Soil biology – Nutrient Cycling

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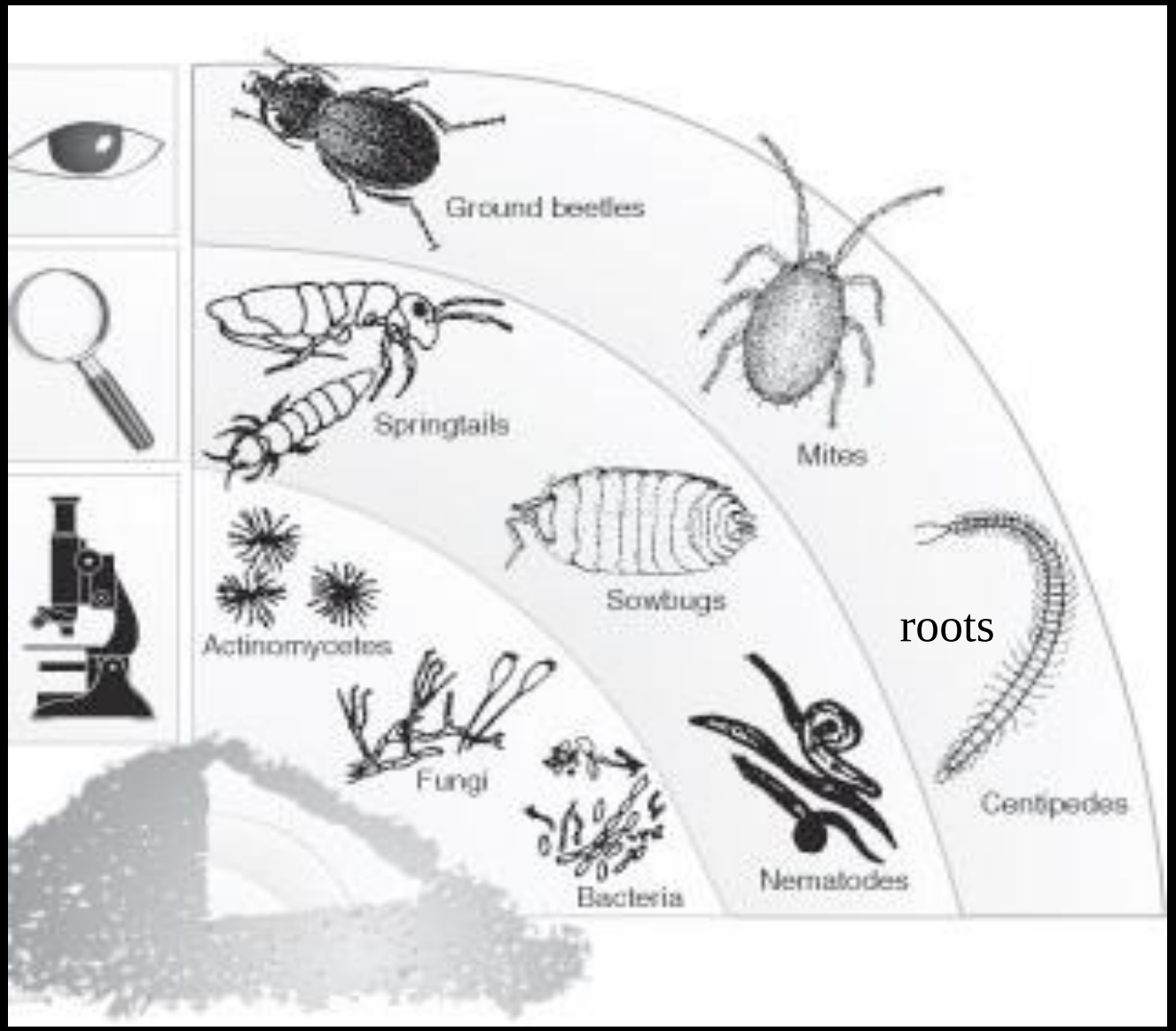
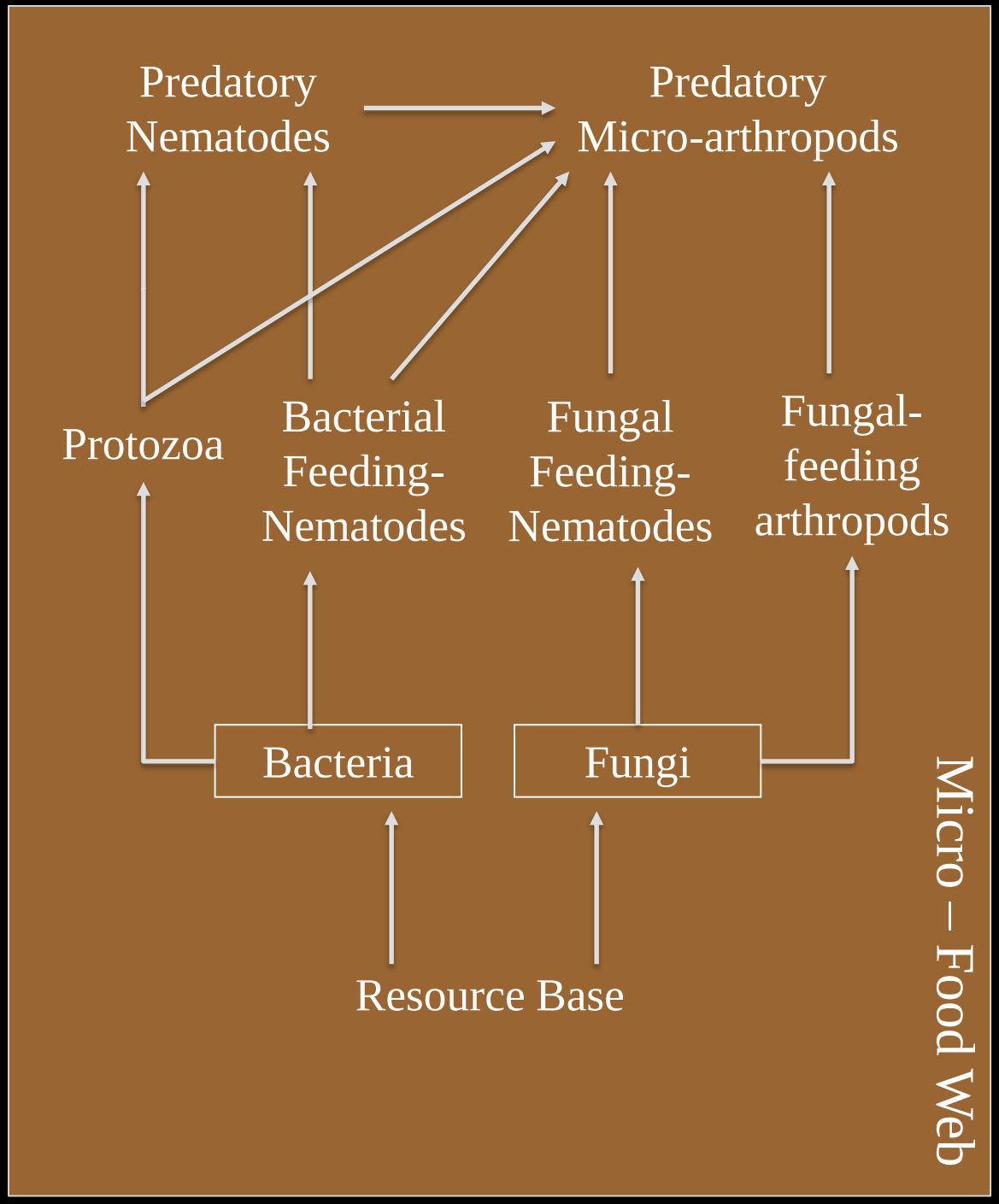
Soil Organisms

