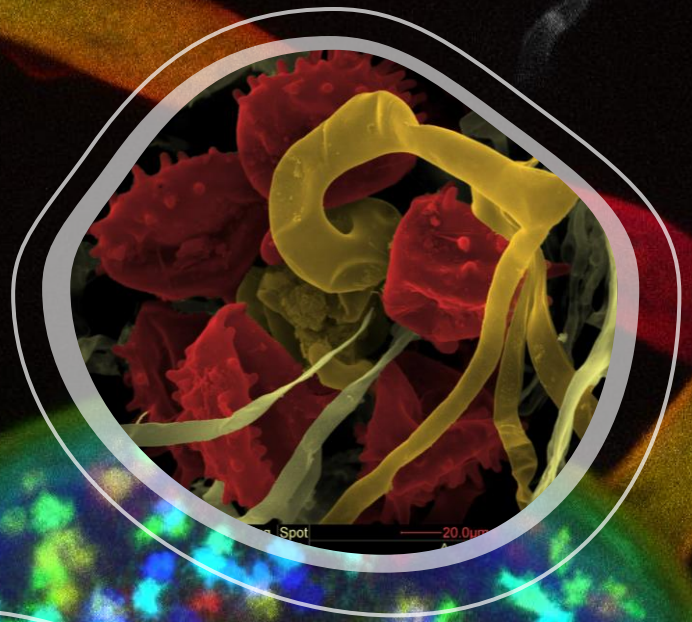
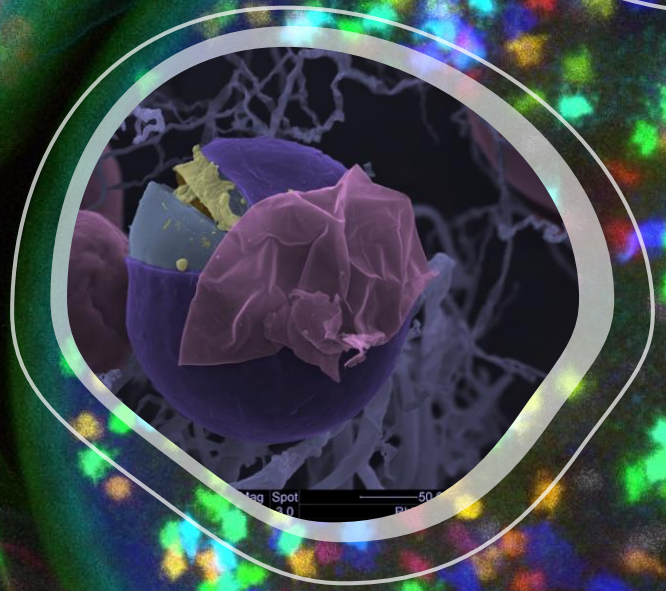
A fungal world beneath our feet

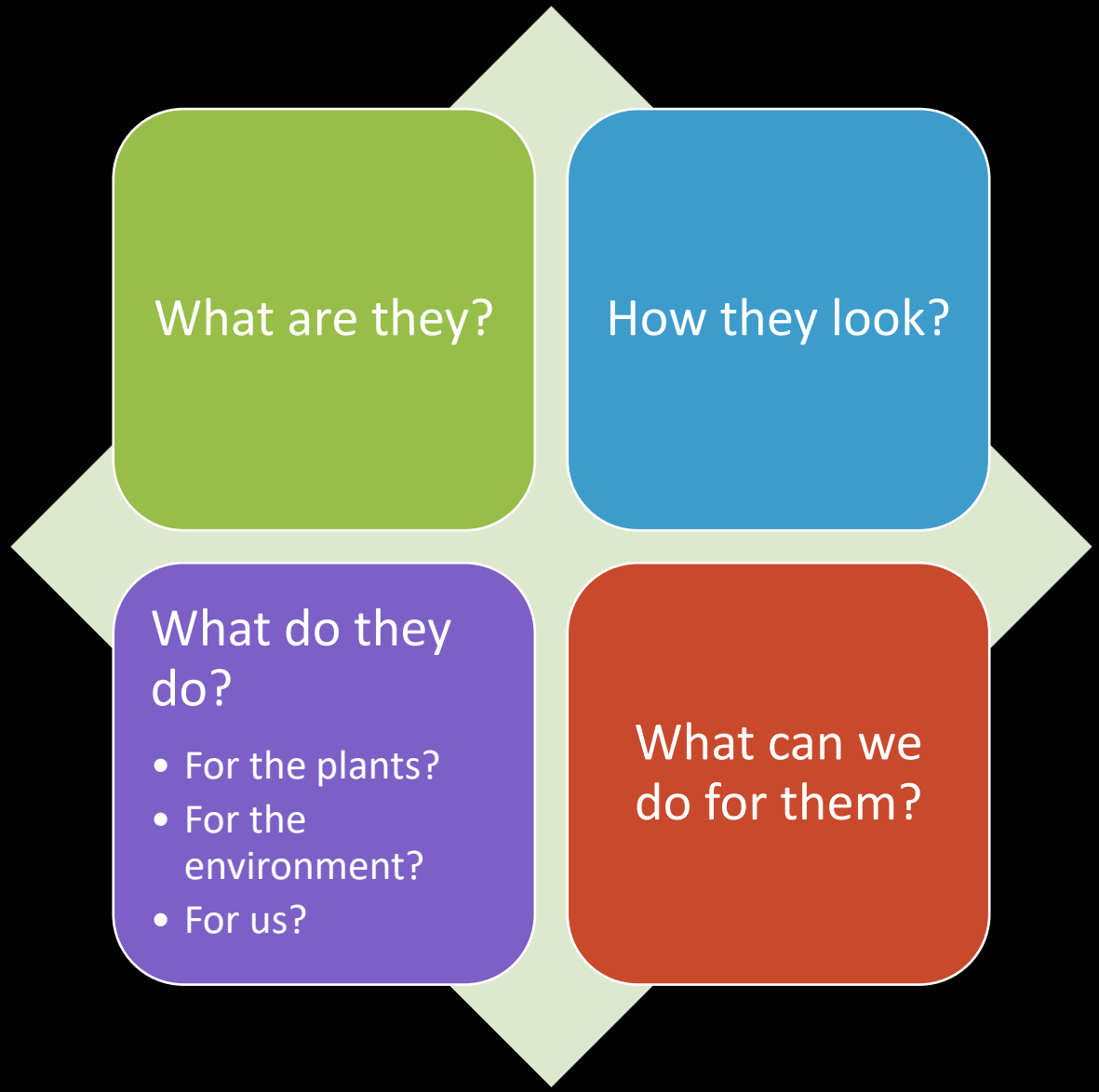
Vasilis Kokkoris

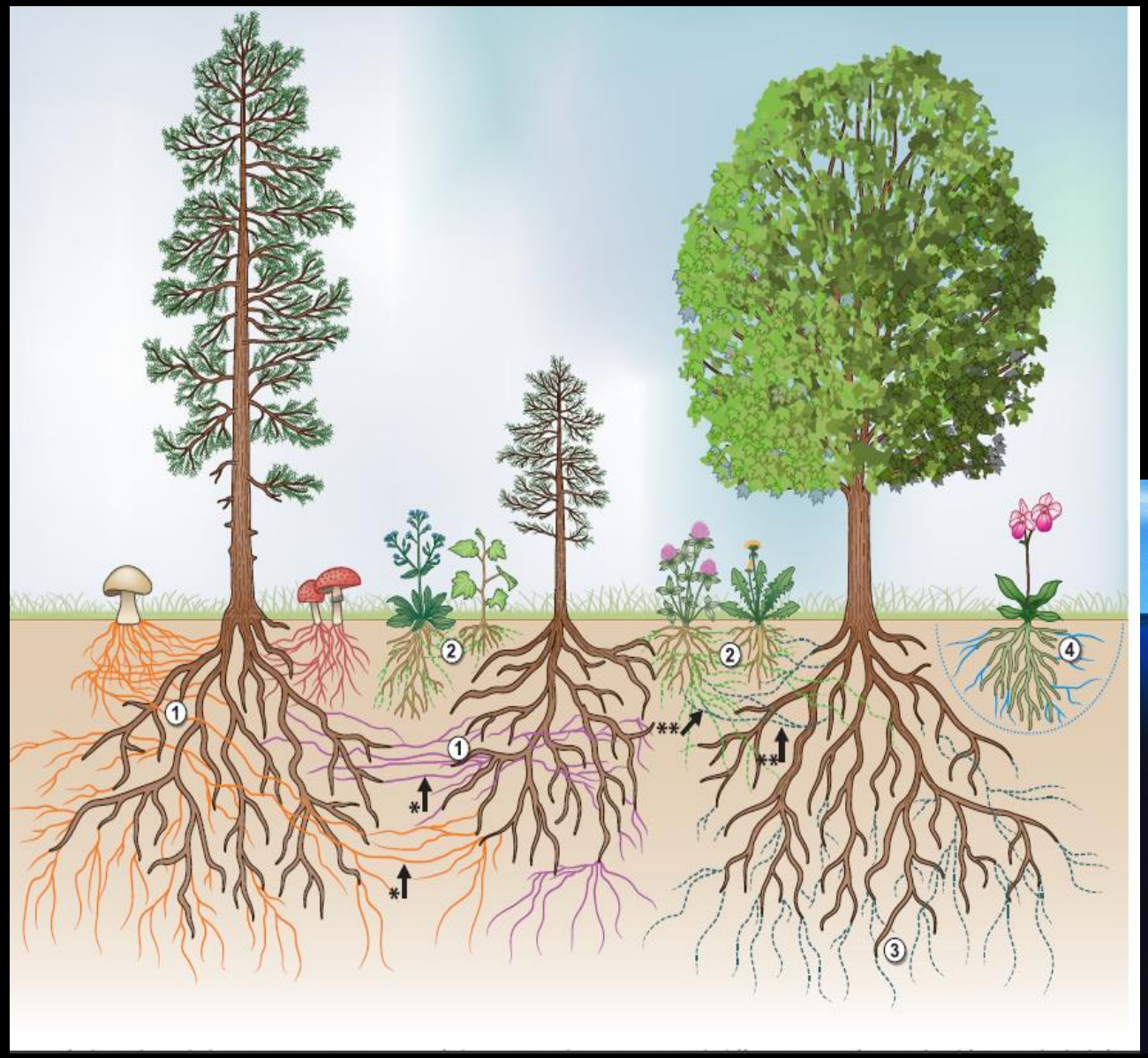
VU Amsterdam





Mycorrhizal fungi




1
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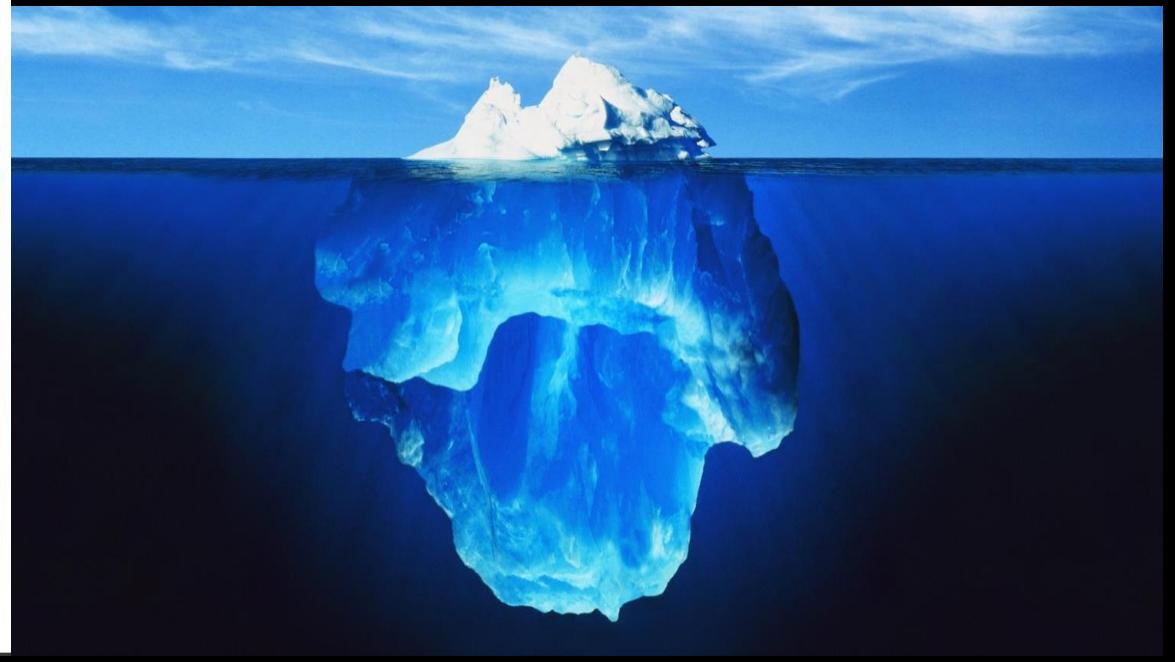
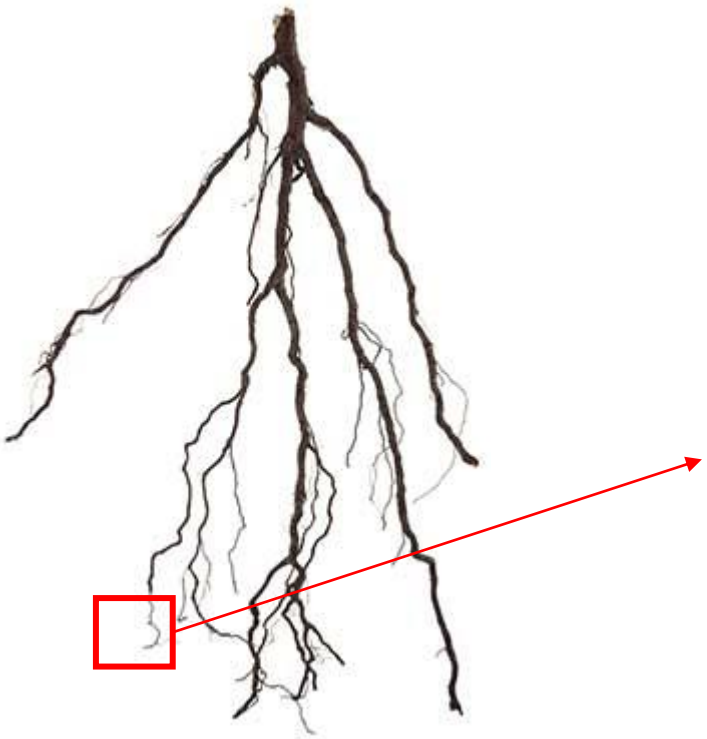
3

