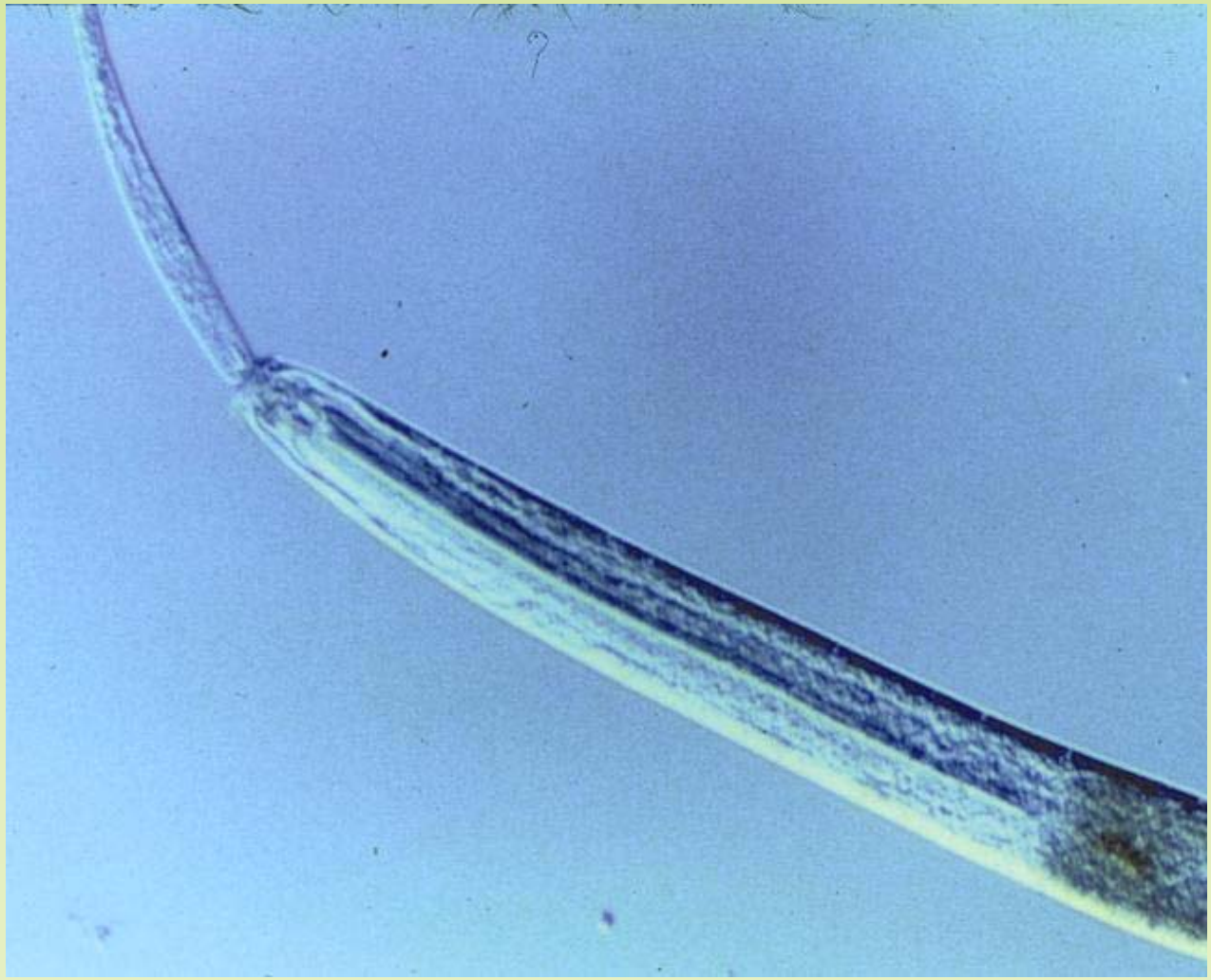


NEMATODES

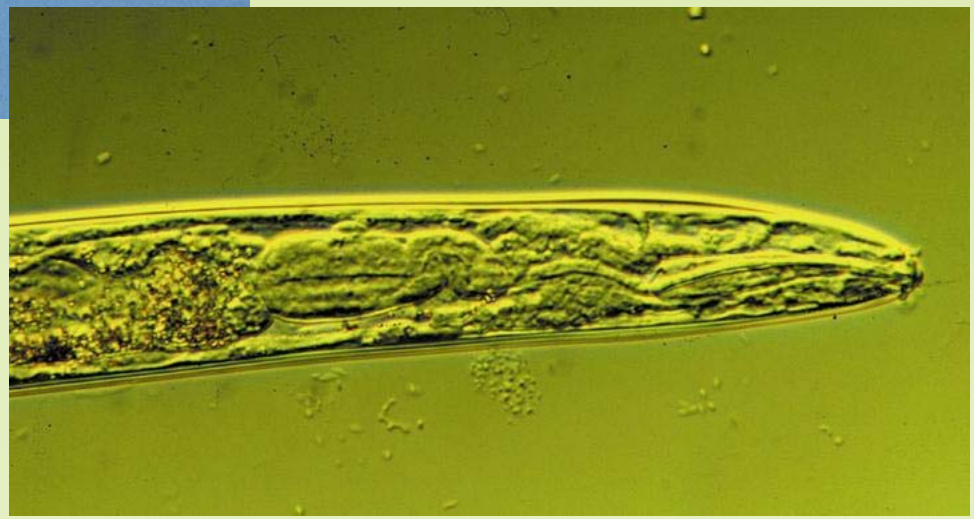
NEMATODES



Predatory Nematode

