The banner features a blue globe on the left with a circular inset showing a microscopic view of soil. In the center, there is a stylized white owl logo. On the right, two large brown mushrooms are depicted against a purple and blue sky with white stars. The entire banner is framed by a decorative border of green leaves and a small blue butterfly on the right side.

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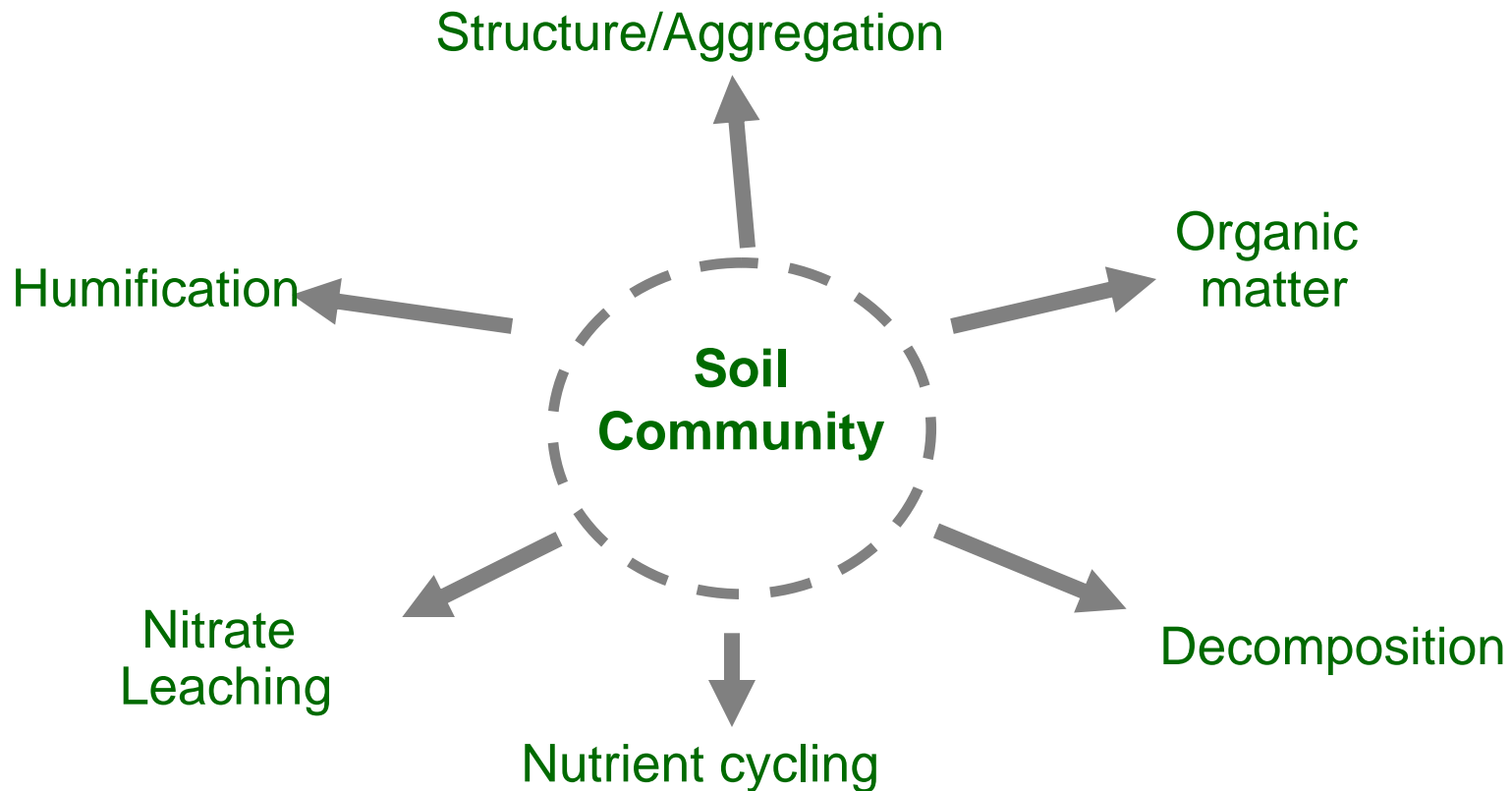
A glimpse below... The soil food web

Teri C. Balsler, Assistant Professor, UW-Madison
tcbalsler@wisc.edu

What is soil biology?

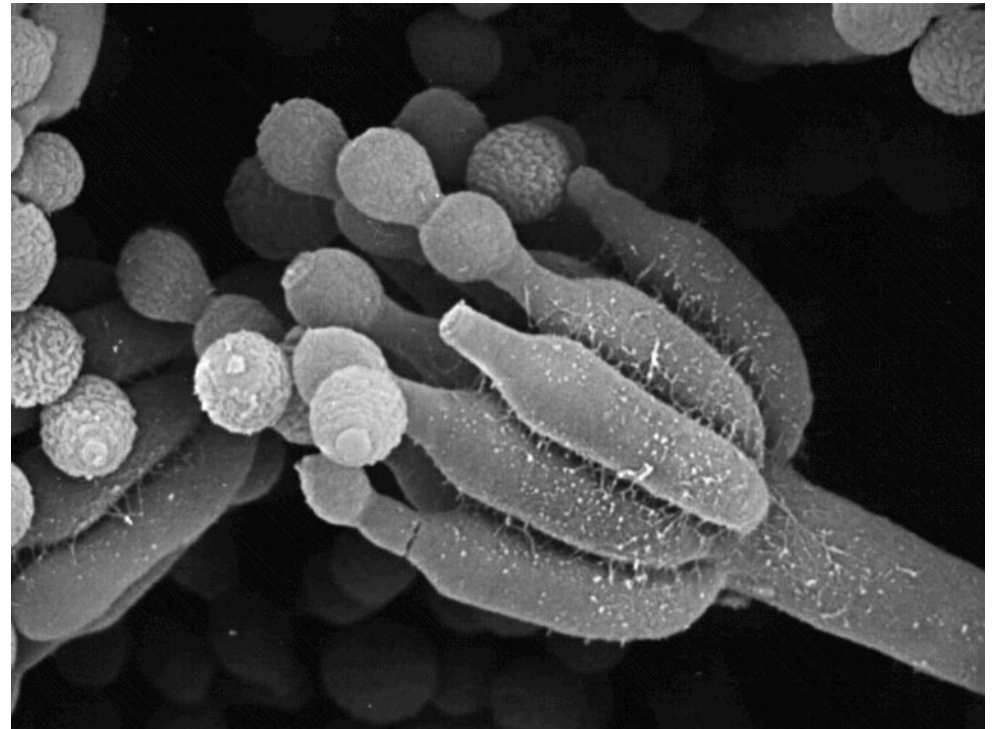
**What role does it play in soil
quality?**

Soil organisms are involved in nearly every aspect of soil quality



In order to understand how biology affects our soils - we need to understand a little about the organisms who live there












QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.