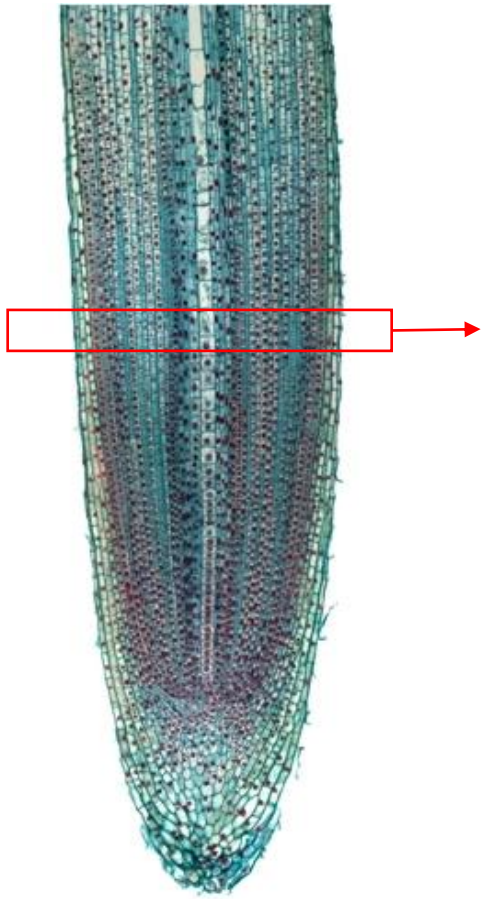


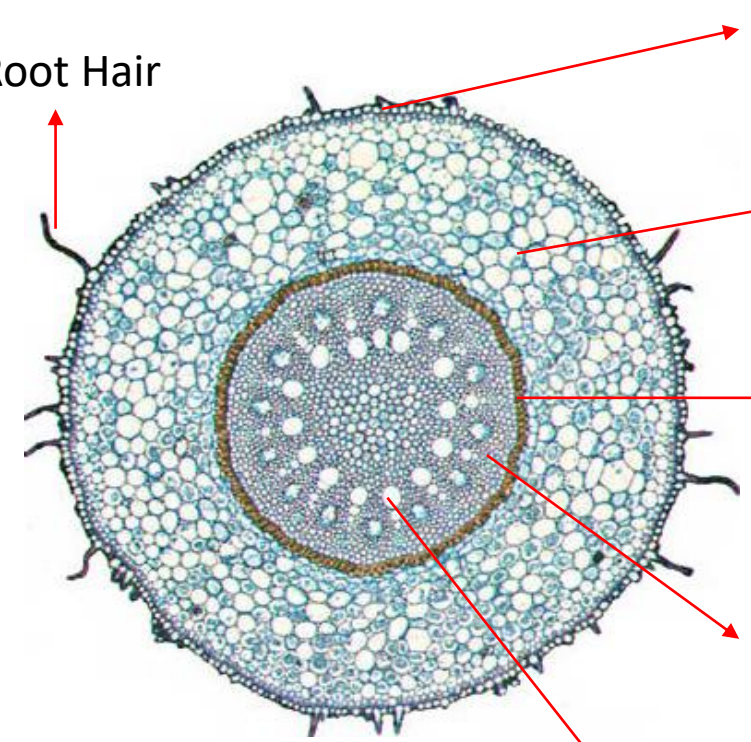
Mycorrhizas

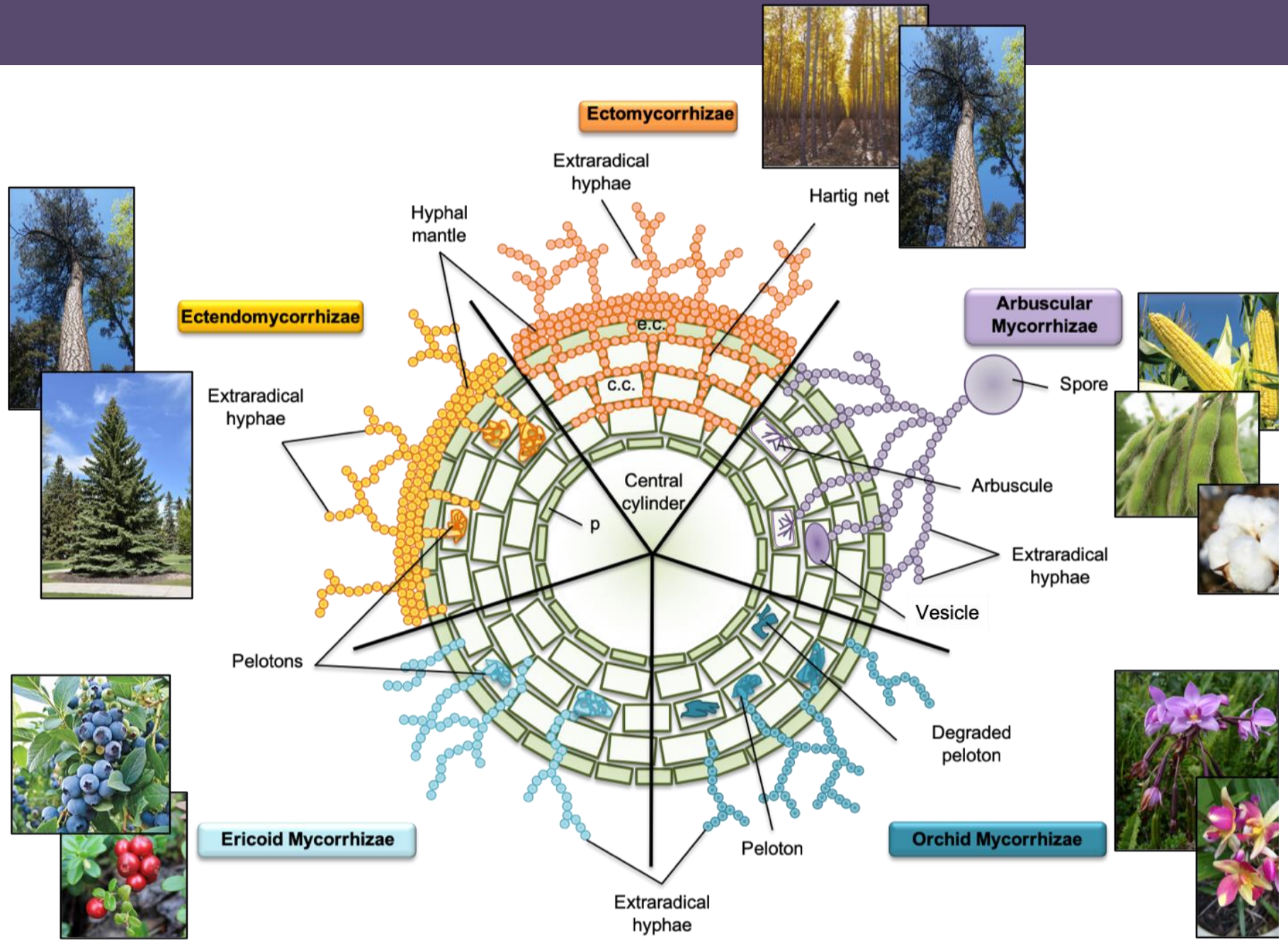
The most widespread symbiotic association between a mycorrhizal fungus and a plant

