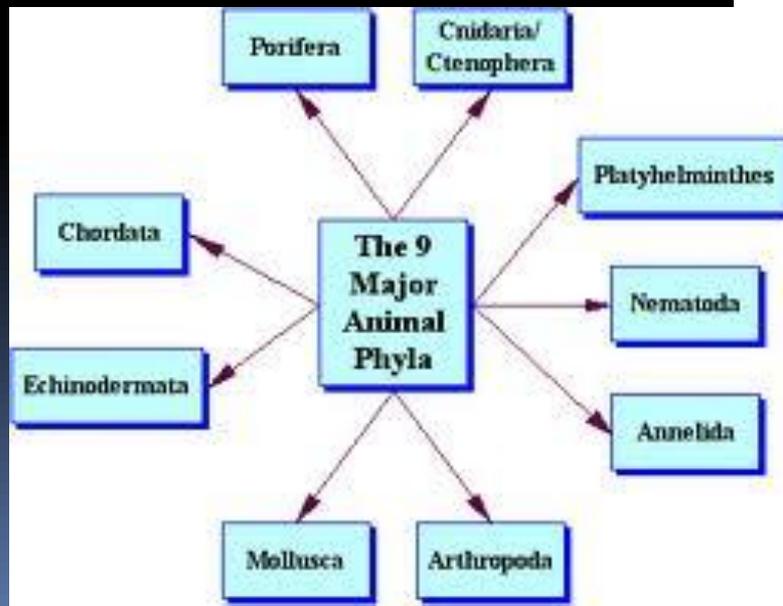
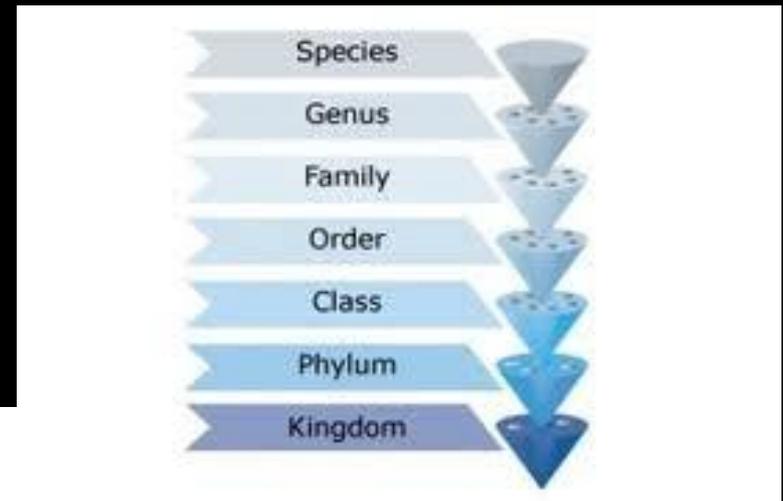
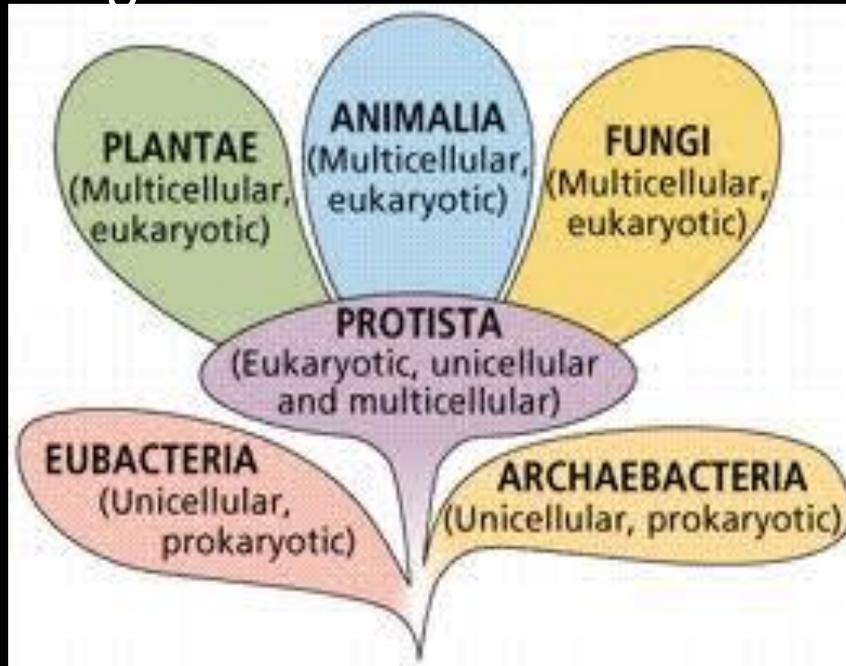