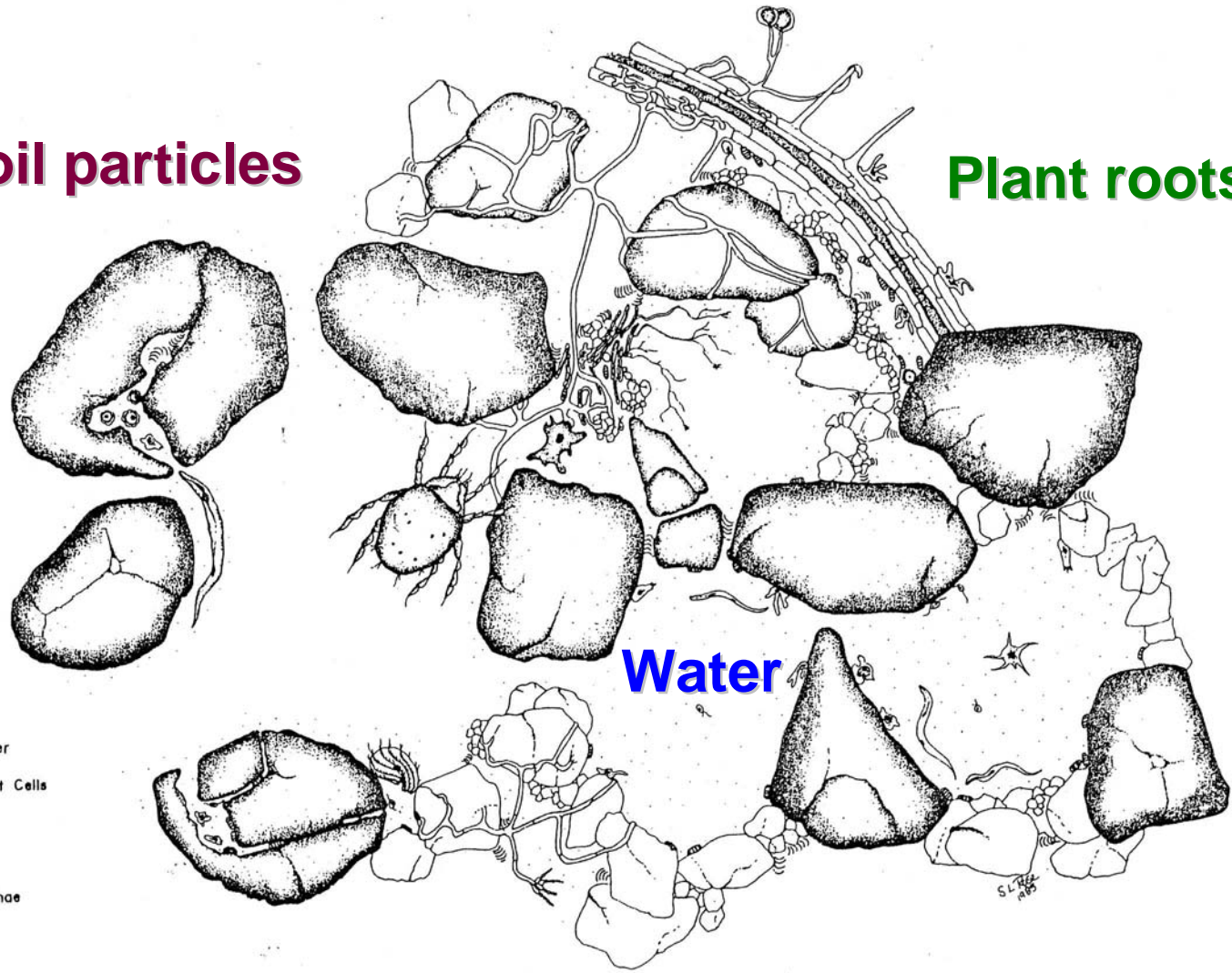
Soil is a habitat

Soil particles

Plant roots

-  Cyst
-  Amoeba
-  Flagellate
-  Bacterial Colonies
-  Nematode
-  Ciliate
-  Clay-Organic Matter Complex
-  Decomposing Plant Cells
-  Water
-  Actinomycete hyphae and spores
-  Fungal hyphae and spores

Water



The image is a composite of several microscopic views of soil organisms. The top left shows a green-tinted micrograph of a chain of yellowish, spherical bacteria. The top right is a grayscale scanning electron micrograph (SEM) showing numerous rod-shaped bacteria. The middle left is a micrograph of a dense network of thin, fibrous structures, likely fungal hyphae. The bottom left is a green-tinted micrograph of a branched, tree-like structure of small, dark, spherical cells. The bottom right is a grayscale SEM showing a large, complex, multi-layered structure, possibly a fungal fruiting body or a large bacterial colony. A central gray box contains text.

Soil is alive...

For example, in 1g of soil:

>100,000,000 bacterial cells

>11,000 species of bacteria

Also fungi and larger animals

Who's there?

**Macrofauna:
Soil 'Engineers'**

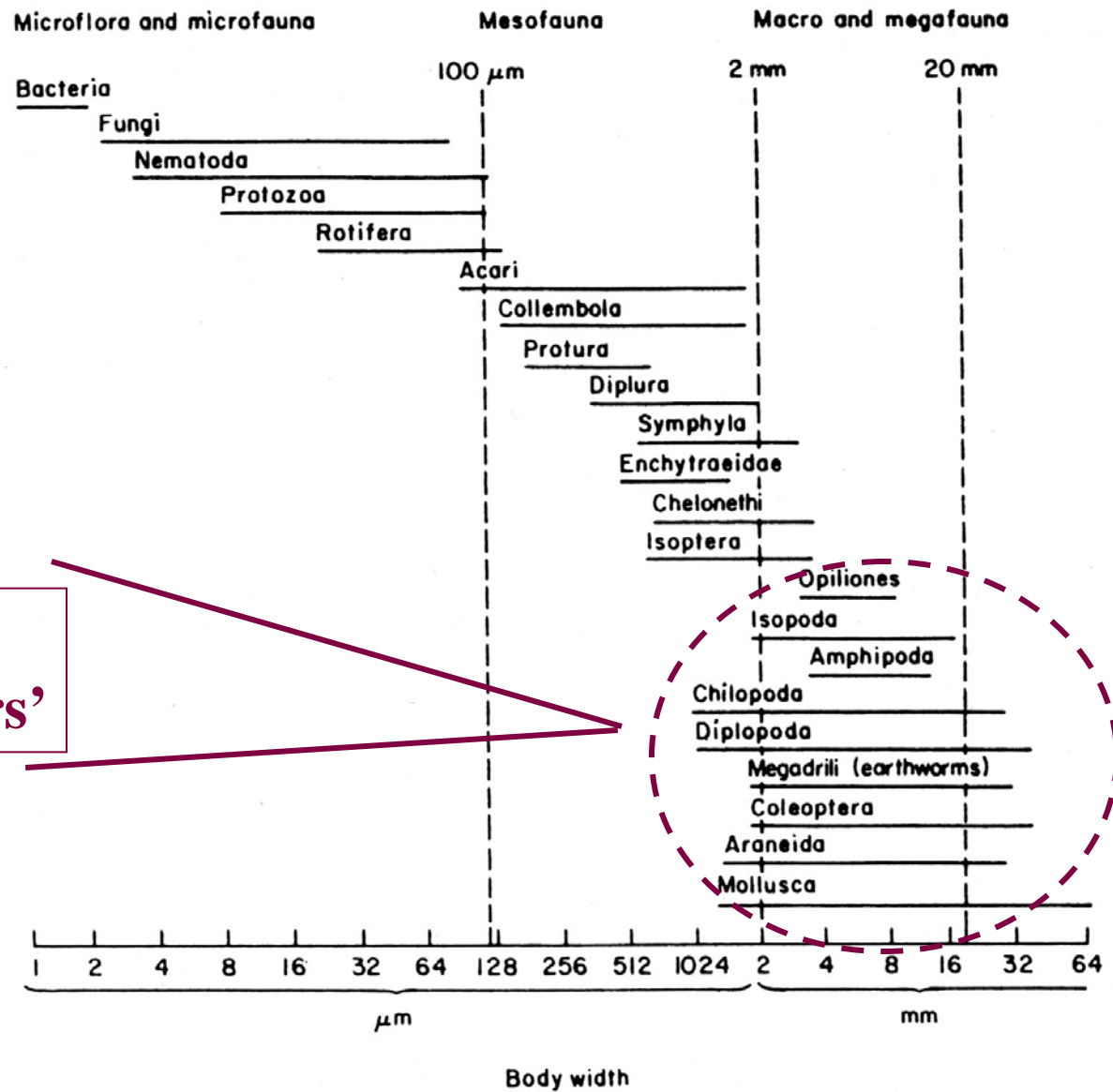
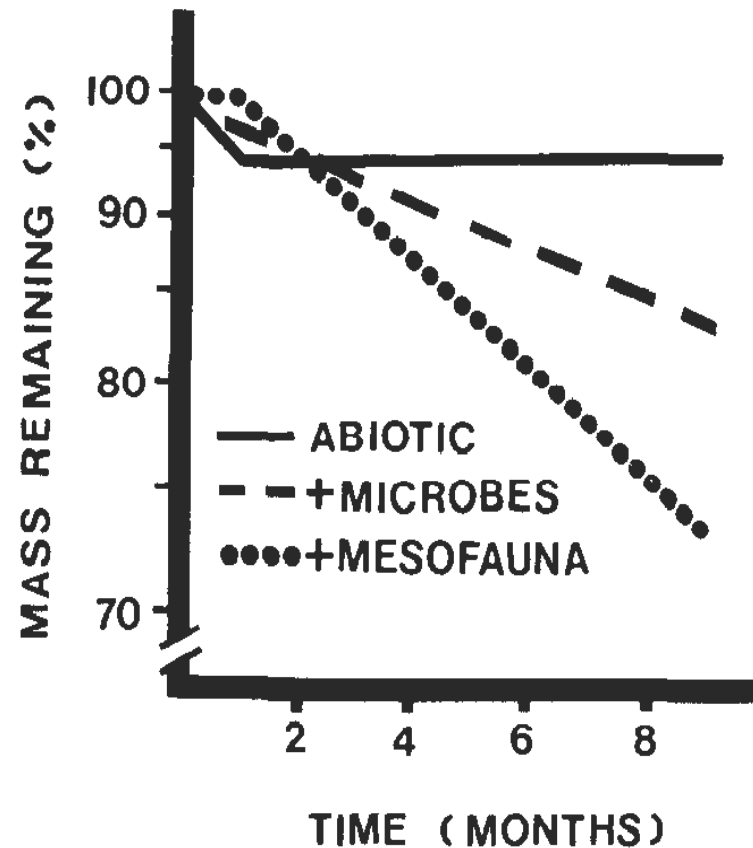


FIGURE 4.3 Size classification of organisms in decomposer food webs by body width (Swift *et al.*, 1979).