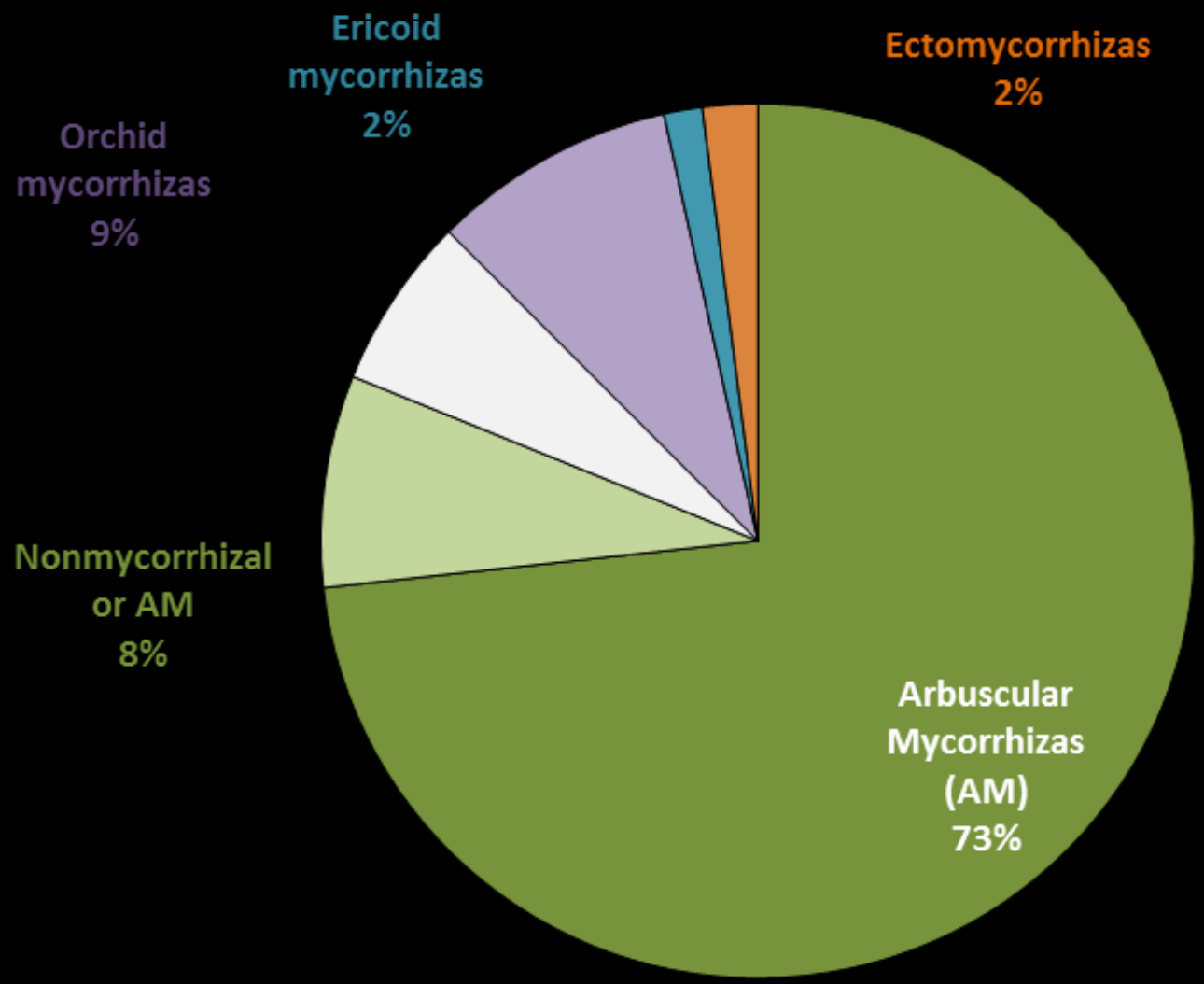
Root microscopy



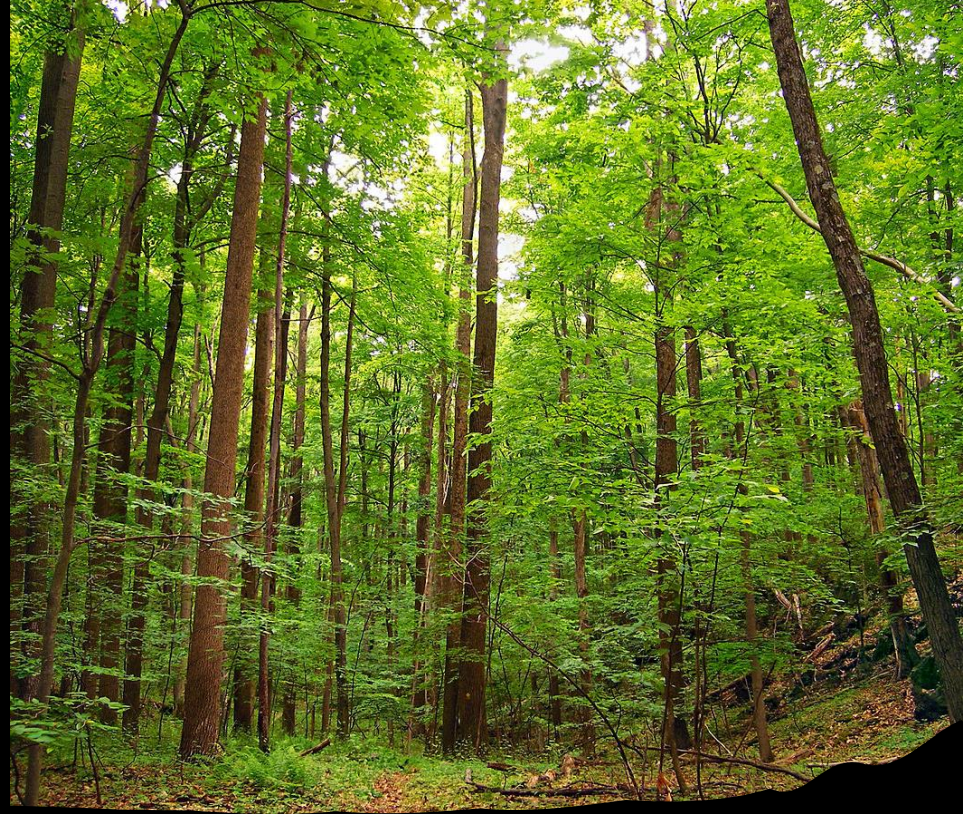




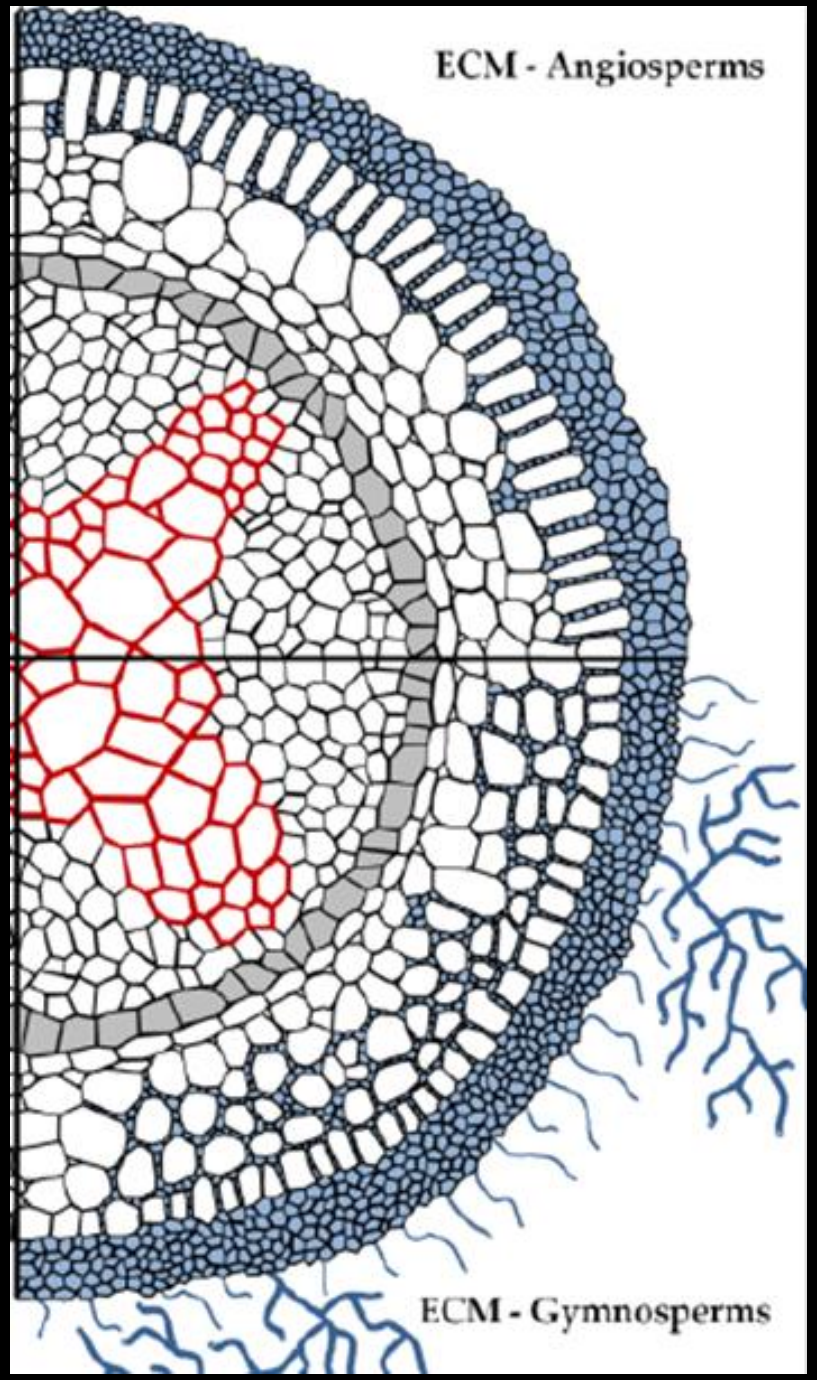

Ectomycorrhizae
Extraradical hyphae
Hartig net
Hyphal mantle
Ectendomycorrhizae
e.c.
c.c.
Extraradical hyphae
Arbuscular Mycorrhizae
Spore
Central cylinder
p
Arbuscule
Extraradical hyphae
Vesicle
Pelotons
Degraded peloton
Peloton
Extraradical hyphae
Ericoid Mycorrhizae
Orchid Mycorrhizae

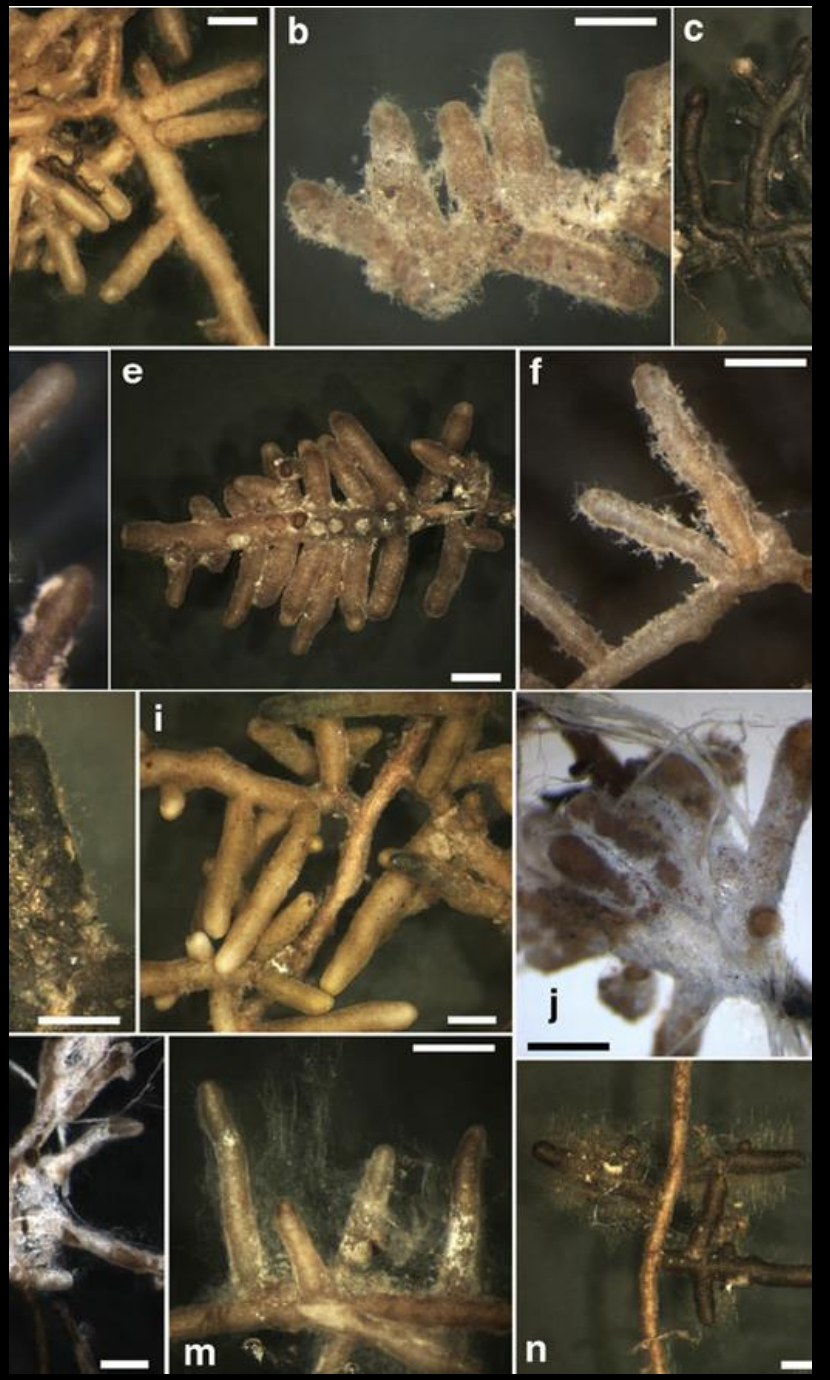


Brundrett 2009



Ectomycorrhizal fungi


ECM - Angiosperms
ECM - Gymnosperms


b
c
e
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i
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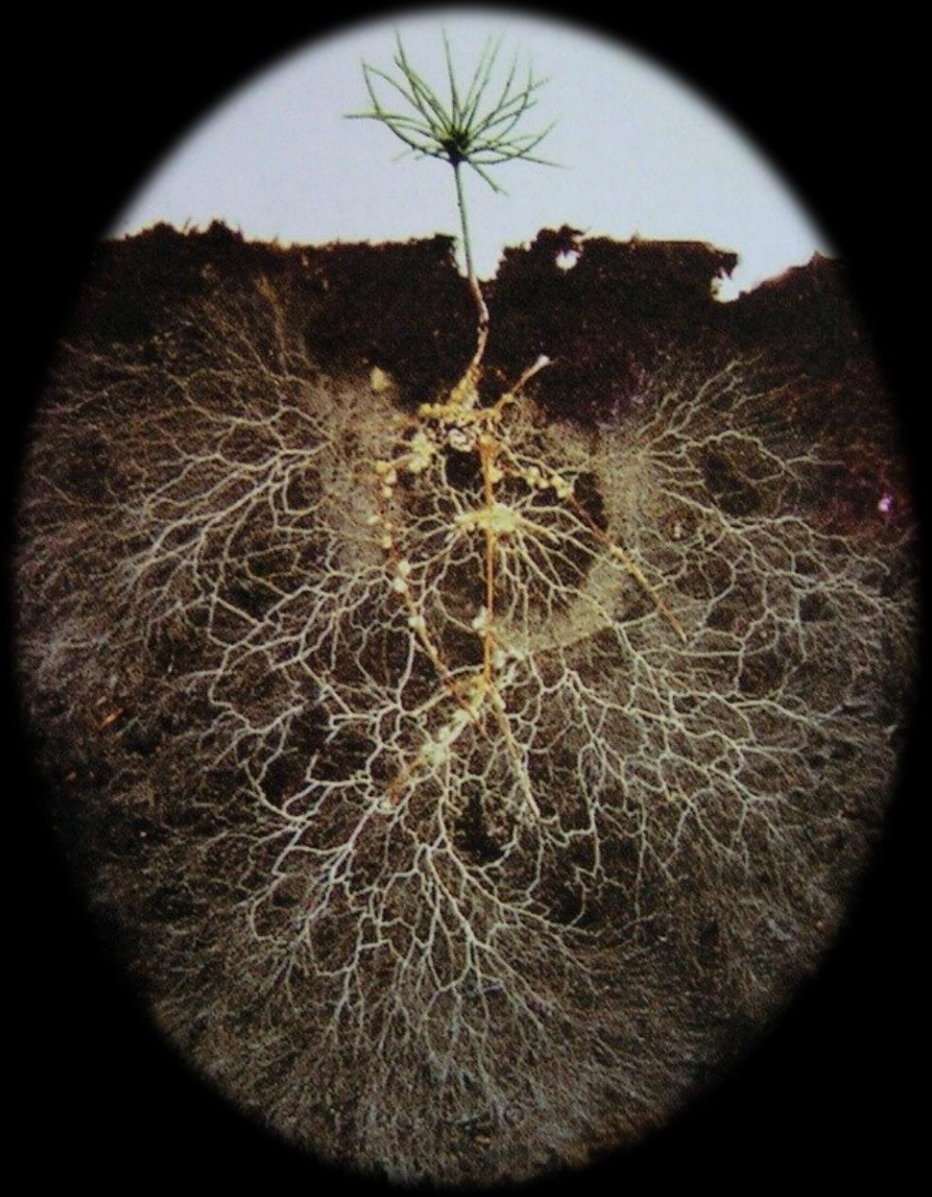
m
n