مجاميع احياء التربة:

**PROFESSOR DR. IDHAM ALI ABED
COLLAGE OF AGRICULTURE
UNIVERSITY OF ANBAR**

Kingdoms of life

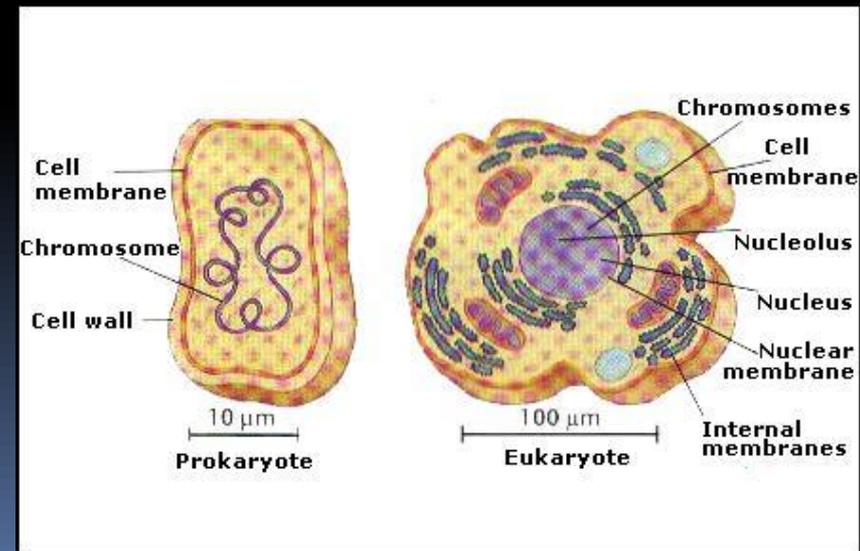


- Eukaryotes have cell membranes and nuclei

□ All species of large complex organisms are eukaryotes, including animals, plants and fungi, although most species of eukaryotic protists are microorganisms.

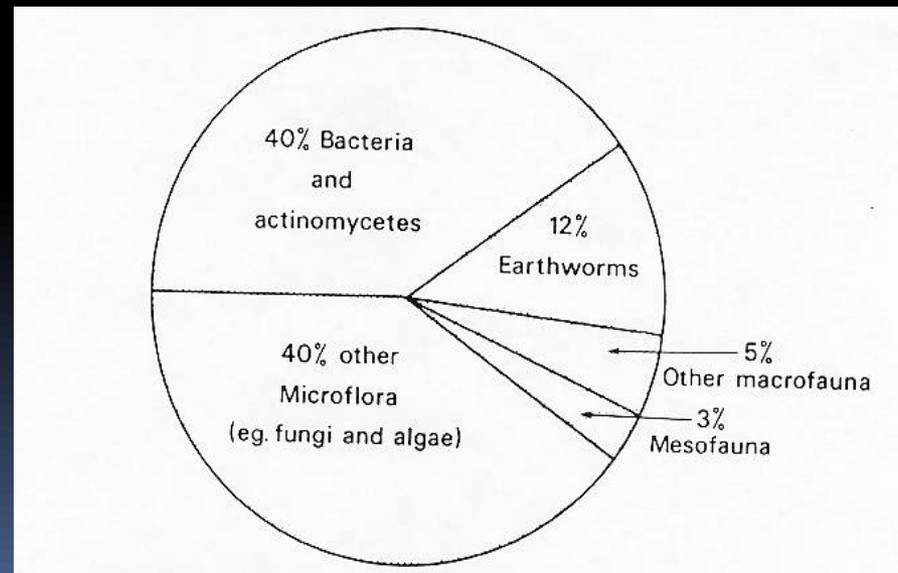
- Prokaryotes lack nucleus

□ **bacteria**



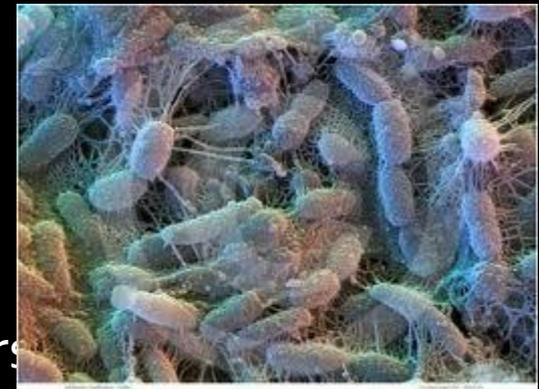
40% Bacteria and actinomycetes:

- bacteria
- actinomycetes

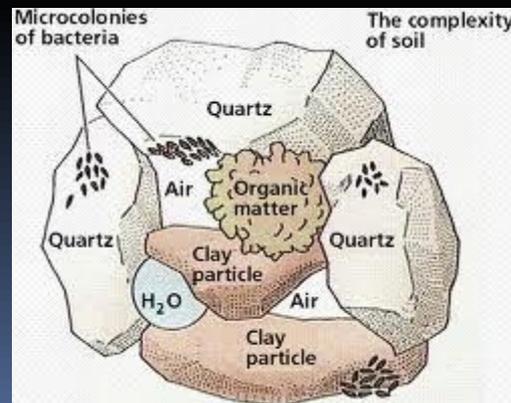


Bacteria

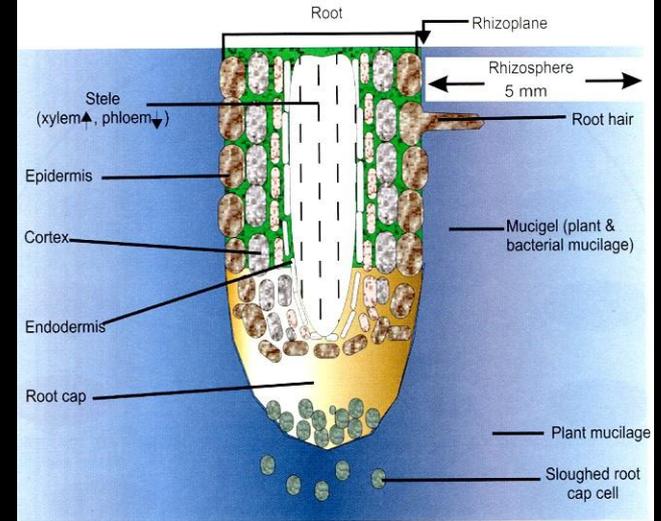
- **Tiny** (1 μm width), **one-celled**
 - Single cell division
 - In lab: 1 can produce 5 billion in 12 hours
 - (In real world limited by predators, water & food availability)



- Abundant in **rhizosphere**
 - zone surrounding root
 - dead root cells and exudate stimulate microbial growth



rhizosphere

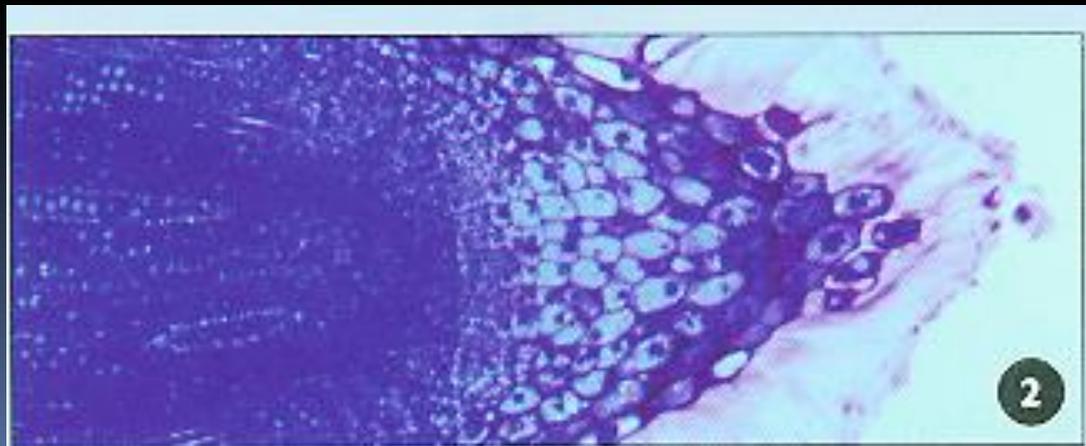


1/10 inch

Exudates: carbohydrates and proteins secreted by roots;
attracts bacteria, fungi, nematodes, protozoa

Bacteria and fungi are like little fertilizer bags

Nematodes and protozoa eat and excrete the fertilizer



4 functional groups of bacteria:

1. Decomposers

- Organic chemicals in big complex chains and rings
 - Bacteria break bonds using enzymes they produce
 - Create simpler, smaller chains
- Immobilize nutrients in their cells; prevents loss of nutrients from rooting zone