Soil Animals



Soil animals are important for



1. Decomposition (shredding residues)
2. Mixing soil (aeration)



Decomposition rate of blue grama (*Bouteloua gracilis*)

Who's there?

Mesofauna:
Soil predators,
pathogens,
herbivores

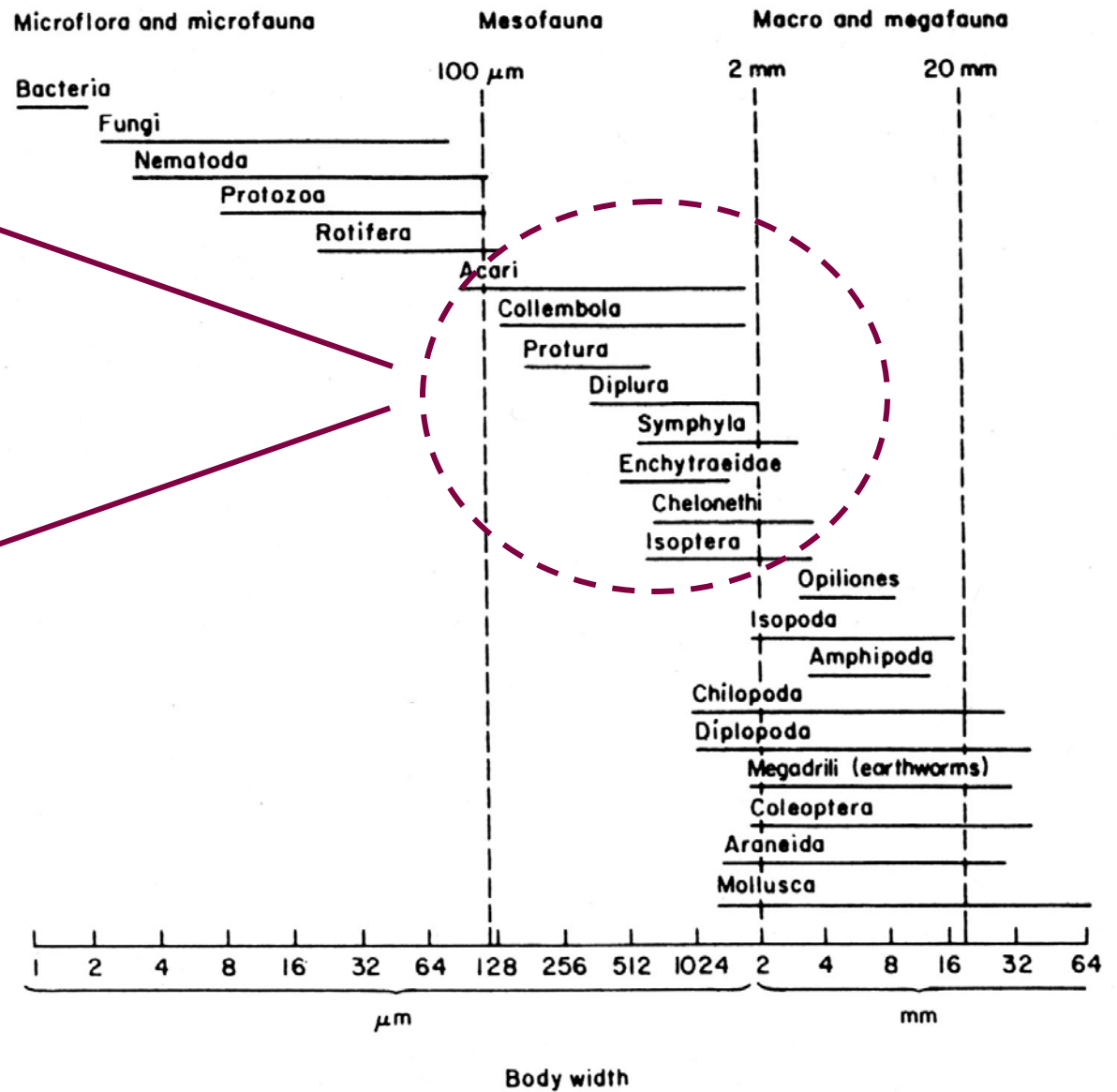
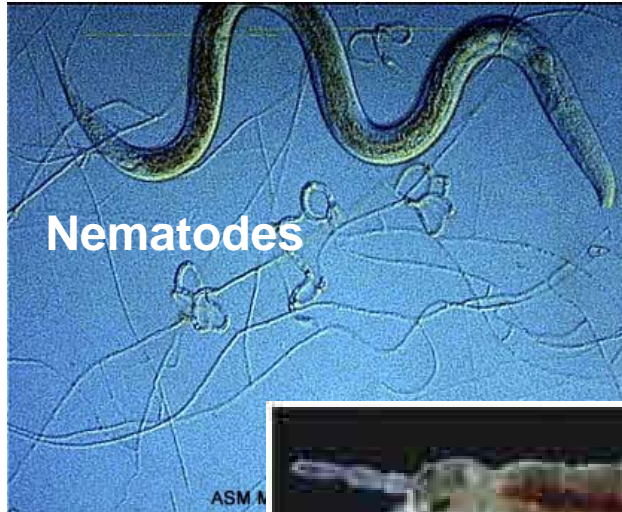
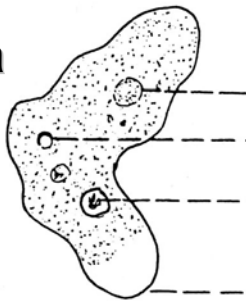


FIGURE 4.3 Size classification of organisms in decomposer food webs by body width (Swift *et al.*, 1979).

Soil mesofauna

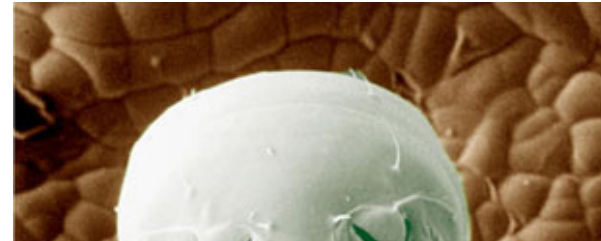


Protozoa



QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Soil mesofauna



Soil mesofauna are important for

- 1. Residue decomposition**
- 2. Predation**
- 3. Pathogenesis**

Protozoa



TIFF (LZW) decompressor
are needed to see this picture.