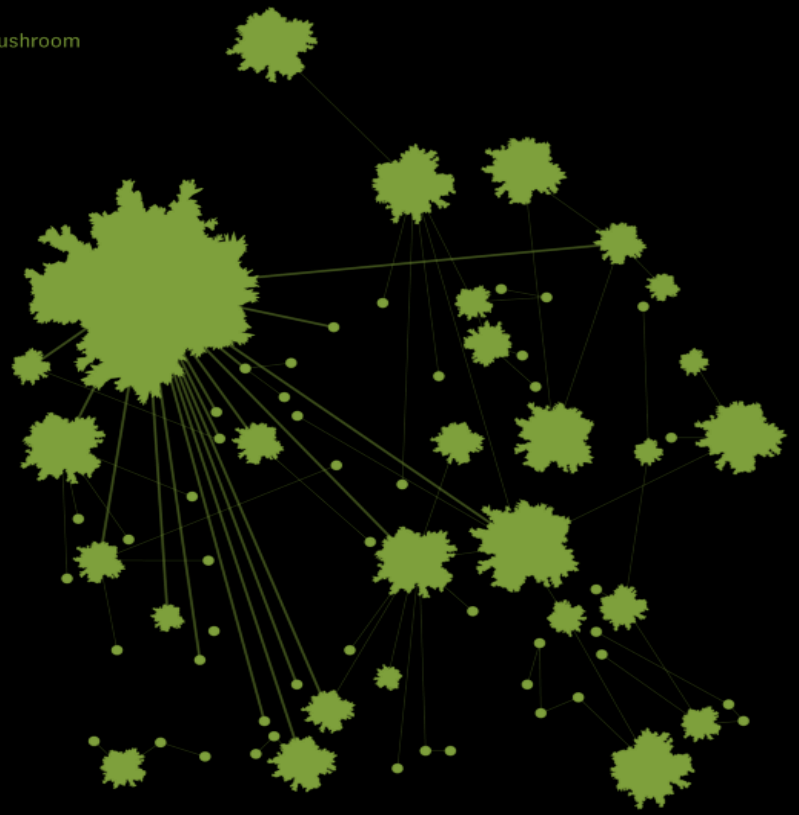
As big as 1,665 football fields, or nearly four-square miles (10 square kilometers)

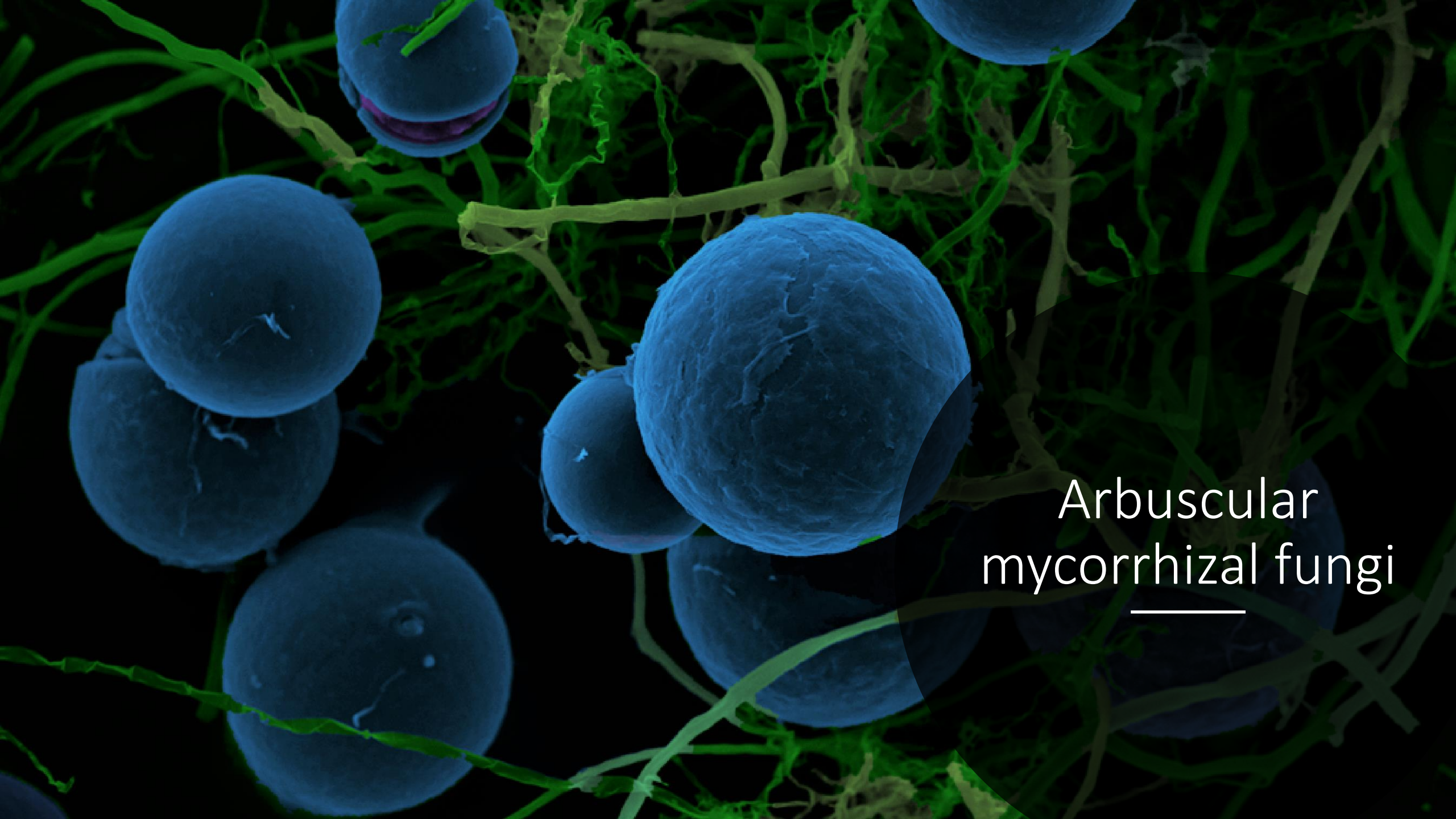


WOOD WIDE WEB

Tree

Mushroom





Arbuscular mycorrhizal fungi

Fungal networks have driven massive changes in the earth's atmosphere: The rise of plant-fungal partnerships corresponds with an inconceivable 90% reduction in atmospheric CO2 levels.

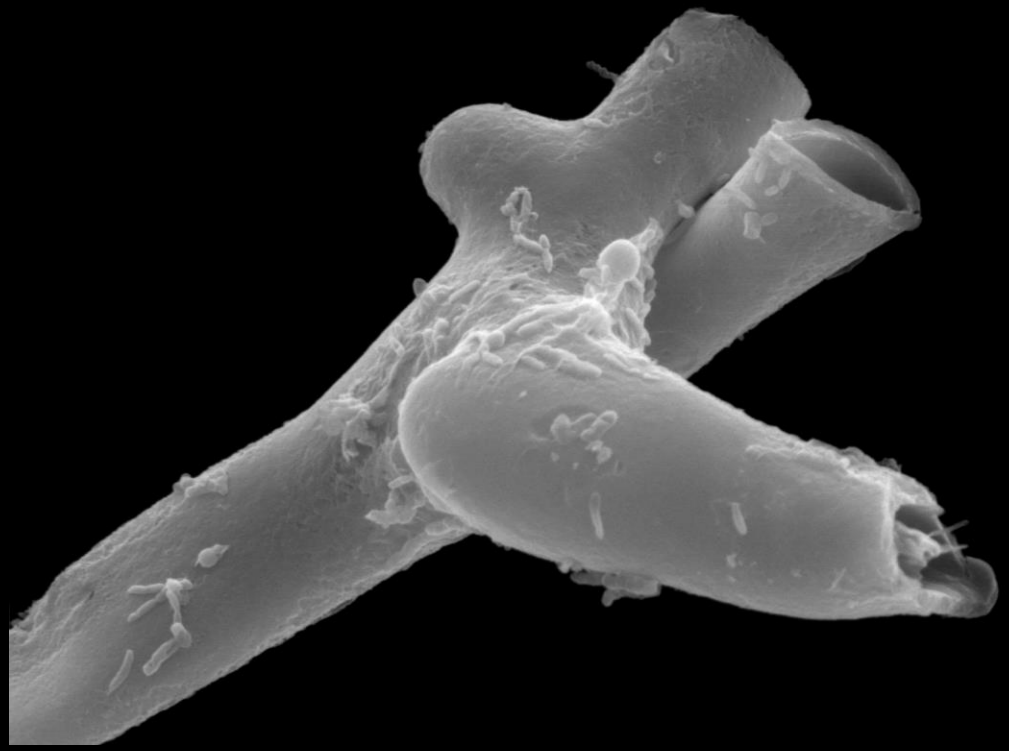
450 million years ago, fungal mycelium facilitated the movement of aquatic plants onto land, serving as plant root systems for tens of millions of years until plants evolved their own roots.

AMF fungal networks now dominate ecosystems like grasslands, which cover about 25% of land on Earth and contribute almost 20% of terrestrial carbon sinks.

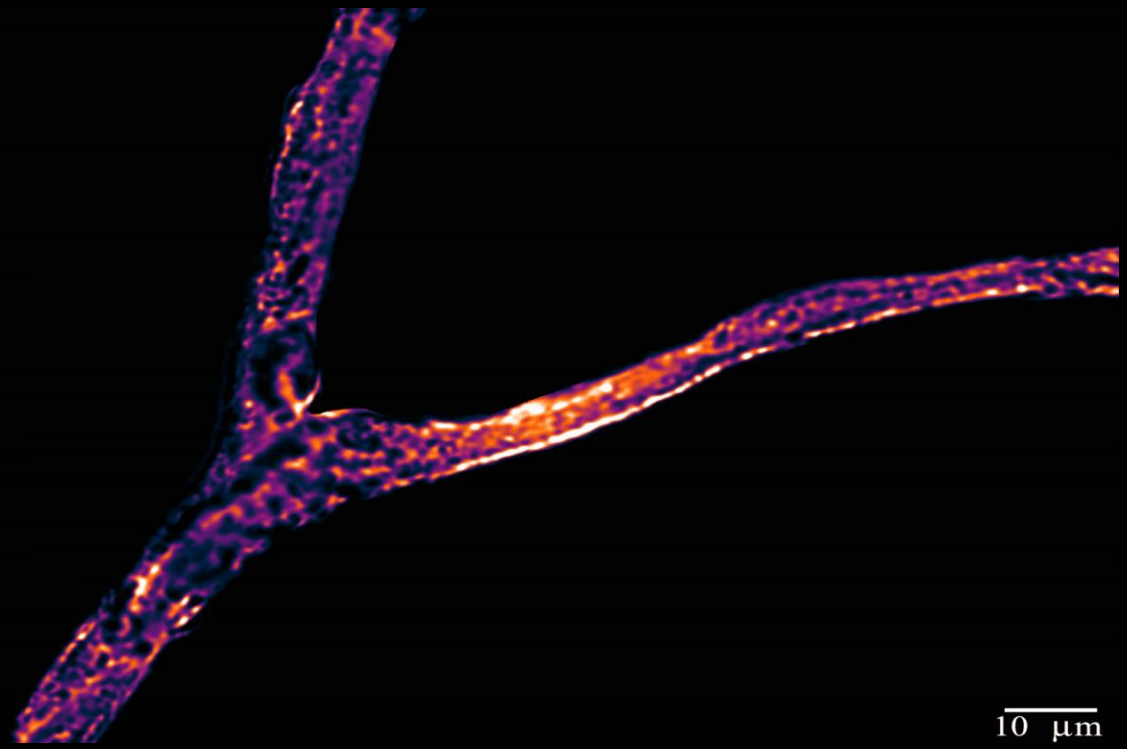
If you could look under single hectare of grasslands, you would find ~90 billion meters of fungal hyphae – that is equivalent to the length of 12.9 million Amazon rivers per hectare.