2. Mutualists

form partnerships with plants (e.g. *Rhizobium* and legumes)

3. Pathogens

cause plant galls

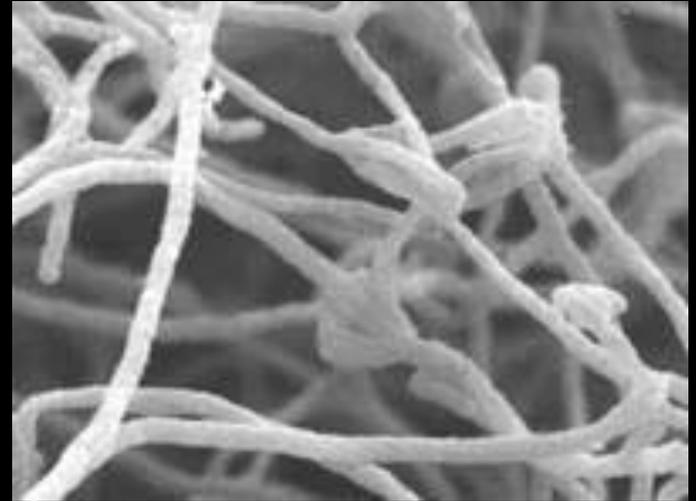


4. Chemoautotrophs

get energy from compounds other than compounds

Actinomycetes: group of bacteria that grow as hyphae like fungi

- Make “earthy” smell
 - by producing geosmin
- adaptable to drought
- Can act in high pH
- usually aerobic heterotrophs
- break down “recalcitrant” compounds
 - Hard-to-decompose (chitin, cellulose)
- Produce antibiotics, like Streptomycin