- Creatures that spend all of part of their lives in the soil environment





Litter Transformers

SAPROTROPHIC
Macro-arthropods
Meso-arthropods
Micro-arthropods

PREDATORY
Macro-, meso-arthropods

Ecosystem Engineers

MIXERS, STRUCTRE BUILDERS

Ants
Termites
Earthworms

Macro-fauna

Meso-fauna

Water films

Rotifers

Fungivore nematode

Protozoa

Micro-fauna

aka coneheads

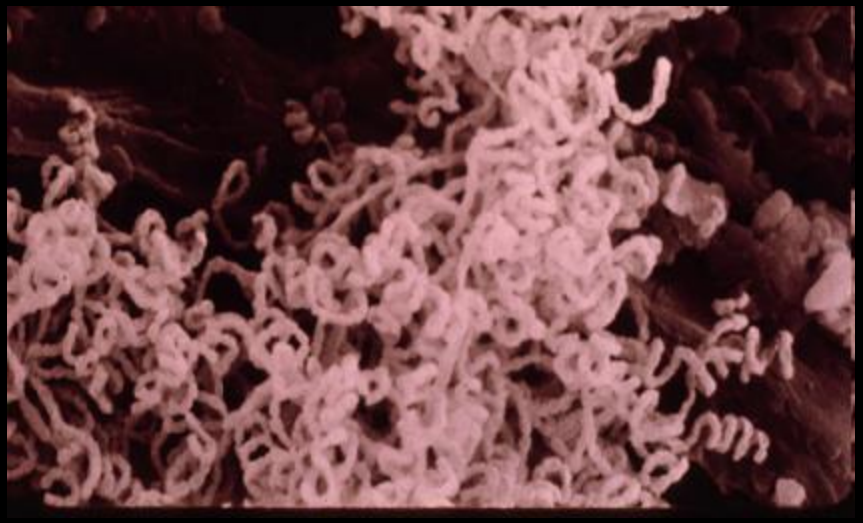
Protura

Mite

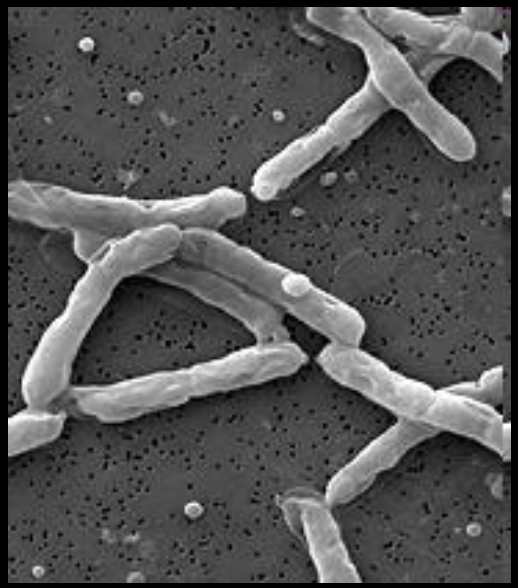
Springtail

Micro-flora

Fungi

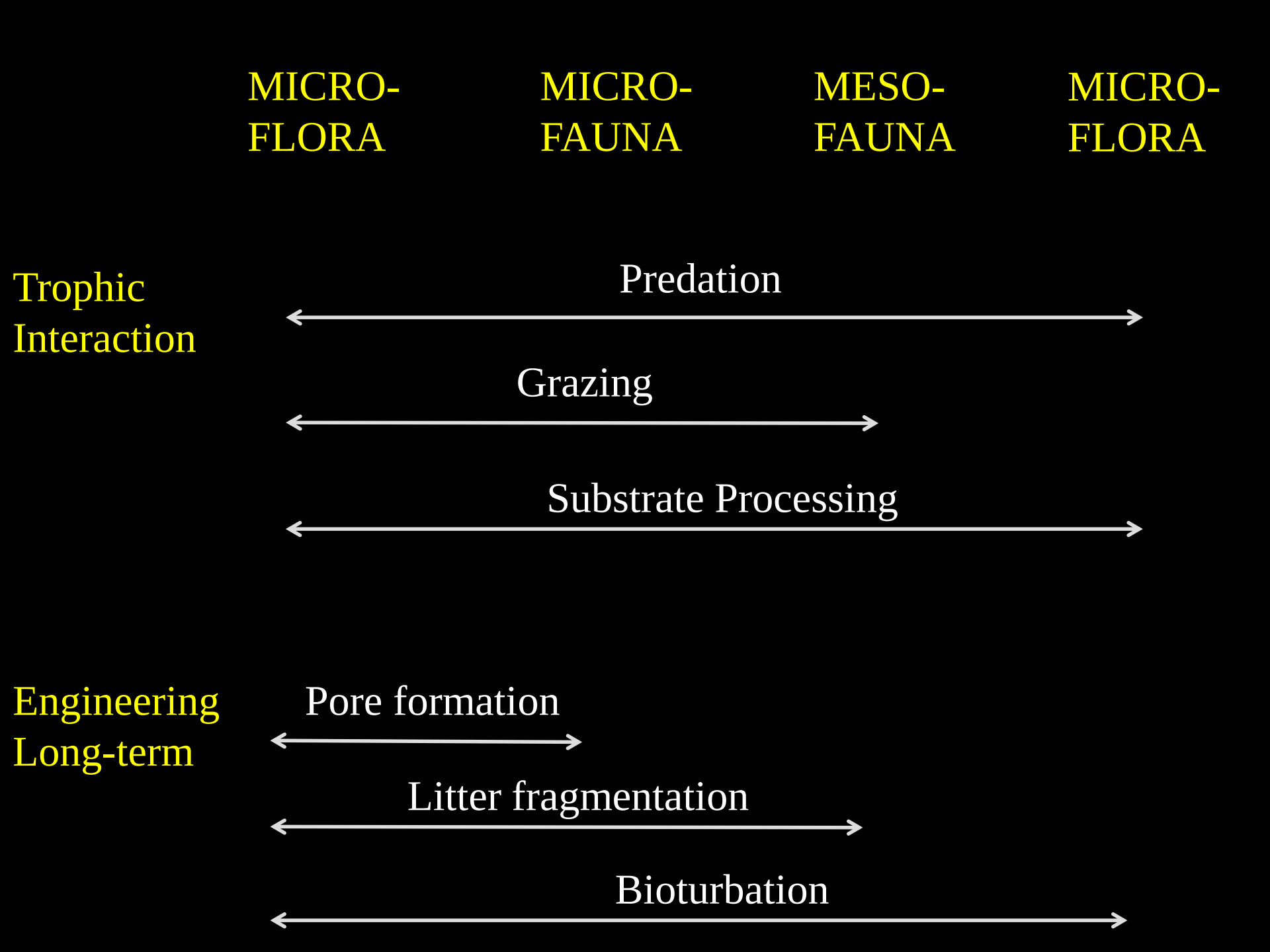


Actinomycetes



Bacteria

Bacteria+Fungal Hyphae


MICRO-
FLORA
MICRO-
FAUNA
MESO-
FAUNA
MICRO-
FLORA
Trophic
Interaction
Predation
Grazing
Substrate Processing
Engineering
Long-term
Pore formation
Litter fragmentation
Bioturbation

Soil Parameters influencing Soil Biology

Organic Matter Availability and Type – C, N, P, S
transformation occurs in rhizosphere

Living Biomass Abundance
predation to obtain nutrients

Soil Physical Properties
texture and aggregation

Soil Water

Soil Atmosphere

Soil pH

Soil Temperature

Soil Light

Soil Microsites

Organisms Facilitate:

decomposition of organic material

mineralization of elements (N,P,S) in OM

transformation of inorganic elements

N fixation (rhizobium in root nodules)

Decomposition

- Serves to reduce dead residue to CO2 and soil organic matter
- Releases nutrient elements into the soil to drive the food web and re-accumulation by plants

- Driven by soil microbial activity

Mineralization

- Release of organically bound nutrients (N, P, S) into plant-available , inorganic forms

Transformation

- Nitrification
  - Organic N – biomass N – ammonium – nitrite – nitrate
  - Carried out by bacteria
- Denitrification
  - nitrate replaces oxygen as an electron acceptor during microbial respiration
  - Carried out by bacteria
  - Loss as N2O and N2

N-Fixation

- Six main types of N fixing organisms:
  - Free living bacteria (*Bacillus, Klebsiella, Clostridium*)
  - Legume associations (*Rhizobium*)
  - Actinomycetes (*Frankia*)
  - Free living cyanobacteria (Nostoc, Anabaena)
  - Symbiotic cyanobacteria (as in lichen)
  - Bacteria loosely assoc. with root