Underground hyphal “rivers”

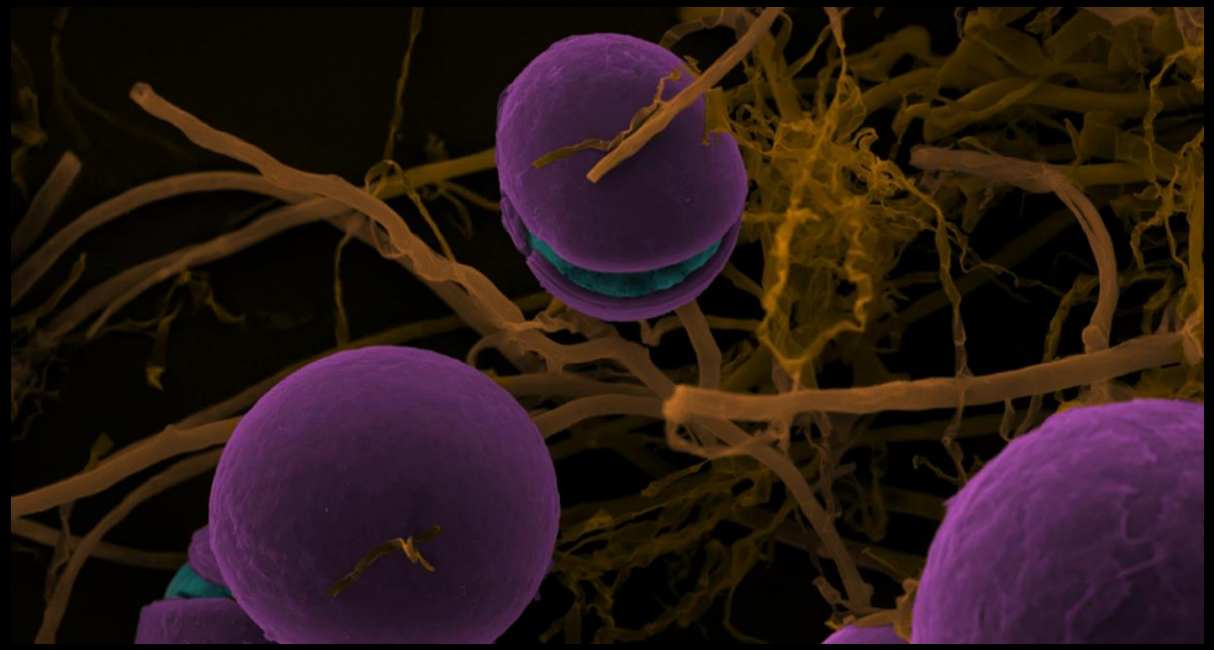
Fungal networks make up to 50% of the living biomass of soils.