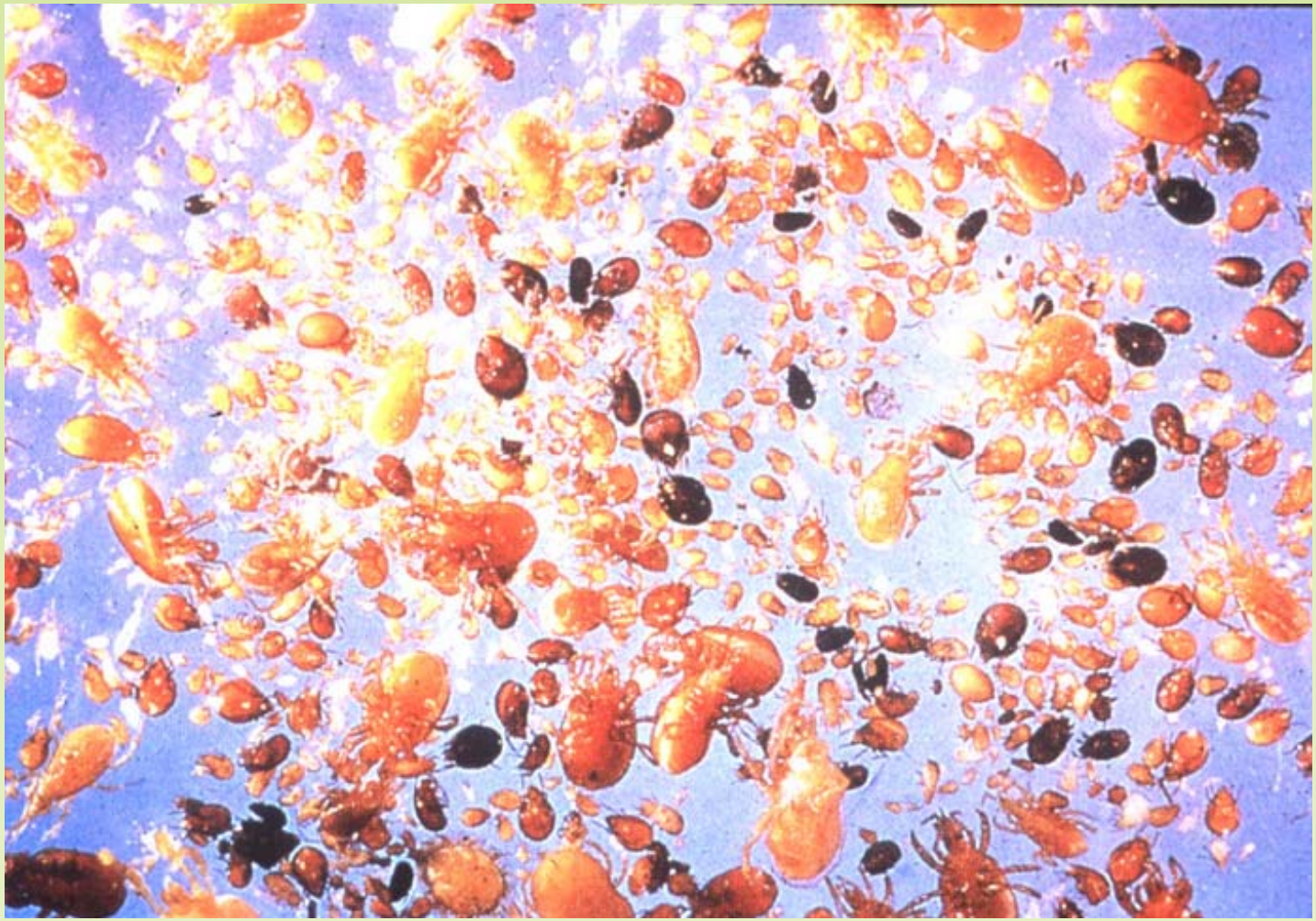


Root-feeding nematodes



ARTHROPODS

Mites and Biodiversity



Types of Arthropods