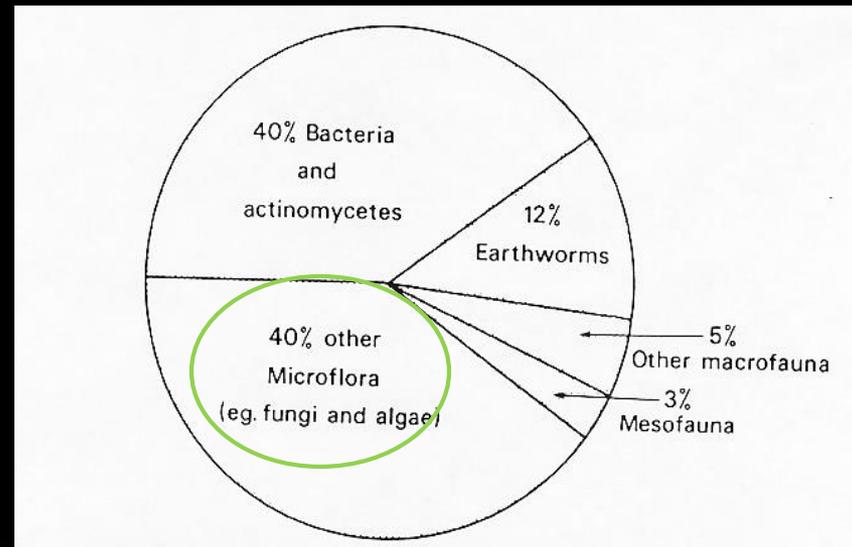


40% other Microflora

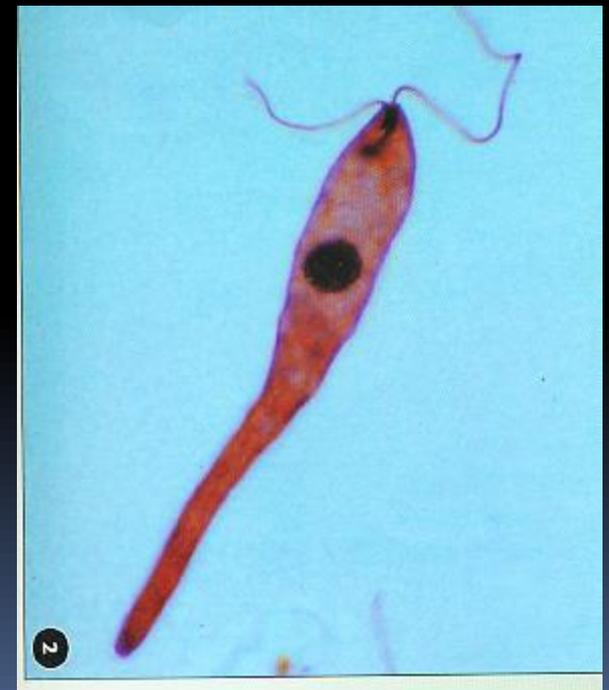
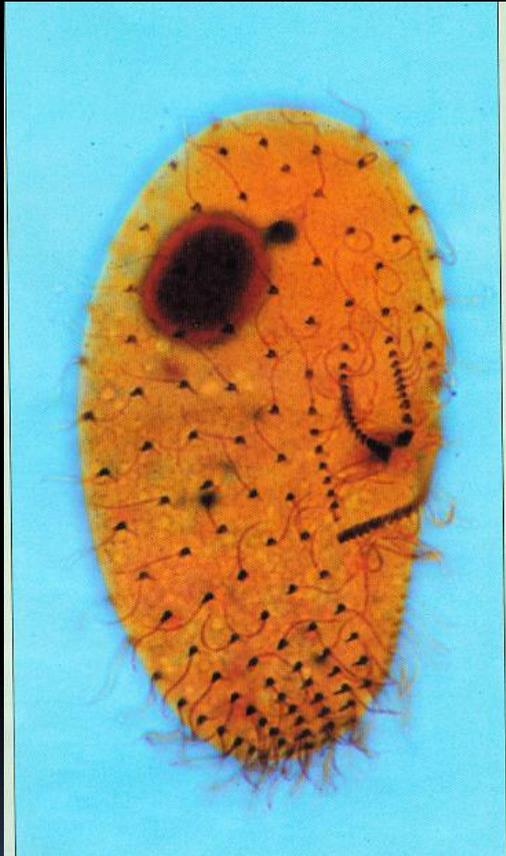
Protozoa

Algae

Fungi



protozoa



protozoa

- Unicellular; larger than bacteria
- Amoeba, ciliates, flagellates
- Heterotrophic
 - Eat bacteria

Bacteria have more nitrogen than protozoa need, so protozoa release the excess
mineralize

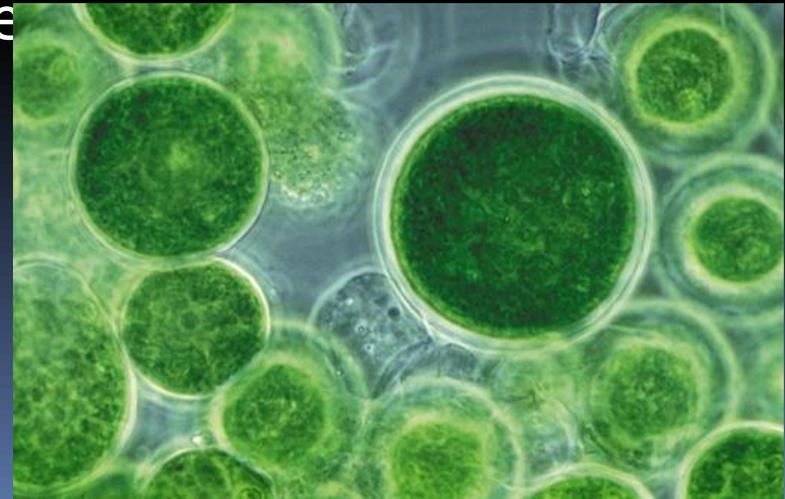
Form symbiotic relationships

e.g., flagellates in termite guts; digest fibers

- Require water
 - Go dormant within cyst in dry conditions

algae

- Filamentous, colonial, unicellular
- Photosynthetic
 - Most in blue-green group, but also yellow-green, diatoms, green algae
 - Need diffuse light in surface horizons; important in early stages of succession
 - Form carbonic acid (weathering)
 - Add OM to soil; bind particles
 - Aeration
 - Some fix nitrogen



Fungi

- Grow as long threads (**hyphae**)
 - Push through soil particles, roots, rocks
- Often group into masses called **mycelium** (look like roots)