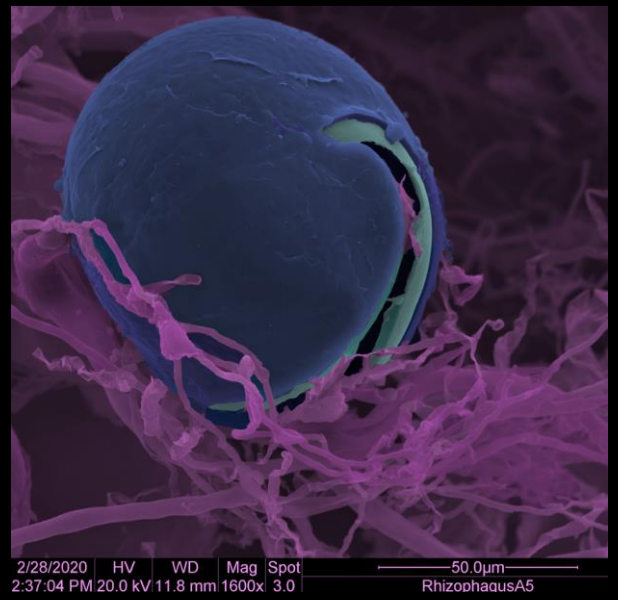
0.00 s

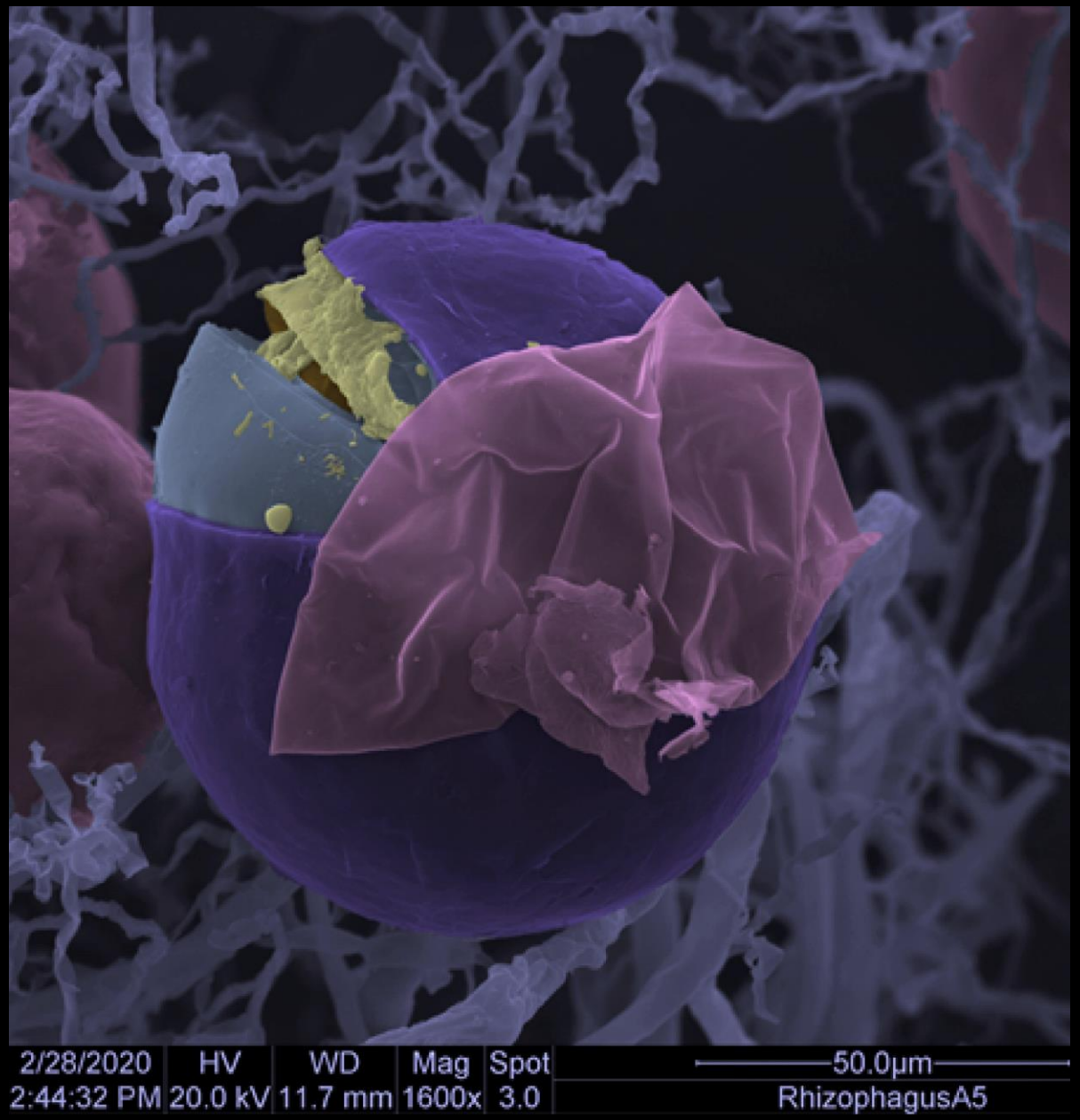


10 µm

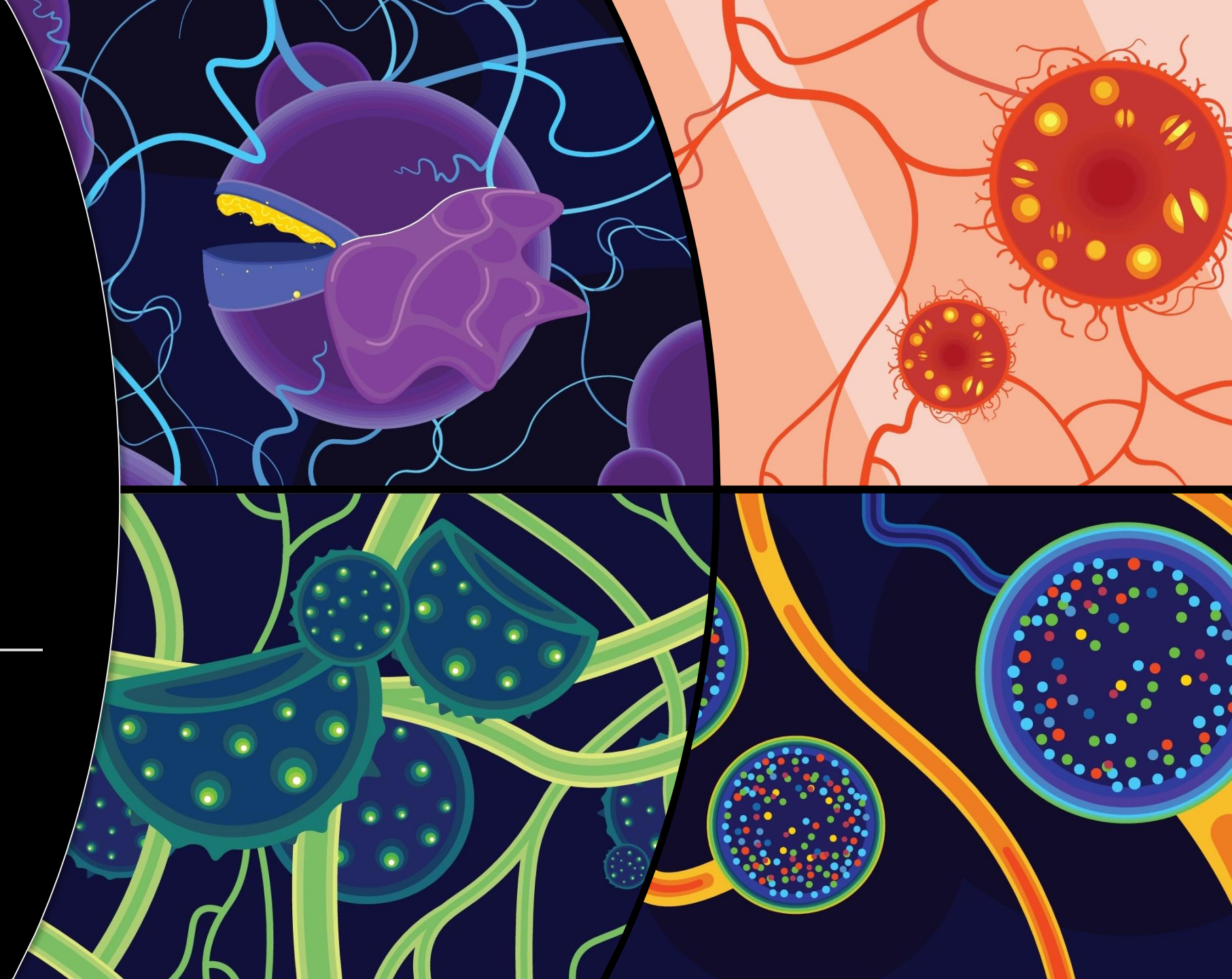


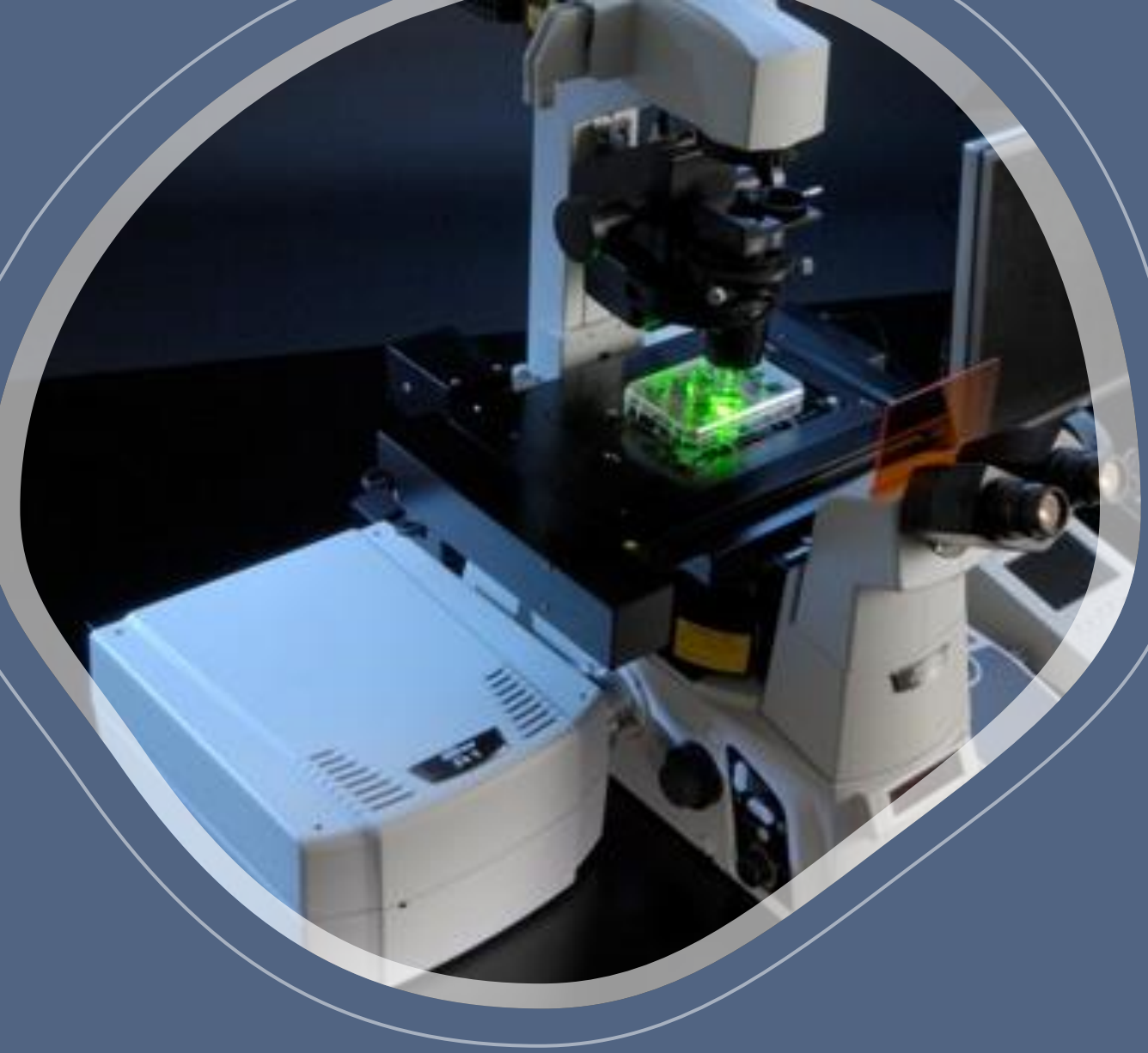

0 HV WD Mag Spot
M 20.0 kV 9.9 mm 3000x 3.0
20.0µm
Auxiliary

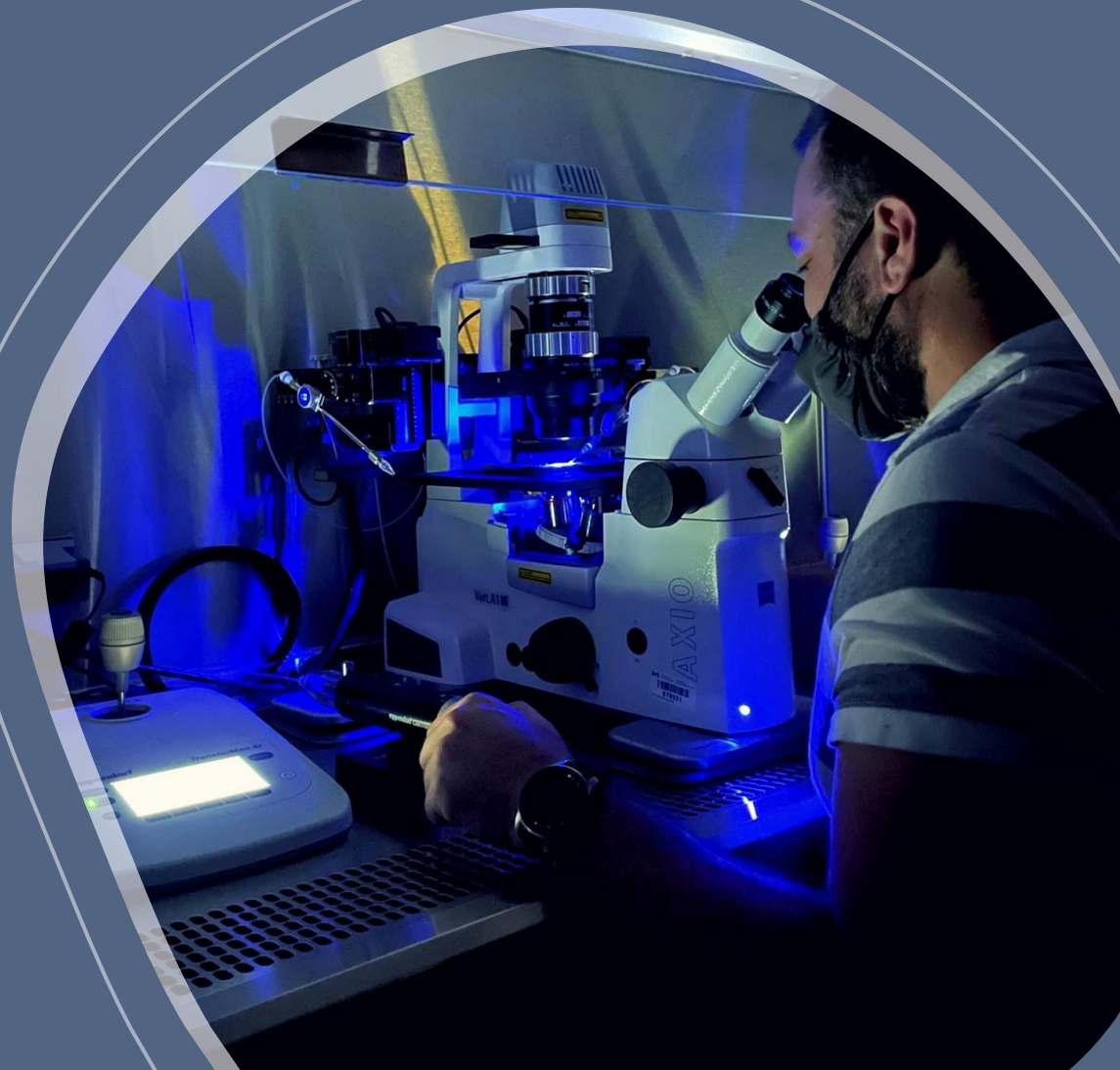

2/28/2020 HV WD Mag Spot
2:37:04 PM 20.0 kV 11.8 mm 1600x 3.0
50.0µm
RhizophagusA5

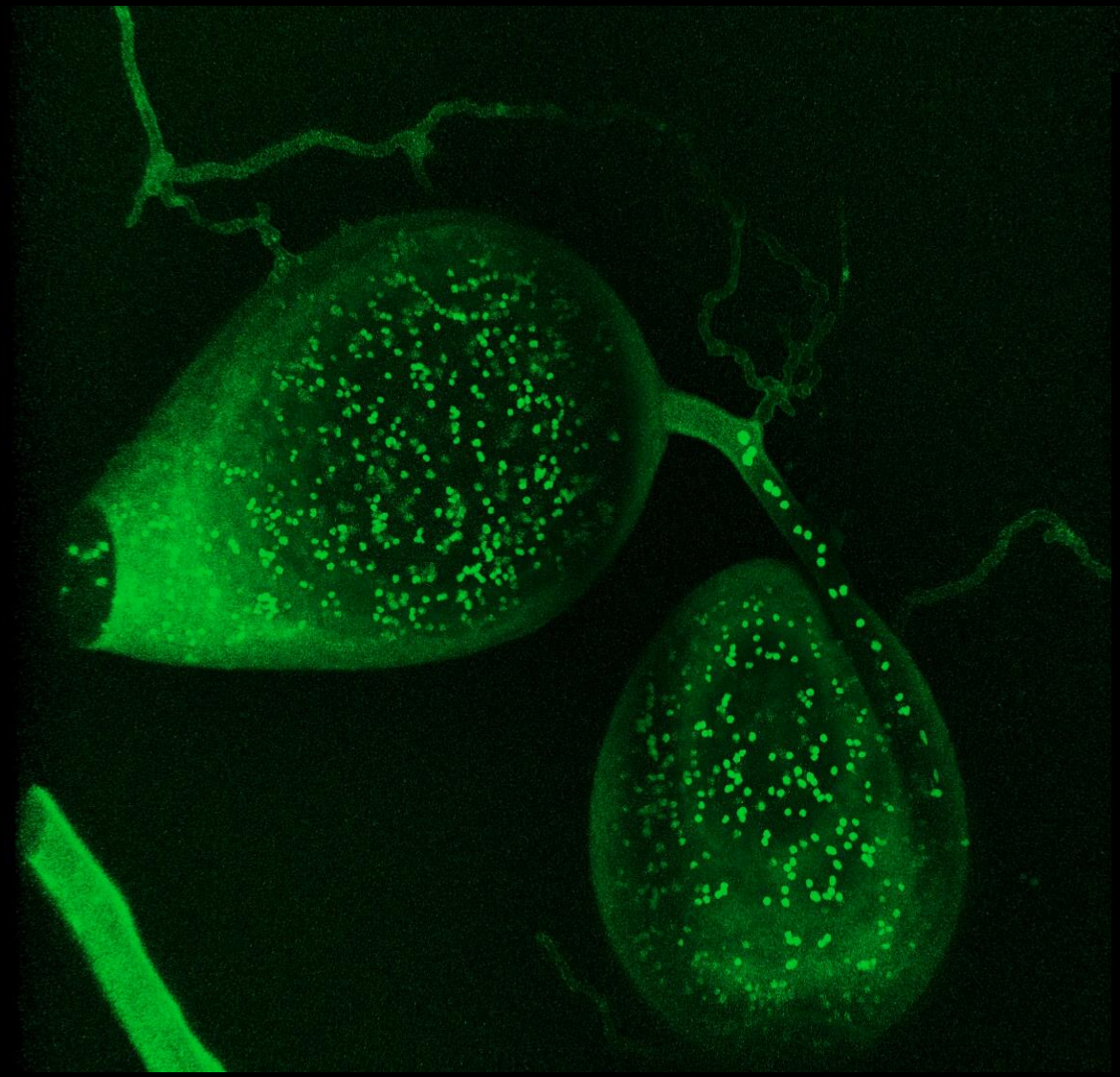

2/28/2020 HV WD Mag Spot
2:44:32 PM 20.0 kV 11.7 mm 1600x 3.0
50.0µm
RhizophagusA5

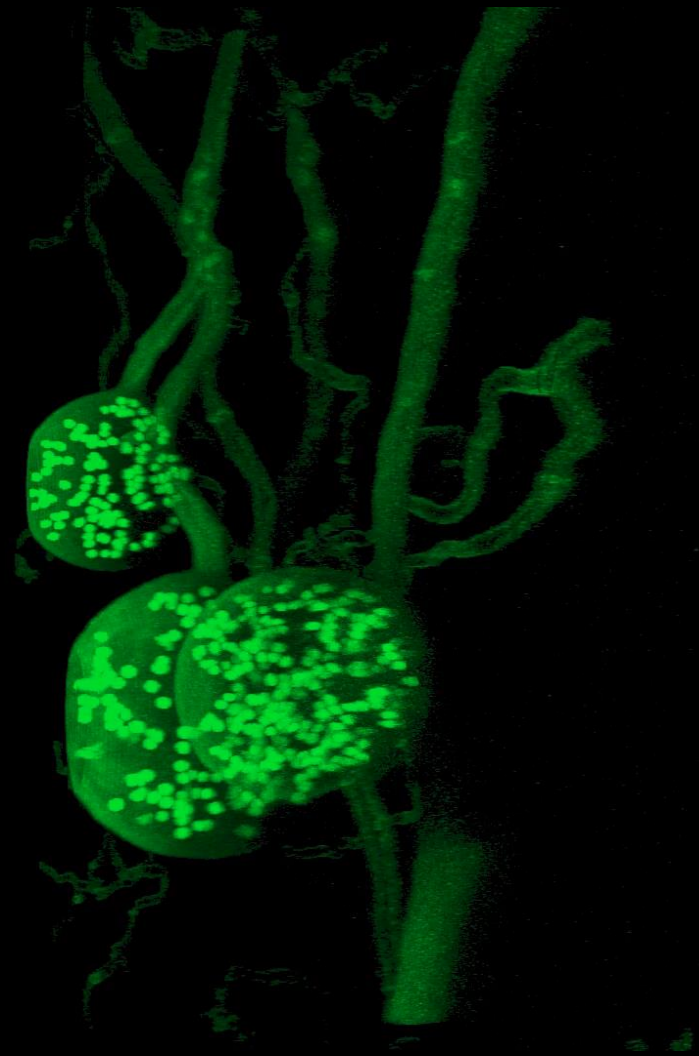
Mycorrhizal art!