Shredders

Predators

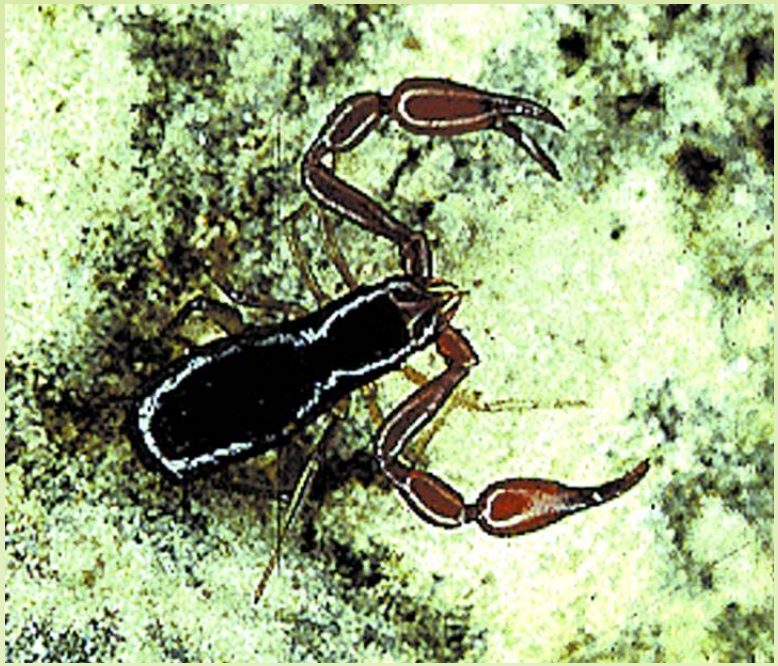
Herbivores

Fungal-feeders

Shredders:
millipedes

Predators (1)