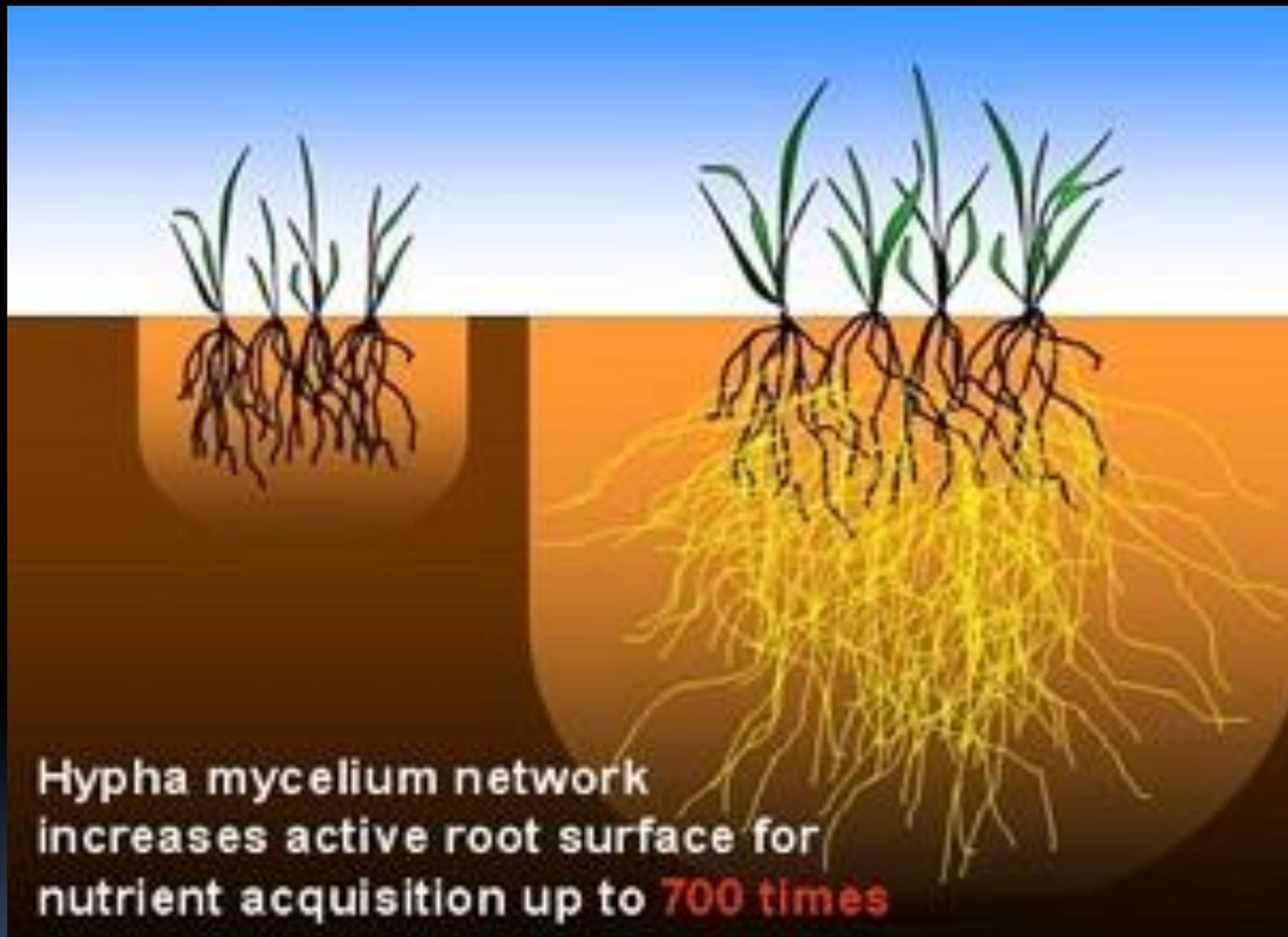


- Higher fungi have **basidium** :
- club-shaped structure ,
- bearing fruiting body
-



Fungi

- ◎ Break down OM, esp important where bacteria are less active; low pH
- ◎ attack any organic residue
 - ◎ feed by absorbing nutrients from organic material ; no stomachs; digest food before it can pass through the cell wall into the hyphae.
 - ◎ Hyphae secrete acids and enzymes that break the surrounding organic material down into simple molecules they can easily absorb.
- ◎ Most are aerobic heterotrophs
- ◎ *chemosynthetic*: adsorb dissolved nutrients for energy



Hypha mycelium network
increases active root surface for
nutrient acquisition up to **700 times**

- *Mycorrhizae*: symbiotic absorbing organisms infecting plant roots, formed by some fungi
 - *Mutualists*
 - Get carbon from plant
 - Give to plant:
 - *Solubilize P; bring soil nutrients to plant*
 - normal feature of root systems, esp. trees
 - increase nutrient availability in return for energy supply
 - plants native to an area have well-developed relationship with mycorrhizal fungi