**Microorganisms:
Soil process
controllers**

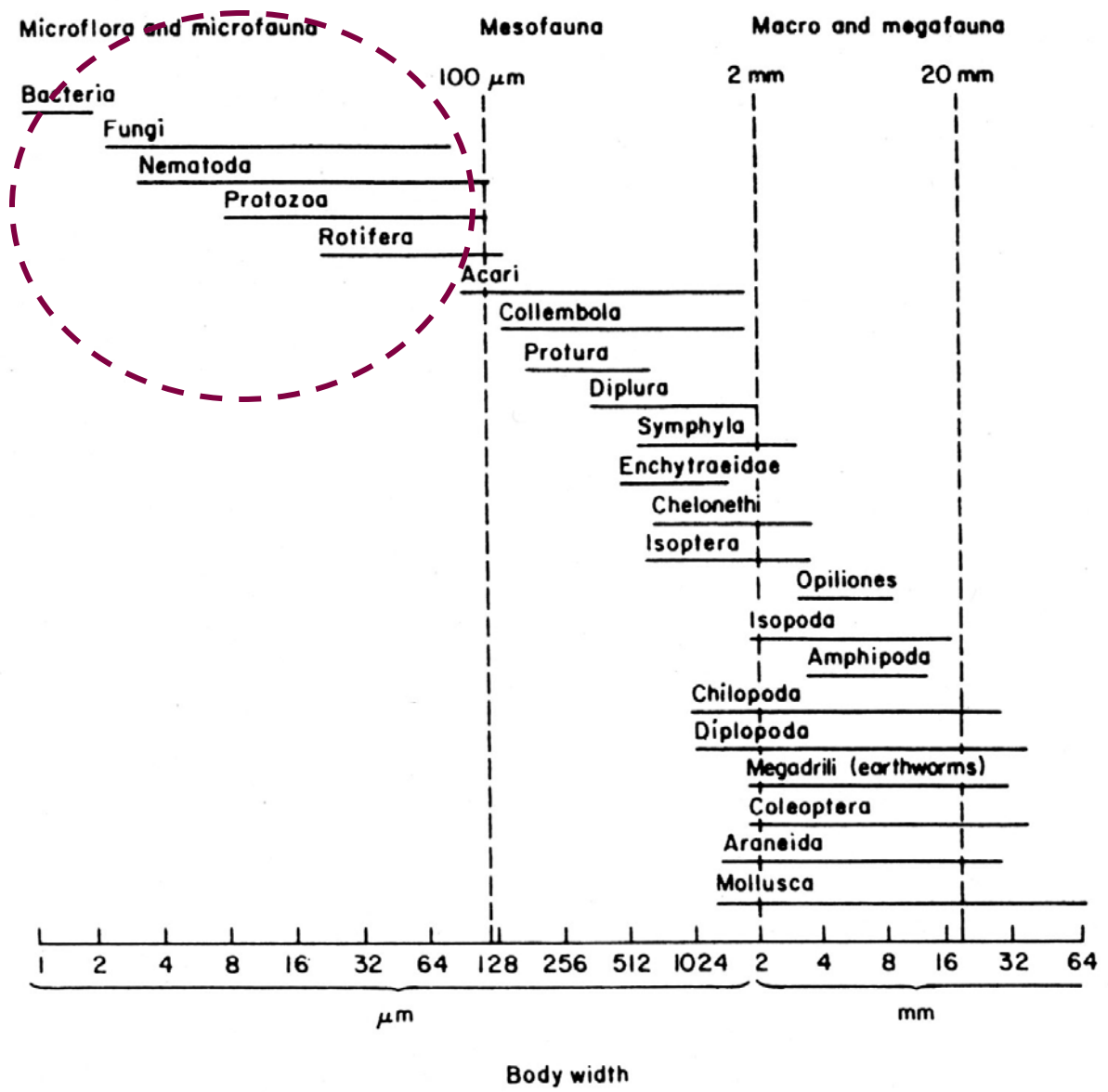
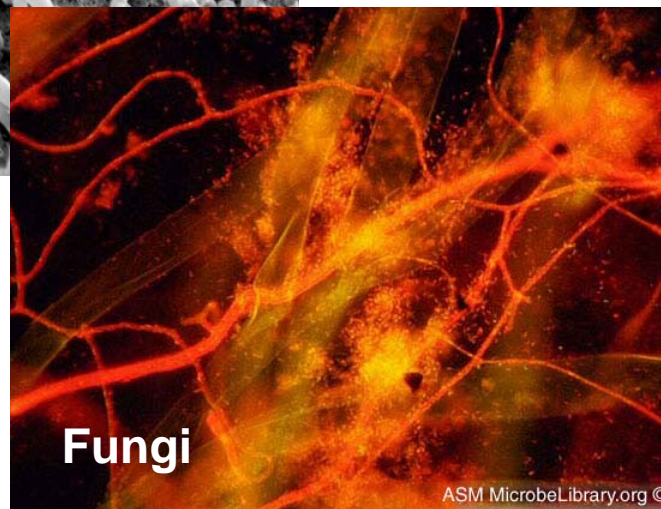
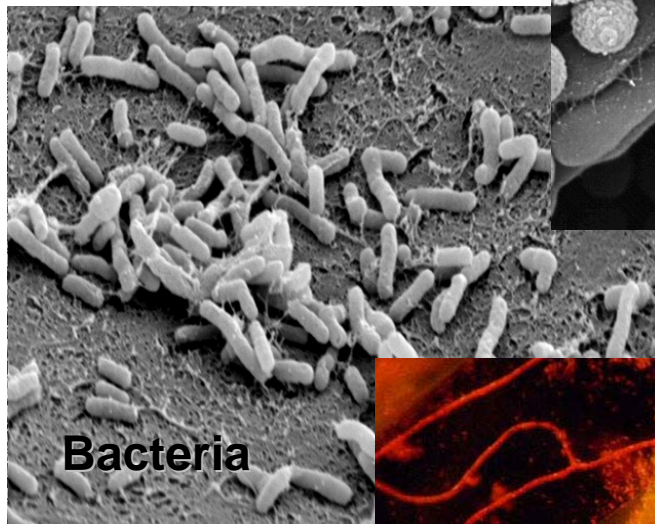
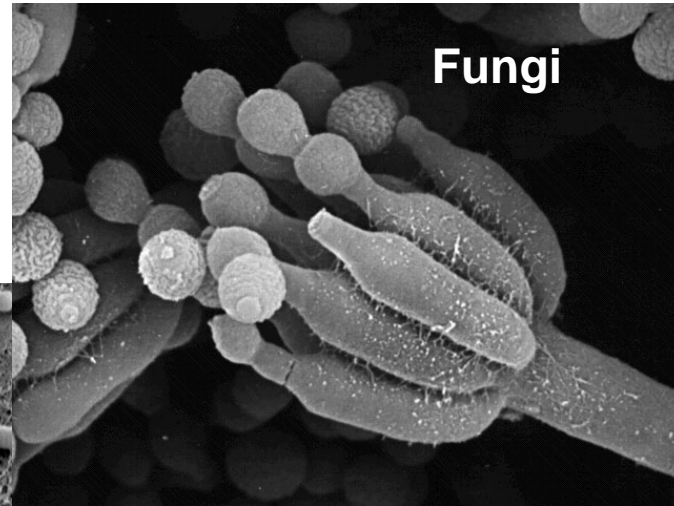


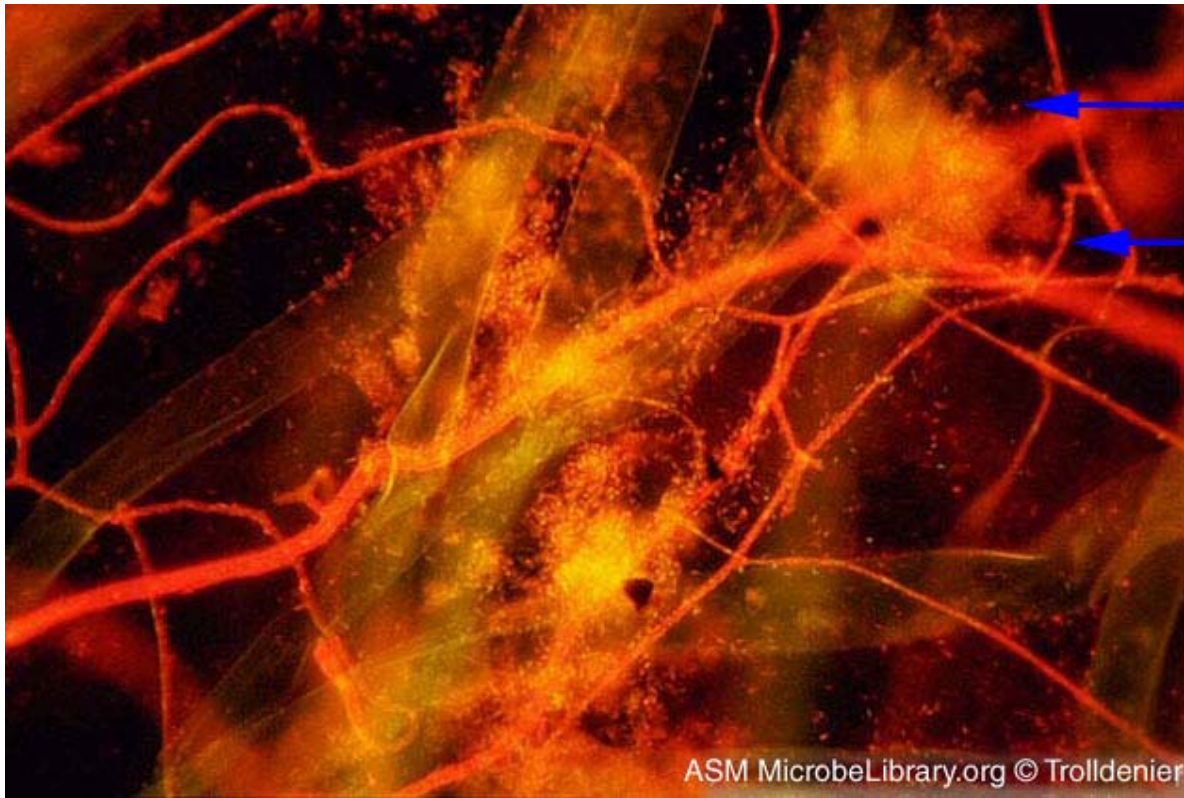
FIGURE 4.3 Size classification of organisms in decomposer food webs by body width (Swift *et al.*, 1979).

