

One Health, Many Microbiomes:

How microbes shape animal, human, and environmental health

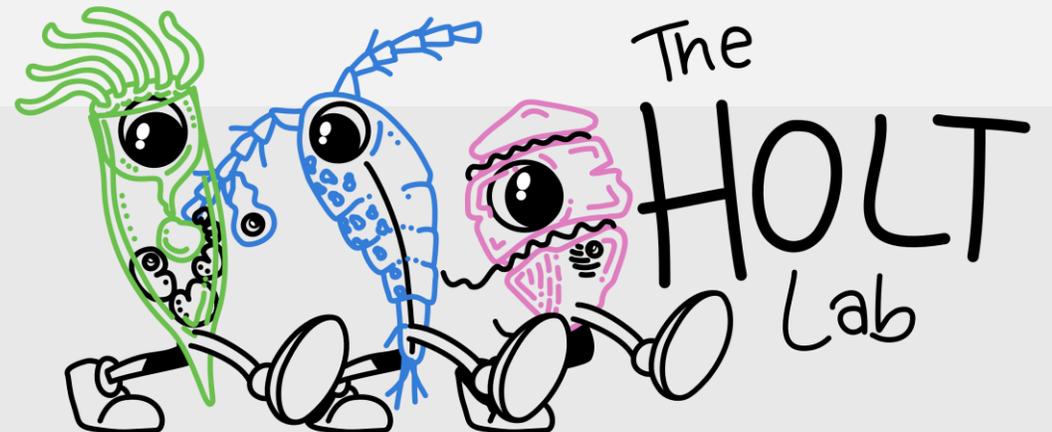
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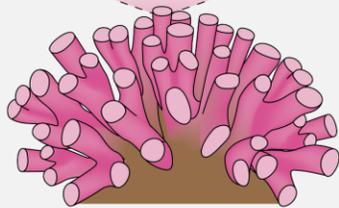
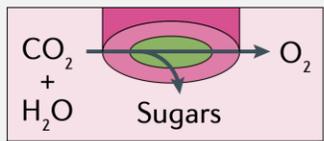
🦋 @coreyholt

🌐 www.theholtlab.com

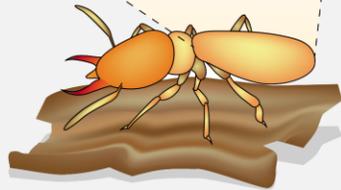
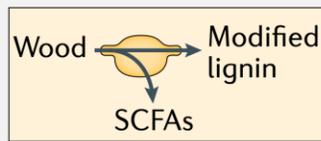


Host-associated microbiomes can be integral to host success

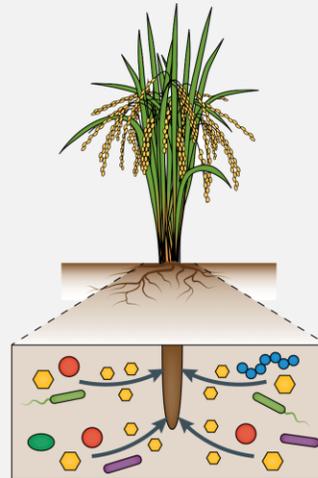
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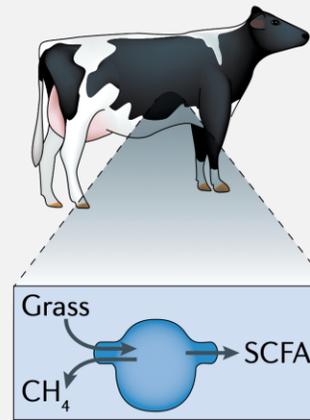
Corals and dinoflagellates
Carbon provision in nutrient-poor waters



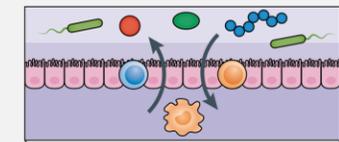
Termites and wood decay
Lignocellulose degradation