Ectomycorrhizae

- Grow on surface layers of roots
 - trees

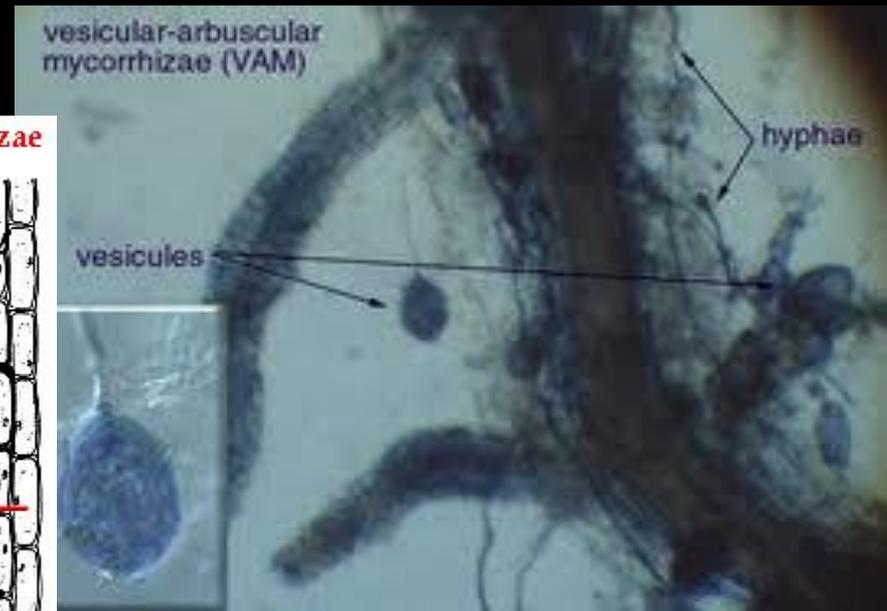
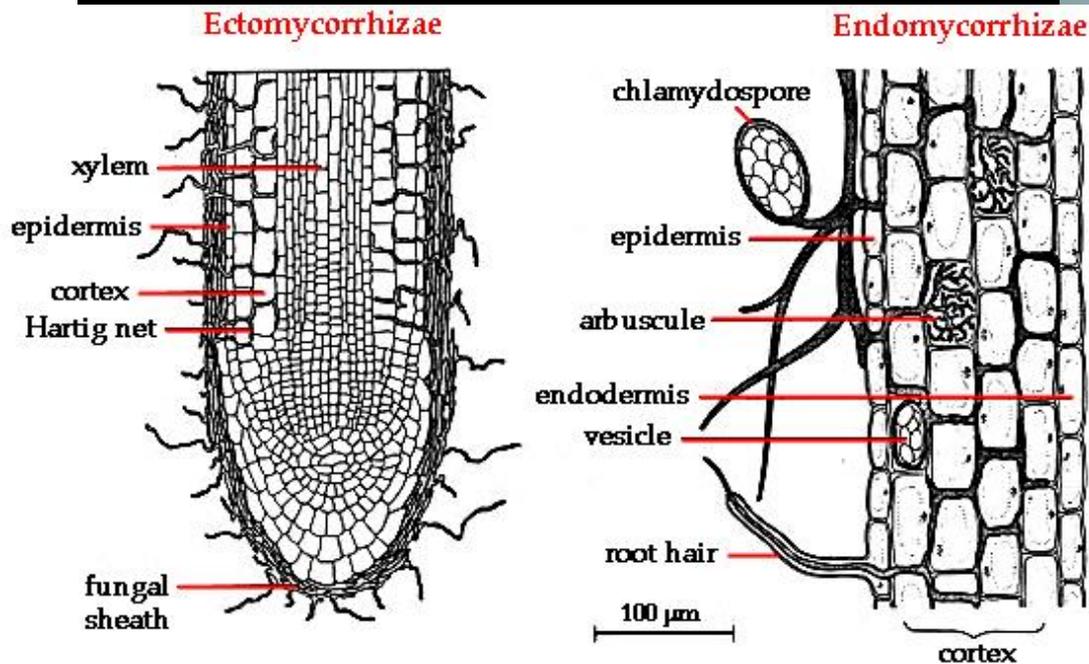


On pine root



endomycorrhizae

- Grow within root cells
 - Grasses, crops, vegetables, shrubs



12% Earthworms

(Macrofauna: > 1 cm long)