Soil microorganisms



Fungi

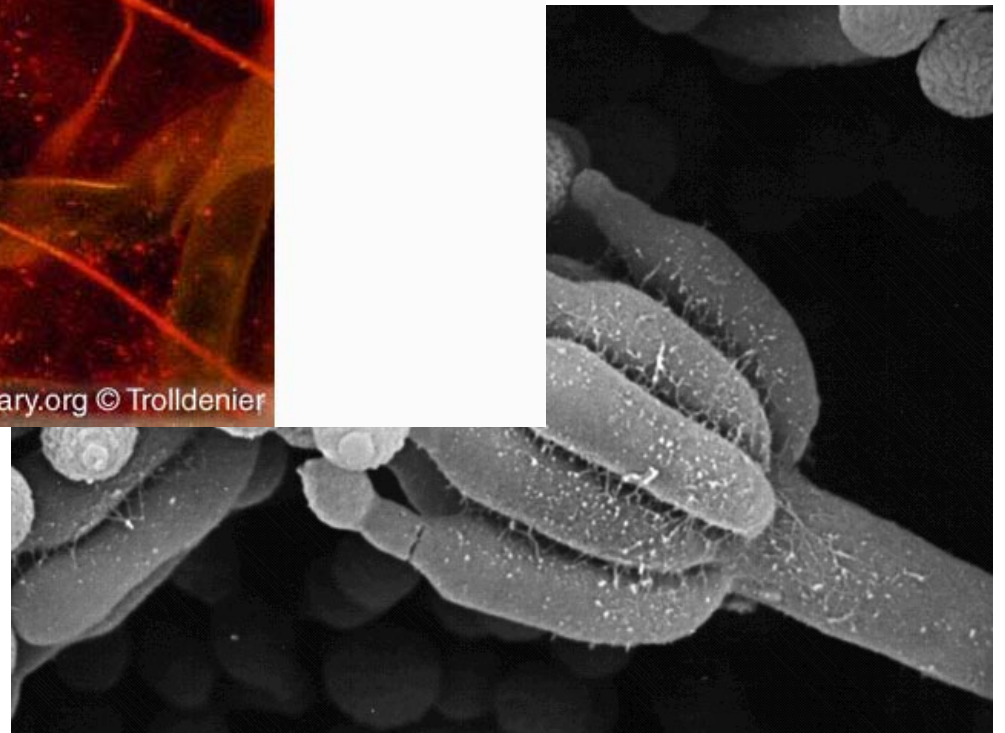
- Filamentous growth



Bacteria
(orange dot)

Fungal
filaments

What are the advantages of filamentous habit?



Fungi

- Filamentous growth
- Functionally critical!

- Wood degrading
- Mycorrhizal association

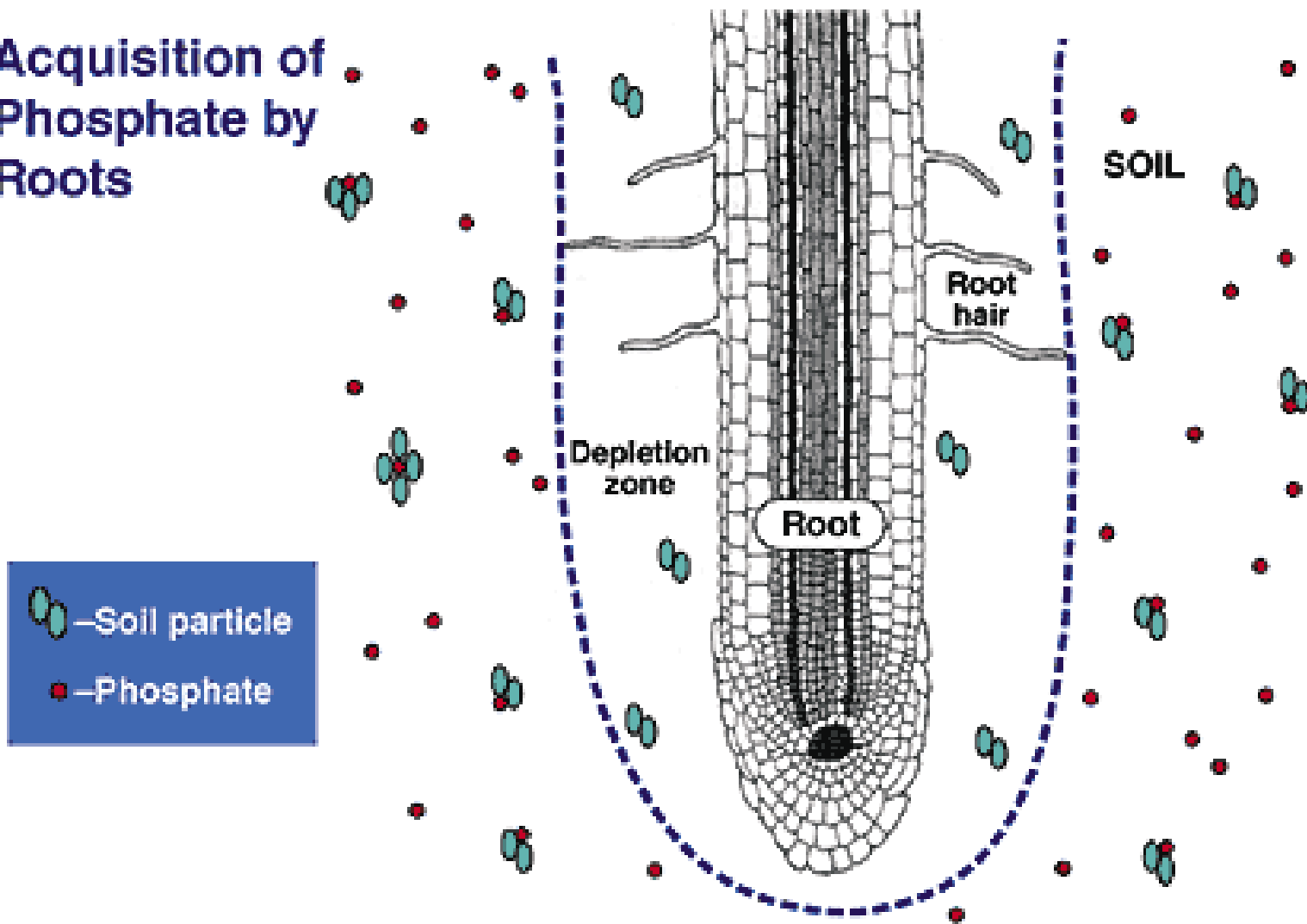
- *myco* (fungus) +
rhiza (root)

(Symbiotic structure
formed by a fungus
plus a plant)

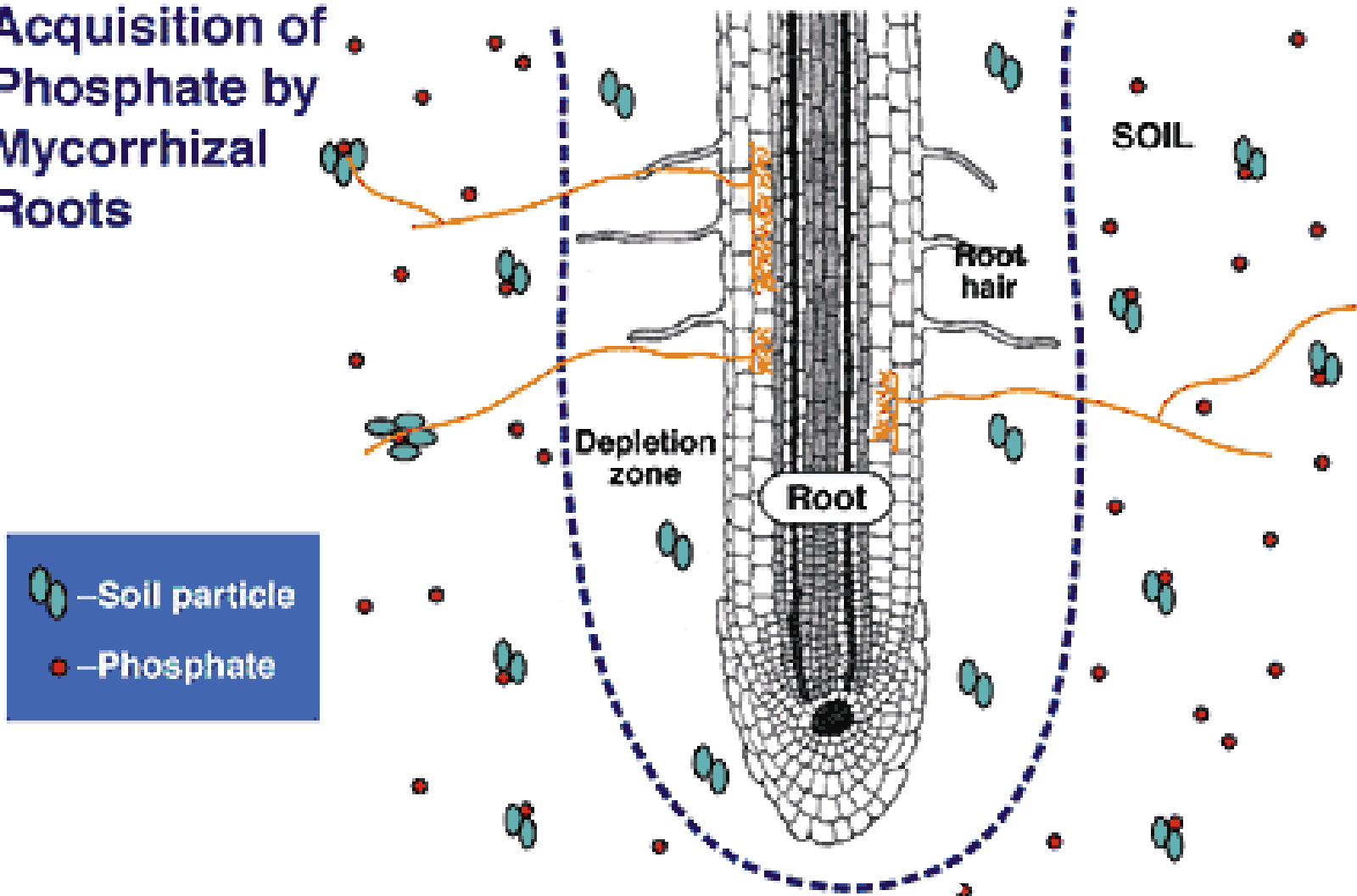
QuickTime™ and a
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Acquisition of Phosphate by Roots