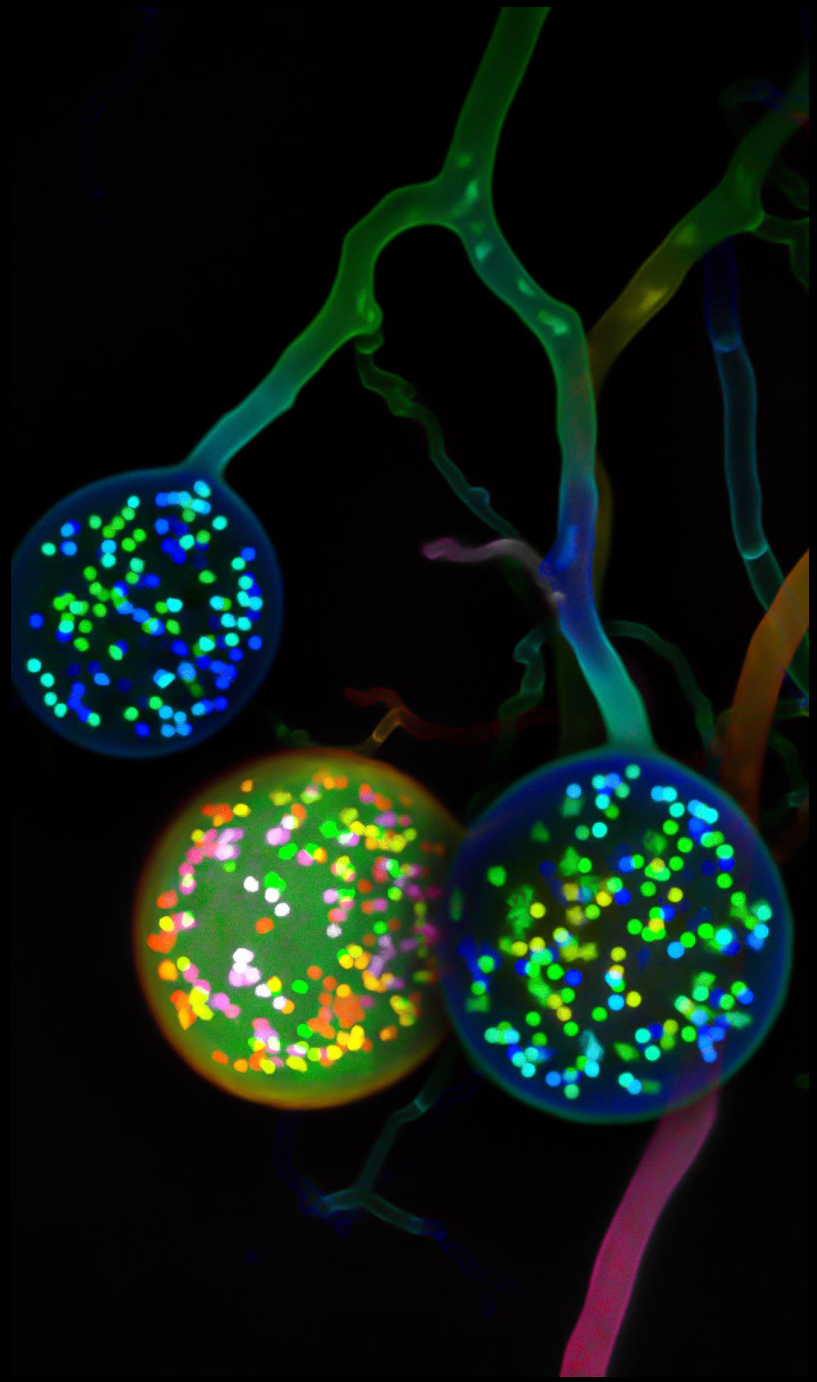


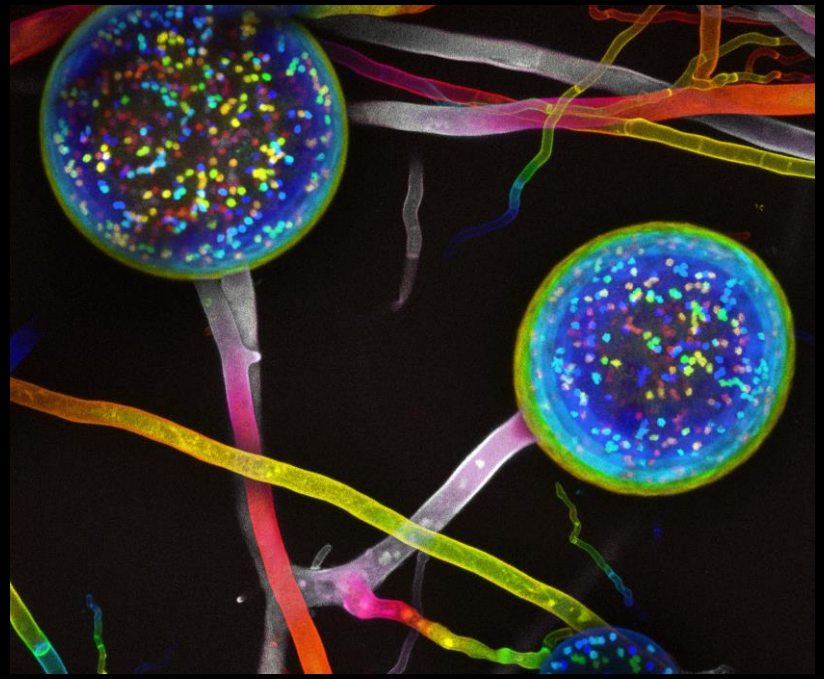


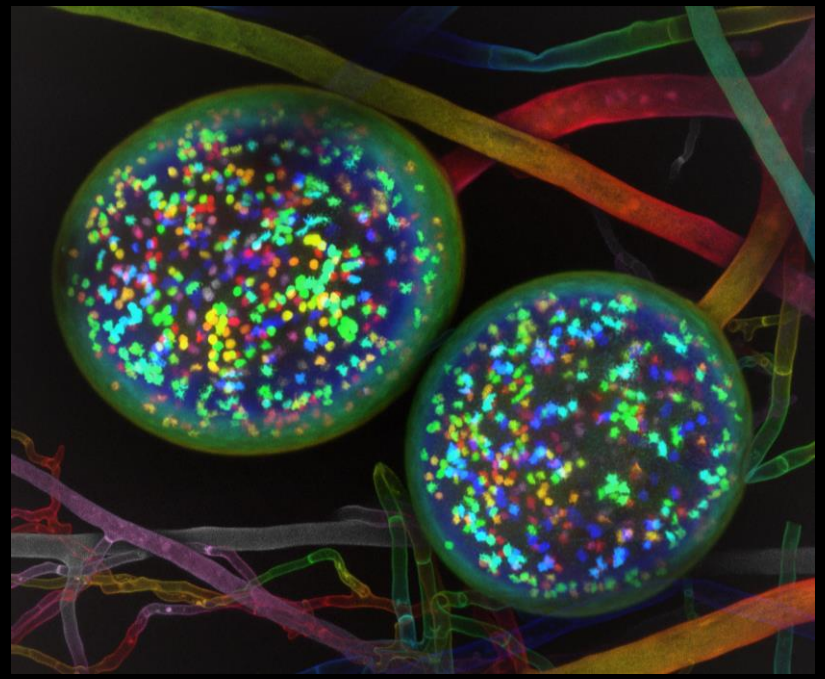

AXIO

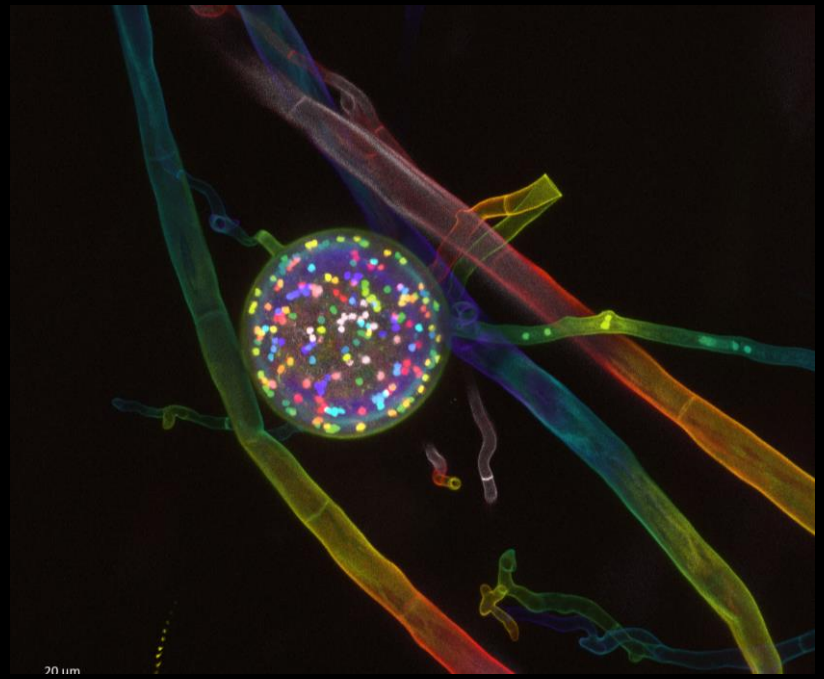






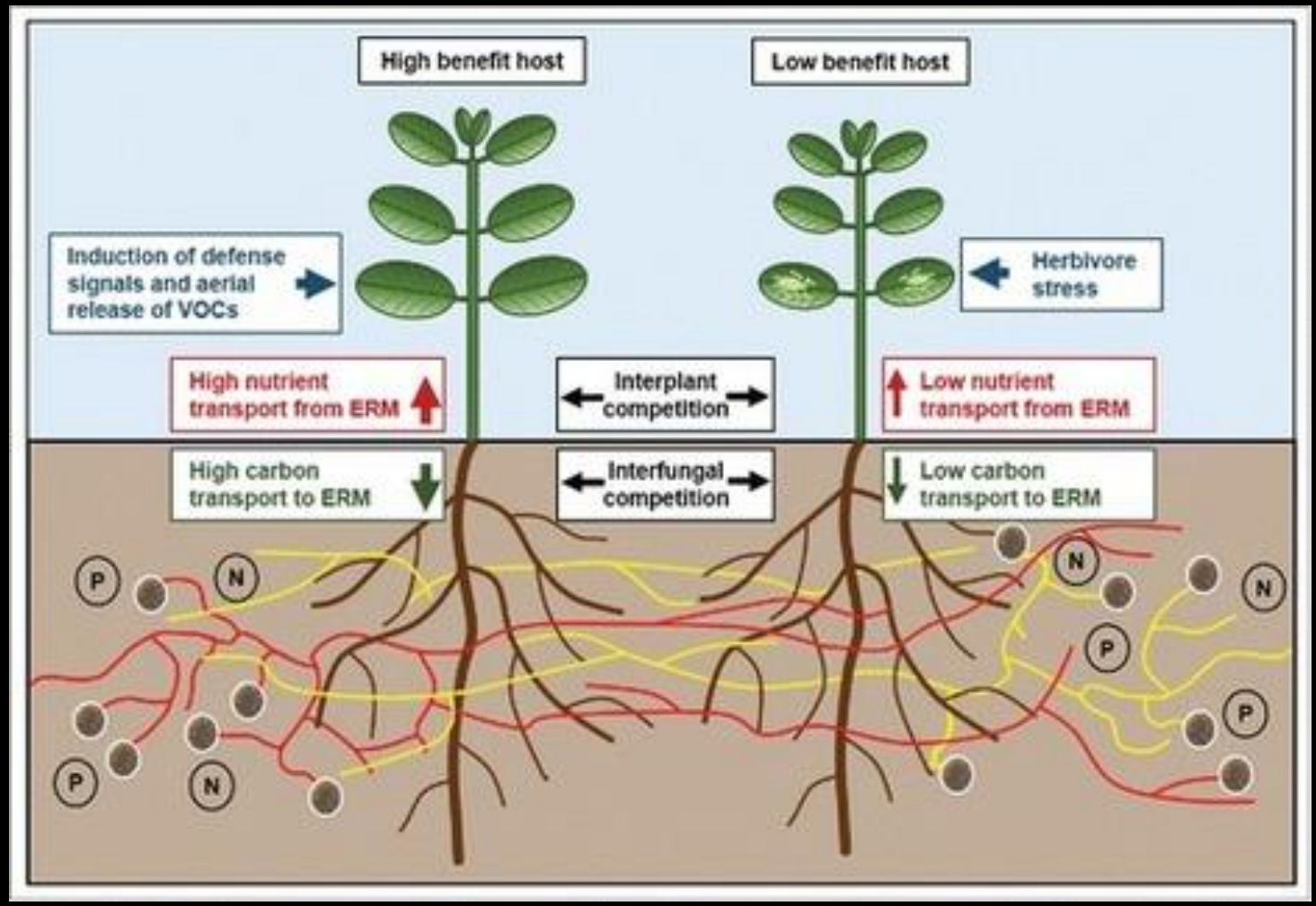


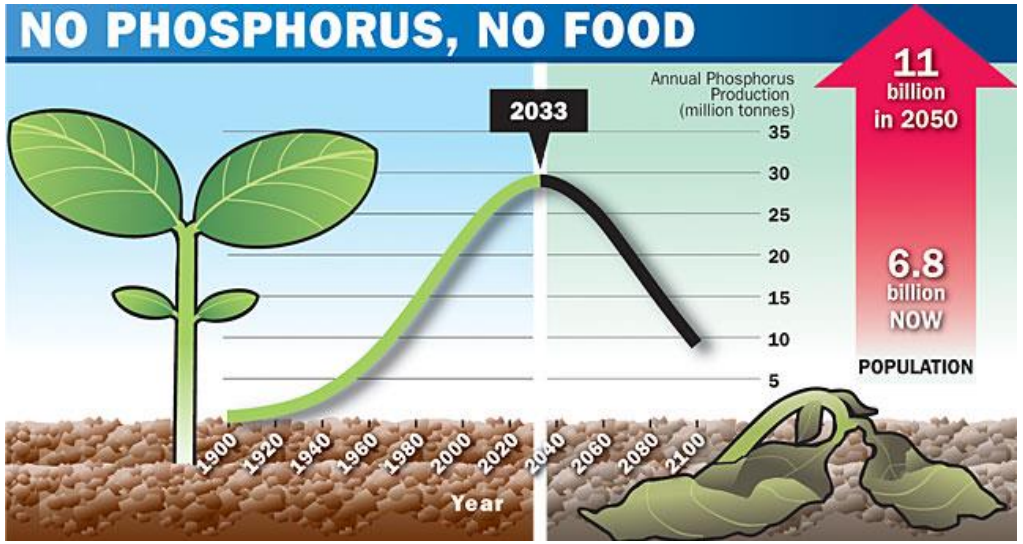


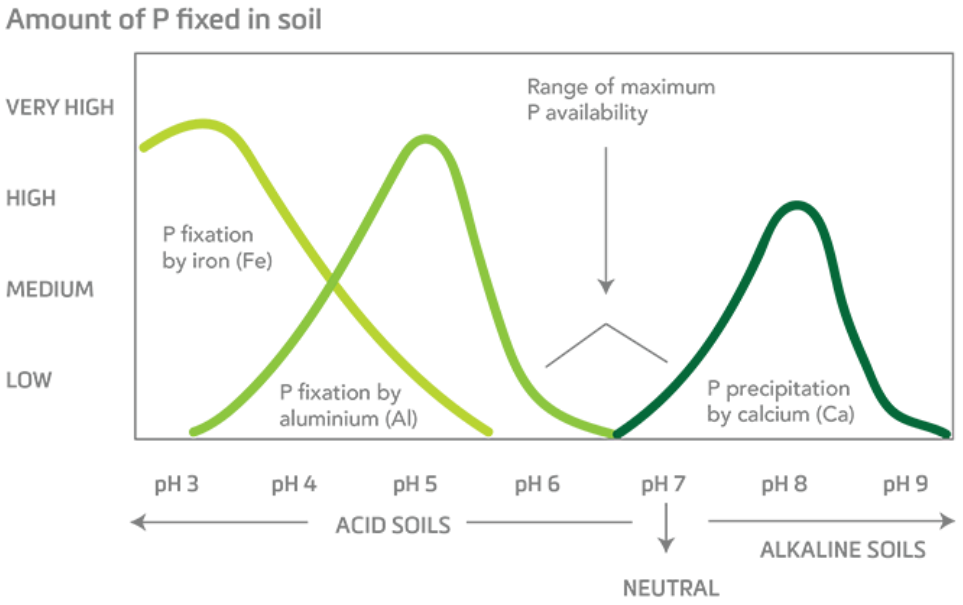

20 µm

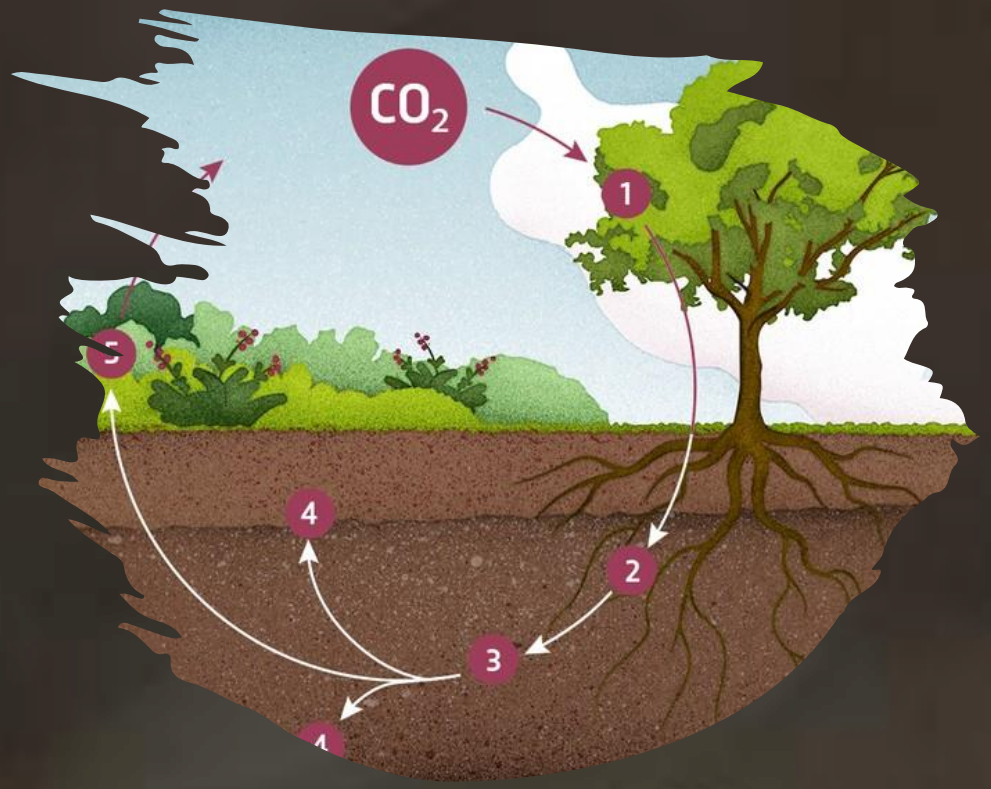
What is their role?

- nutrient uptake
- water relations
- pathogen defense
- stress tolerance
- soil aggregation
- soil food web
- Soil networks (Carbon sequesters)




NO PHOSPHORUS, NO FOOD
Annual Phosphorus Production (million tonnes)
2033
11 billion in 2050
6.8 billion NOW
POPULATION
35
30
25
20
15
10
5
1900
1920
1940
1960
1980
2000
2020
2040
2060
2080
2100
Year


Amount of P fixed in soil
VERY HIGH
HIGH
MEDIUM
LOW
Range of maximum P availability
P fixation by iron (Fe)
P fixation by aluminium (Al)
P precipitation by calcium (Ca)
pH 3
pH 4
pH 5
pH 6
pH 7
pH 8
pH 9
ACID SOILS
ALKALINE SOILS
NEUTRAL

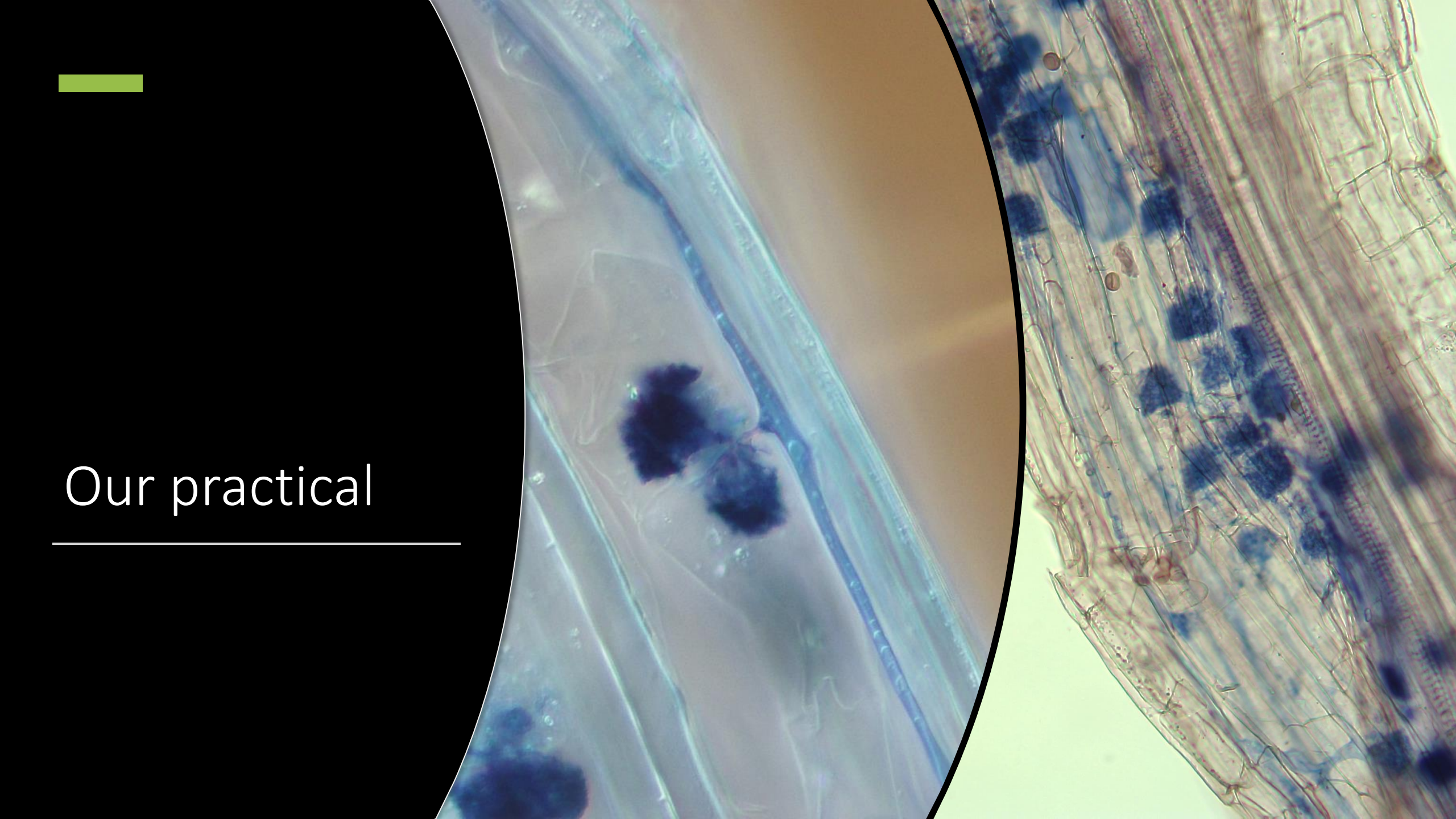


- More than 20 meters in 1g of soil
- Our research suggests that as much as 5 billion tons of carbon dioxide can flow into fungal networks each year
- A release of just 0.1% of the carbon now stored in Europe’s soils would be equal to the annual emissions from 100 million cars

75% of the terrestrial carbon is in the soil.


root rescue
Transplanter
Plant Starter • Démarreur de plantes
45g
180g
TRANSPLANTER
TRANSPLANTEUR