Predators (2): Pseudoscorpions



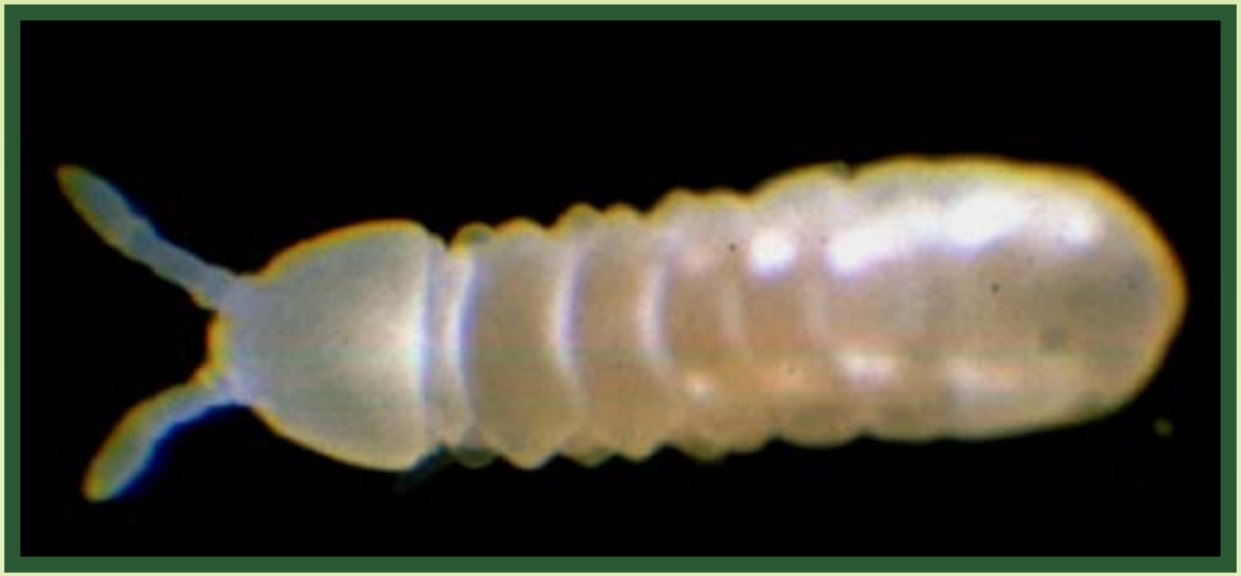
Predators (4): Centipedes

Predators (5)

Herbivores

Springtails (fungal feeders)

- Abundant in many soils.
- Feed on some disease-causing fungi.
- Jump by slamming their tail down.



What is in Your Soil?