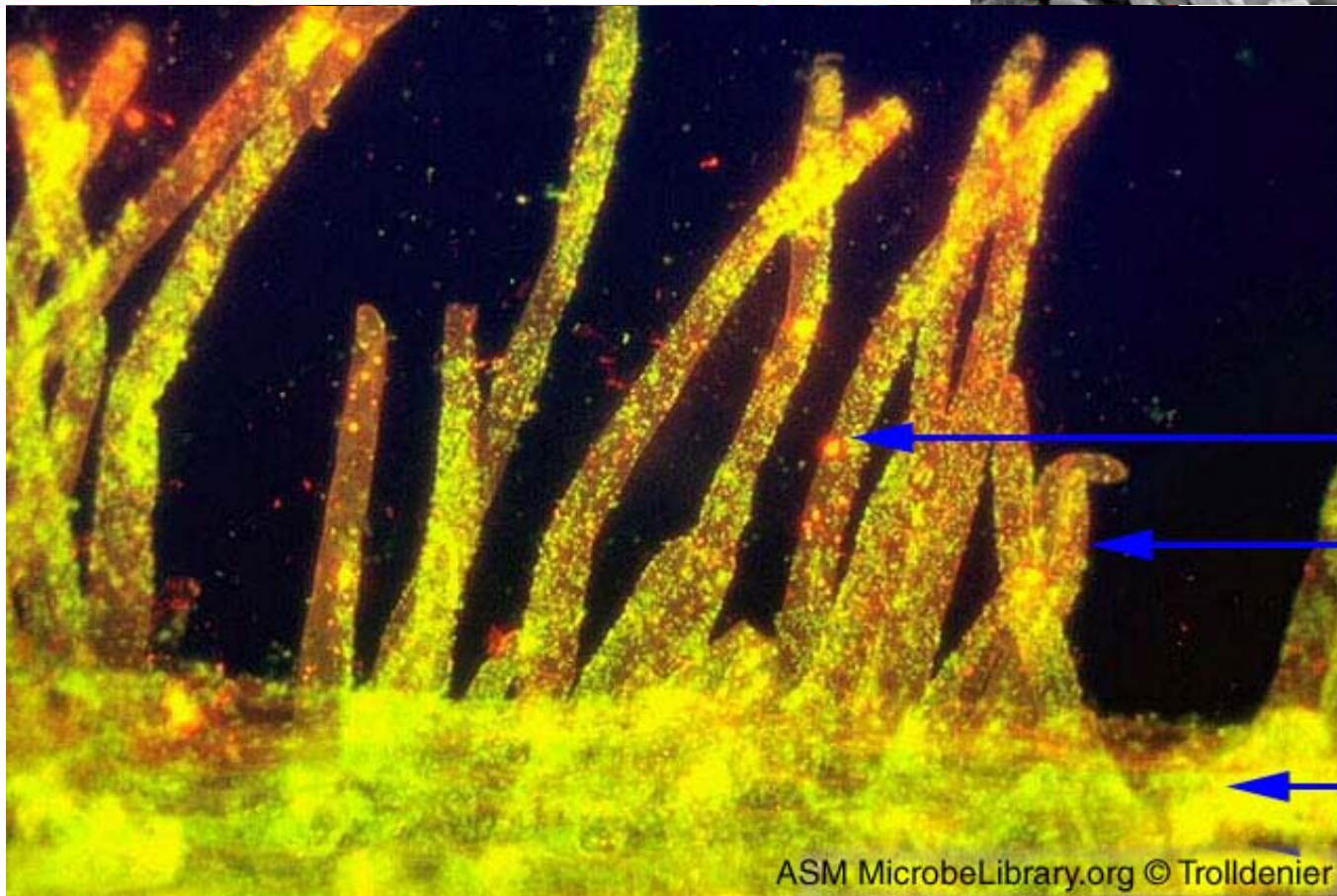
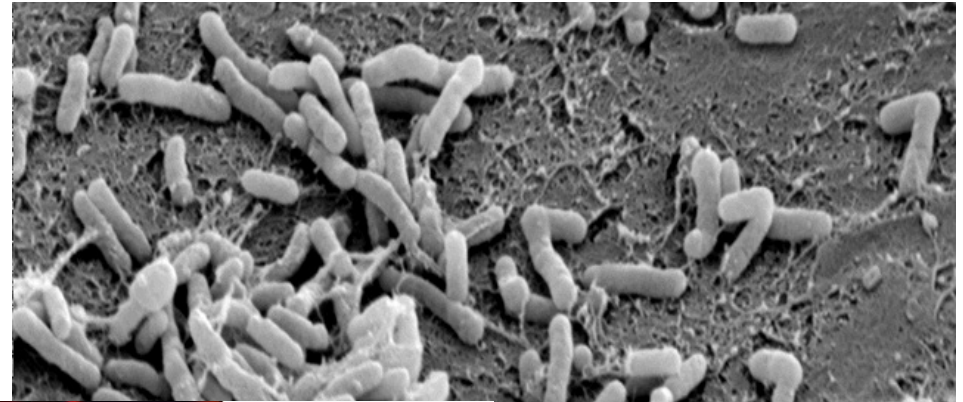
Acquisition of Phosphate by Mycorrhizal Roots



—Soil particle
—Phosphate

Bacteria

- Small, single celled
~2 μm



Bacteria
(red dots)
Root hair
(green yellow
stalks)
Root
surface

ASM MicrobeLibrary.org © Trolldenier



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What is the importance of small size.