450g
Makes 750 L of solution! Fait 750 L de solution!
OMRI
Change Your World
Myco Apply®
Ultrafine Endo
MYCORRHIZAL INOCULANT
Contains viable mycorrhizal fungi propagules
EMPOWER YOUR ROOT
BioOrganics™
Mycorrhizal
Landscape Inoculant
AUXILIARY BIOTIC SOIL AND PLANT SUBSTANCE.
NON-PLANT FOOD INGREDIENT.
Many benefits may result from the use of this inoculant, including increased nutrient uptake and enhanced tolerance of various environmental stresses such as drought and soil salinity.
BIOTIC INGREDIENTS: Endomycorrhizal fungi spores, minimum 10 spores/cc each of: Glomus aggregatum, G. etunicatum, G. intraradices, G. mosseae; minimum 2 spores/cc each of G. clarum, G. deserticola, G. monosporus, Gigaspora margarita, Paraglomus brasilianum. Ectomycorrhizal fungi spores, minimum 30,000 spores/cc of Pisolithus tinctorius; 5000 each of Scleroderma cepa, S. citrinum; 2000 each of Rhizopogon amylpogon, R. fulvigleba, R. luteolus, R. villosullus, Laccaria laccata.
STORAGE: Store in cool location or refrigerate. Do not freeze. Avoid exposure to direct sunlight, Product expiration: 24 months after date on jar.
CONTENTS: 3 lbs. (1360 grams)
Bio Organics™
Adding Life to Soil

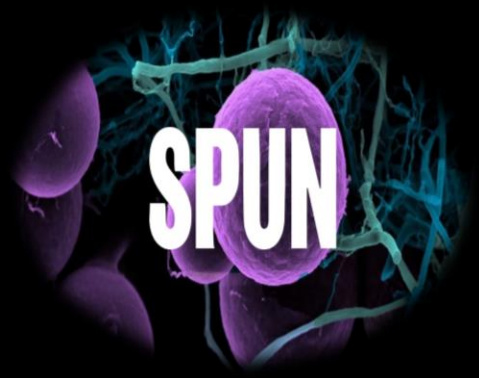
Our practical

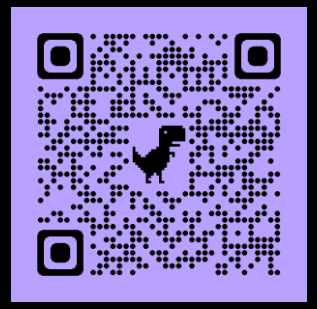


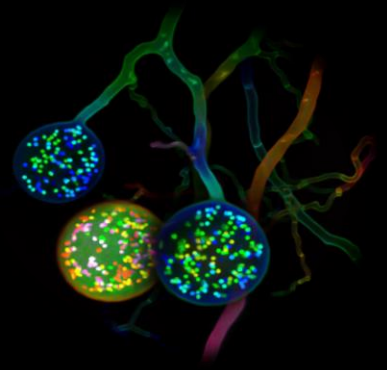
Visualisation Lab

MICROP
Harnessing the second genome of plants

Our practical







the living Soils workshop