Berlese funnel

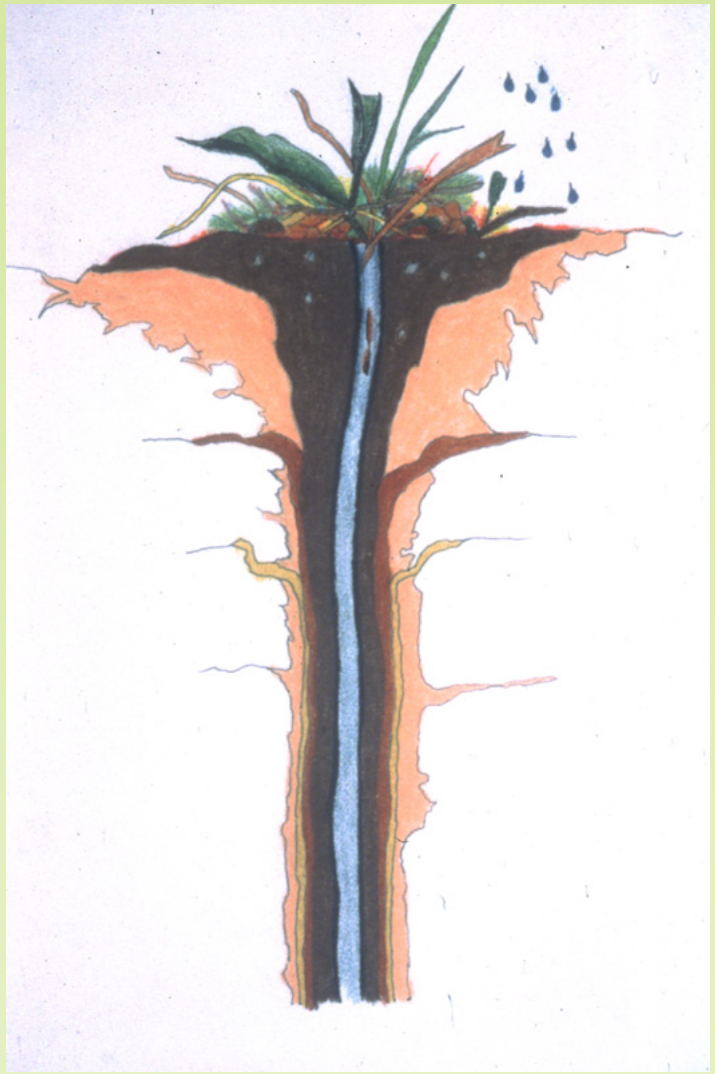
Pitfall trap

EARTHWORMS

Earthworms bury litter

Earthworm burrow

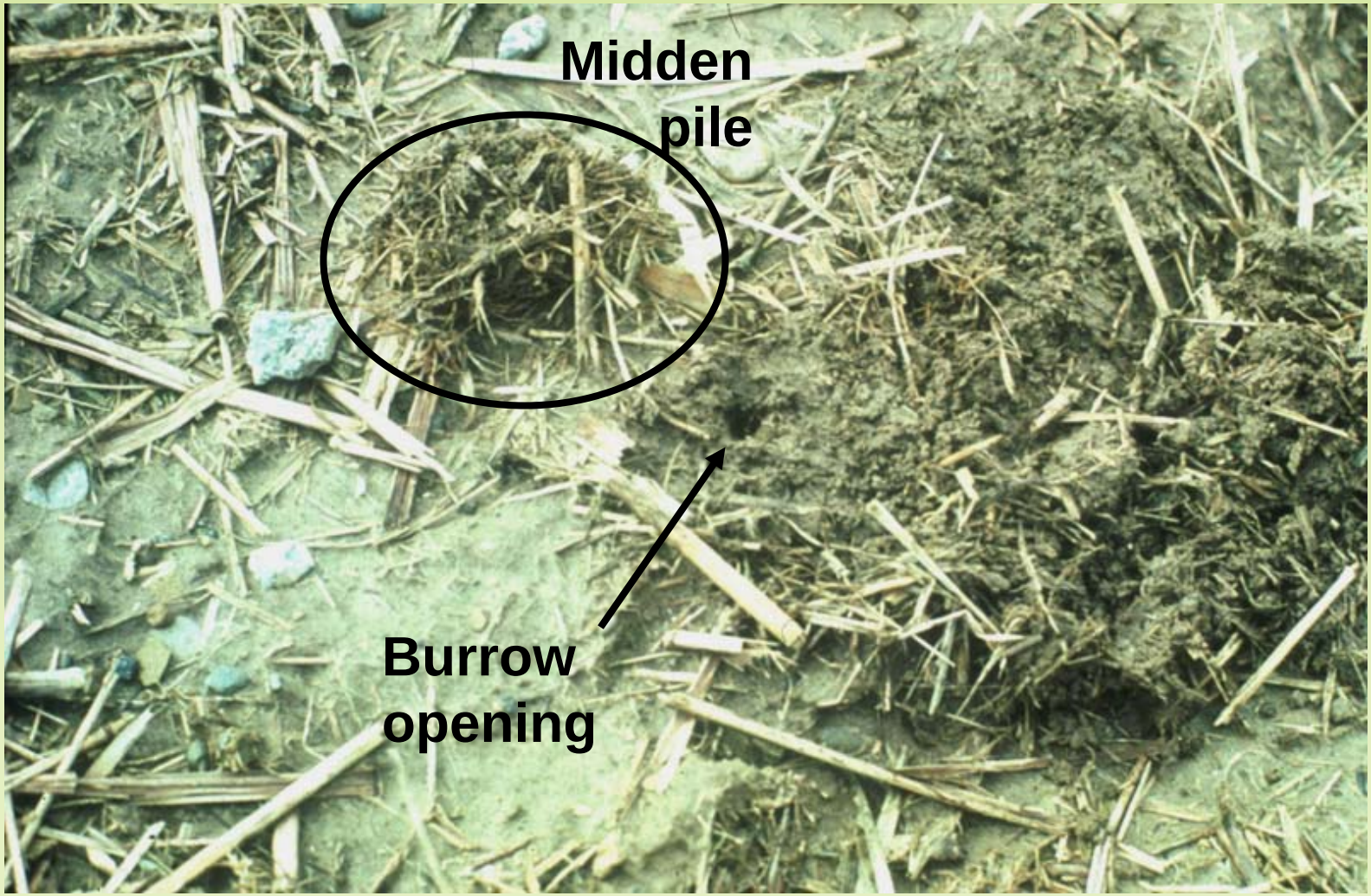
Vertical burrows



Earthworm casts

Earthworm burrow opening

Earthworm burrow opening



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