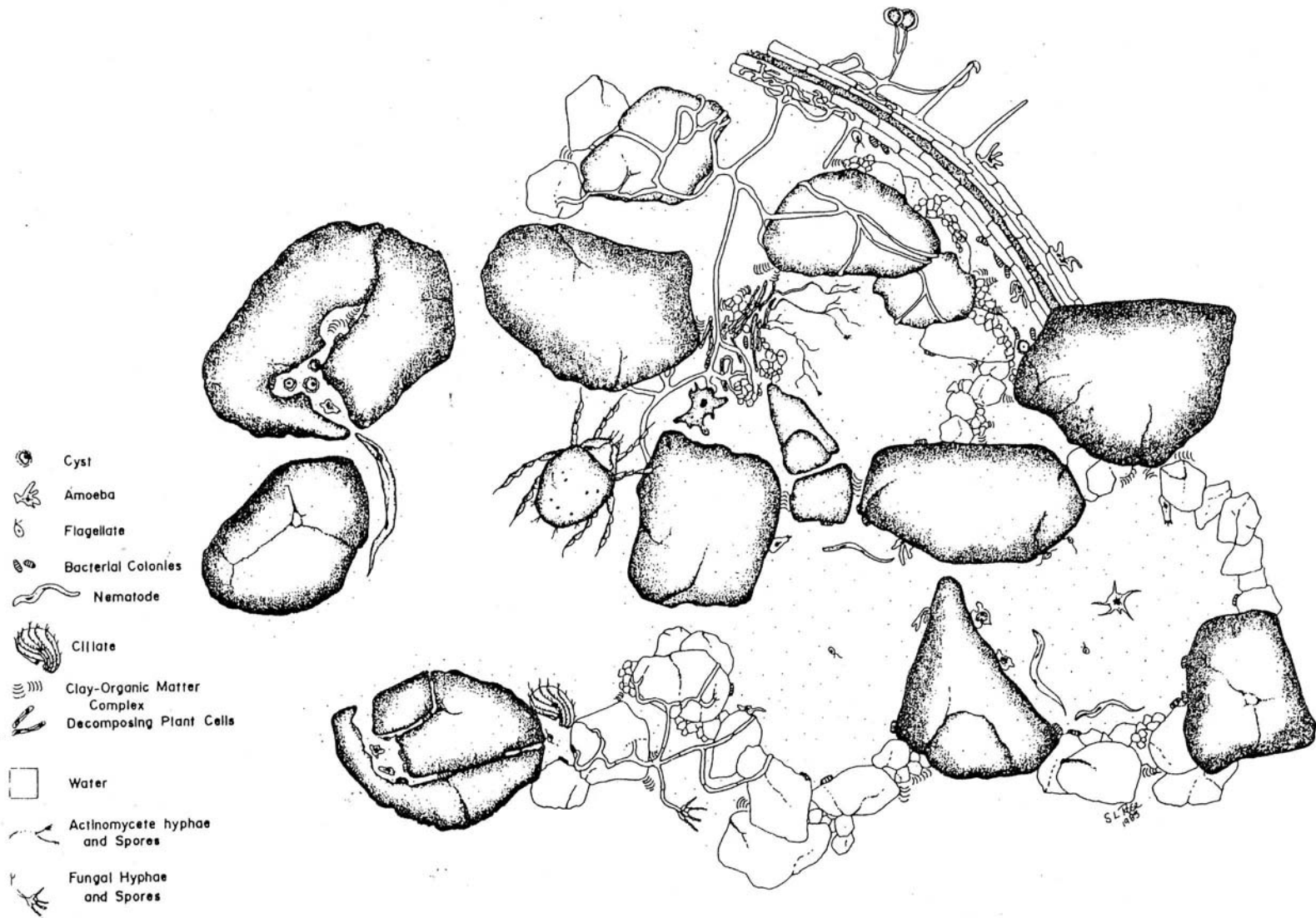
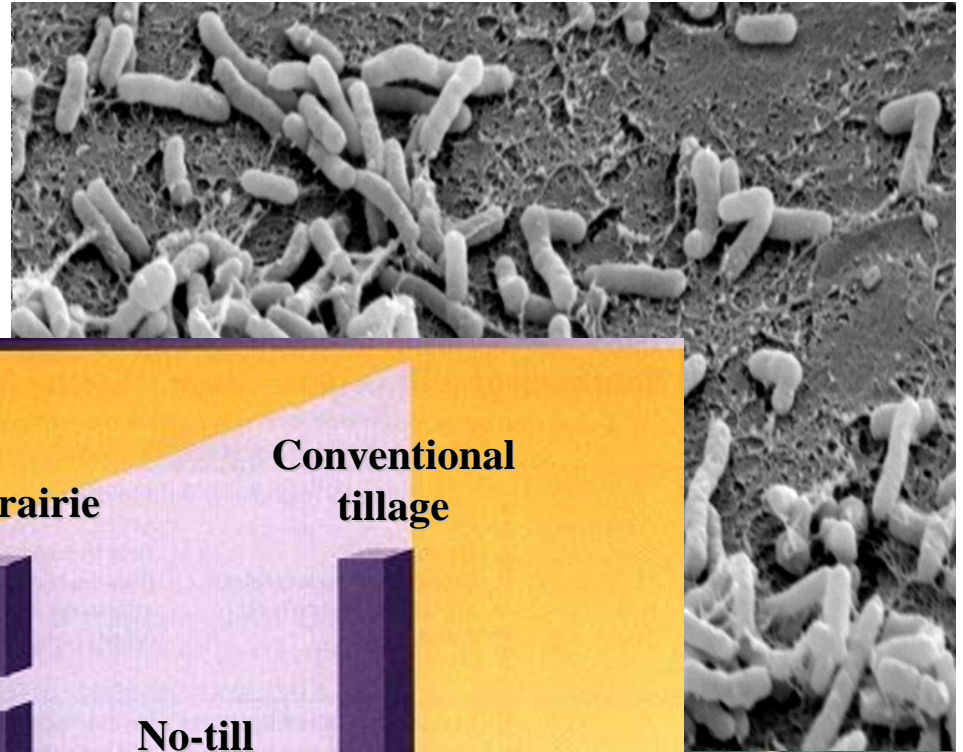


Figure 5.2. Trophic relationships among different groups of soil organisms are controlled by accessibility to their resources. This illustration represents approximately 1 cm² of a highly structured microzone in the surface horizon of a grassland soil. (Courtesy of S. Rose and T. Elliott, personal communication.)