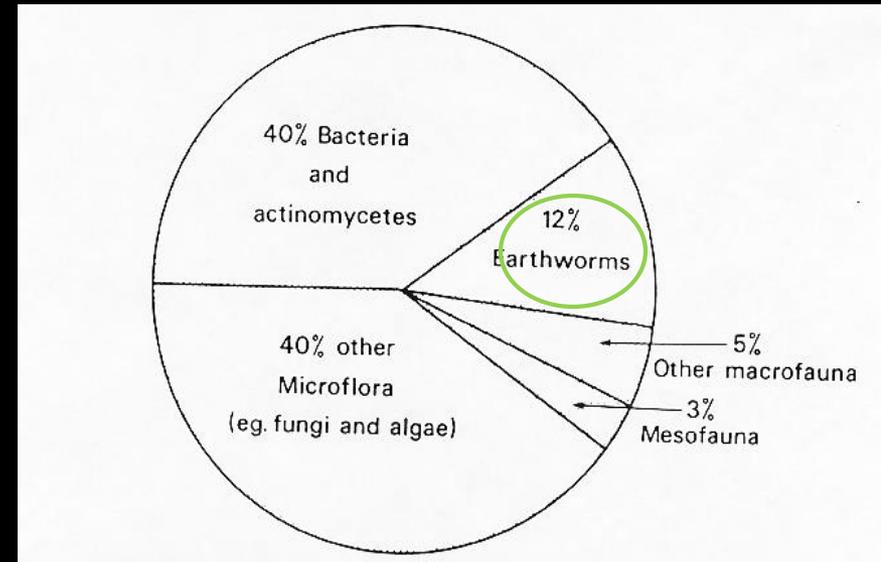
ANNELIDS

several types:

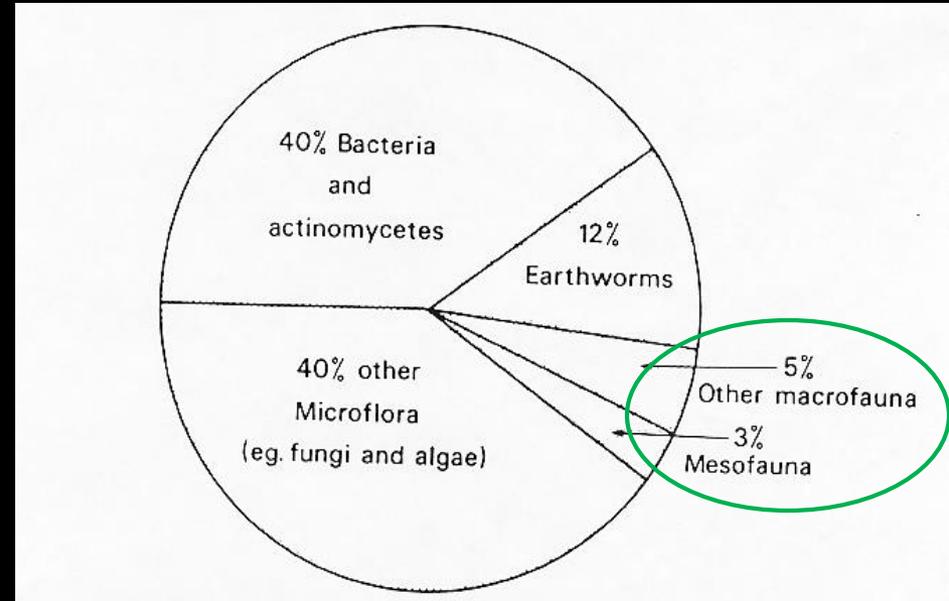
epigeic (litter)

anecic (burrow)

endogeic (in soil)



Other Macrofauna (5%) and Mesofauna (3%)



CHORDATES (vertebrates)

mammals, amphibians, reptiles

PLATYHELMINTHES (flatworms)

ASCHELMINTHES (roundworms, nematodes)

MOLLUSKS (snails, slugs)

ARTHROPODS : (insects, crustaceans, arachnids, myriapoda)

arthropods

- $\frac{3}{4}$ of all living organisms
- Exoskeleton, jointed legs, segmented body
- Insects
- Crustaceans
- Arachnids
- Myriapoda





Feeding Habits

Carnivores : parasites and predators

Phytophages: eat above ground green plant parts, roots, woody parts

Saprophages: eat dead and decaying OM



Microphytic feeders: eat spores, hyphae, lichens, algae, bacteria

Distribution with depth

most active biotic horizons correspond with amount of OM:

- **Litter (O)**: has most OM but extremes of climate, therefore only specialists live there
 - Most animals in litter

Roots:

- **Rhizosphere**: zone surrounding root
 - dead root cells and exudate stimulates microbial growth
 - Most microbiotic population in A and rhizosphere