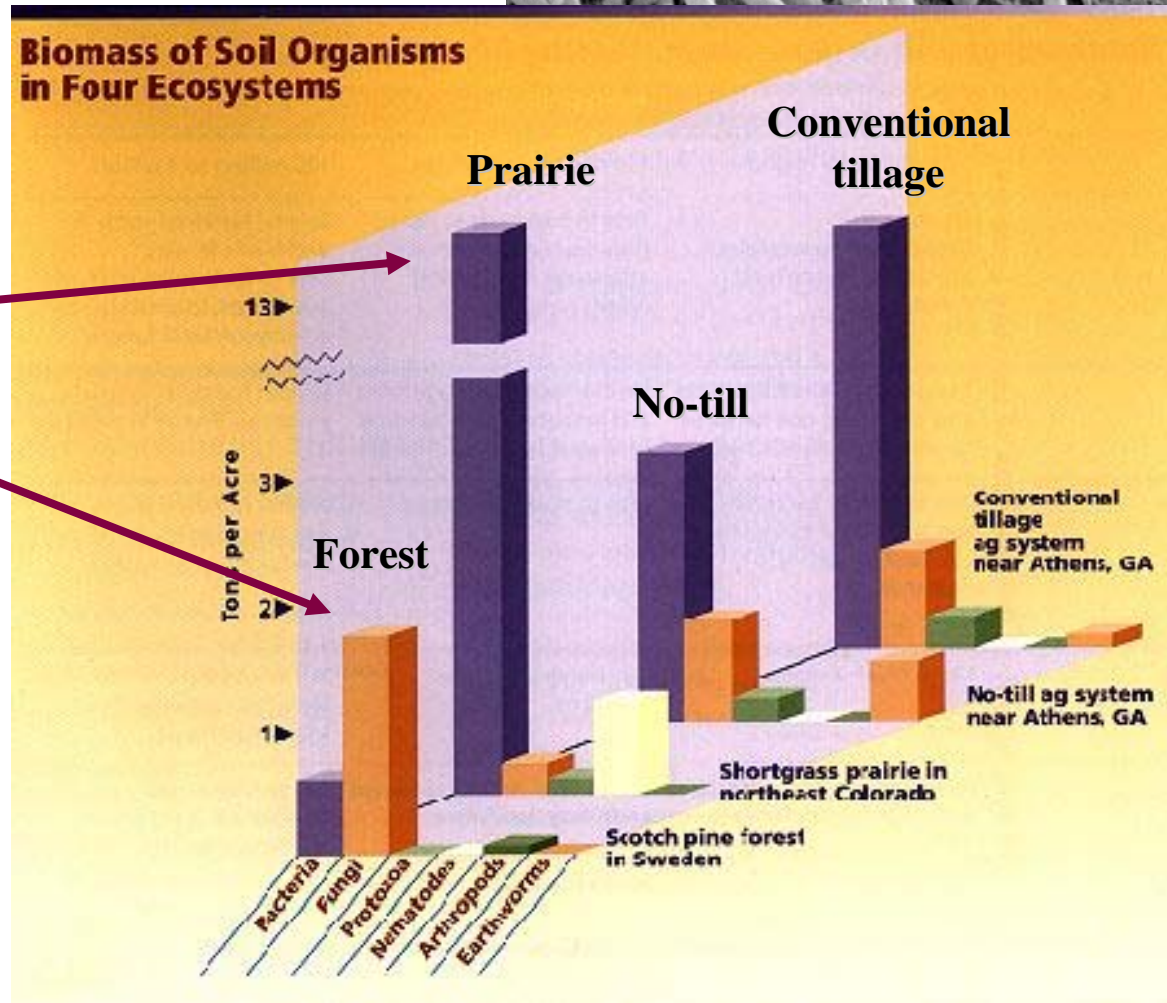
Bacteria

- Small, single celled
- Abundant

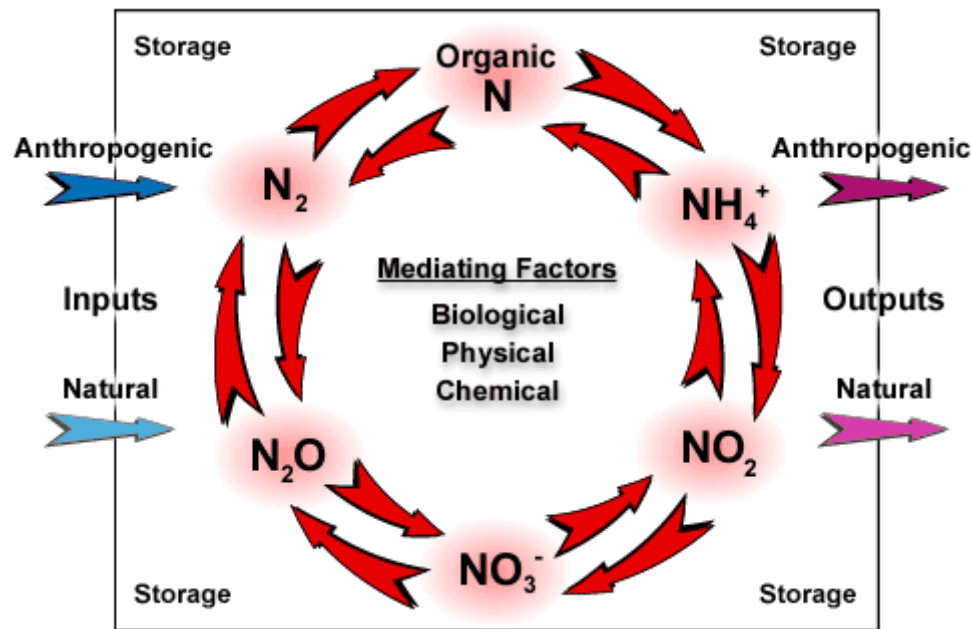


Bacteria

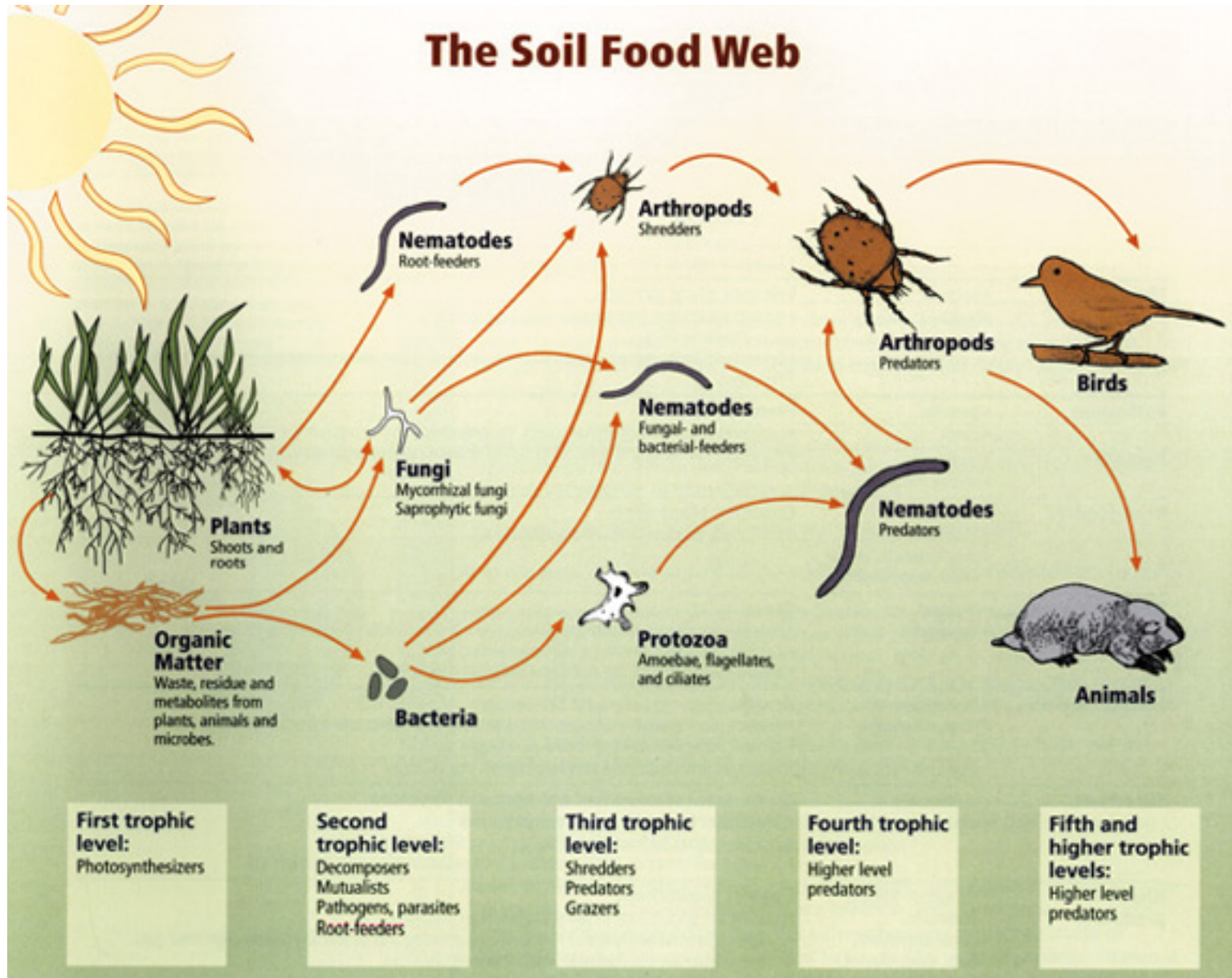
Fungi



Diversity in soil is important for nitrogen cycling.



Relationship to soil quality?



Diversity may be important in response to management

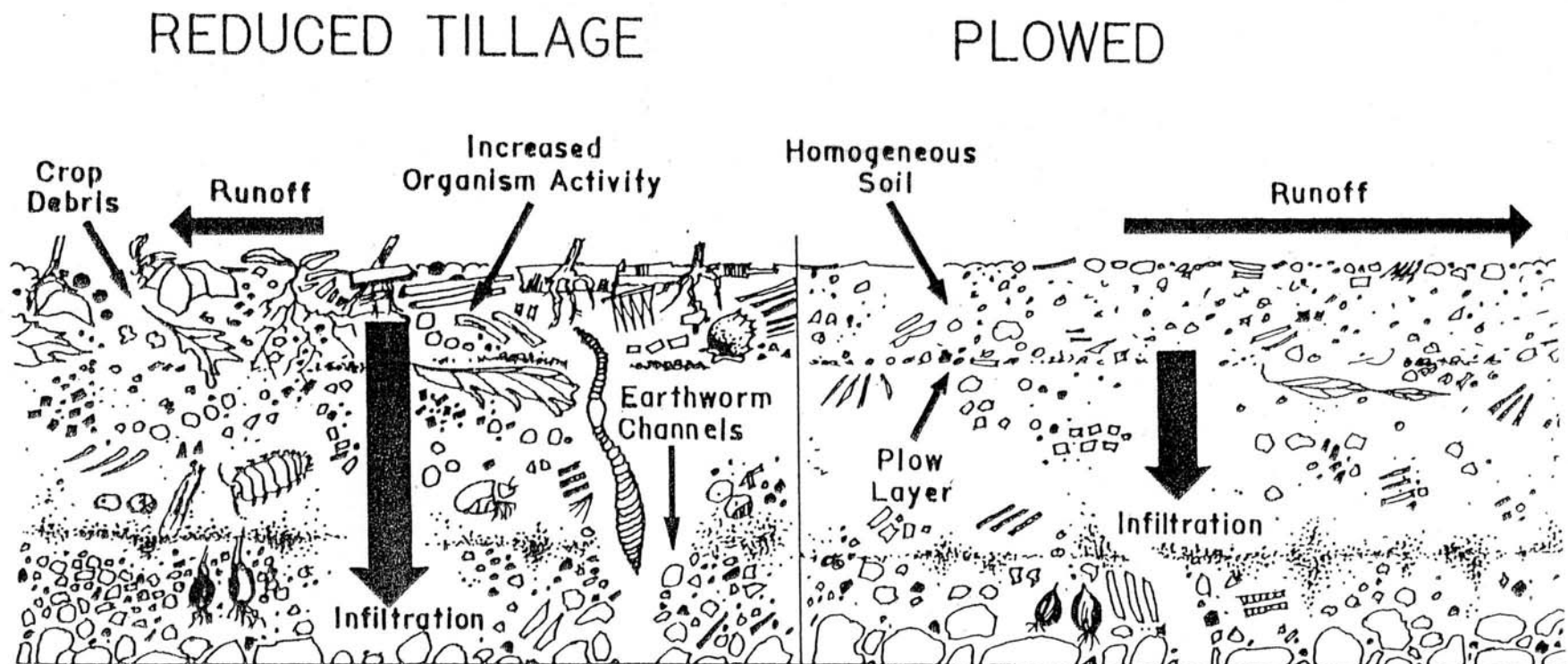



Figure 2. A comparison of biological, physical, and chemical properties of minimum tillage and plowed soils (from Stinner and Stinner, 1989).



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Ecosystem Microbiology Laboratory, UW-Madison
(www.ecosystem-microbiology.wisc.edu)

Teri C. Balsler
tcbalsler@wisc.edu

USDA-CREES, NSF, Andrew W. Mellon Foundation, NASA

Lab members: Jessica Mentzer, Jenny Kao, Liang Chao, Nicole Craig, Lindsey Moritz, Meredith Schuman, Dr. David Bart, Dr. Daouda Ndaiye, Dr. Harry Read