Crop plants and root microbiome
Nutrient provision



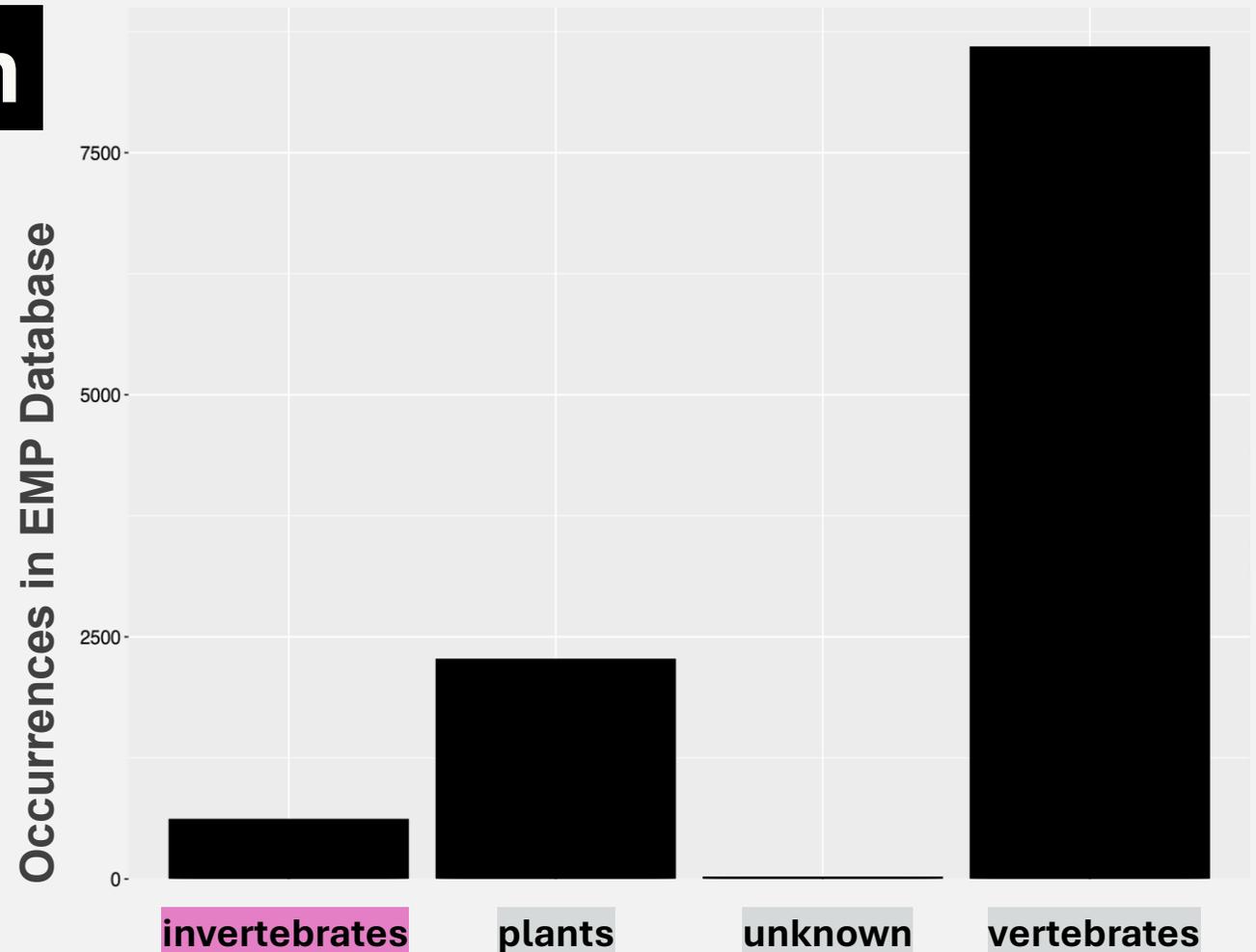
Cows and rumen microbiota
Nutrient metabolism

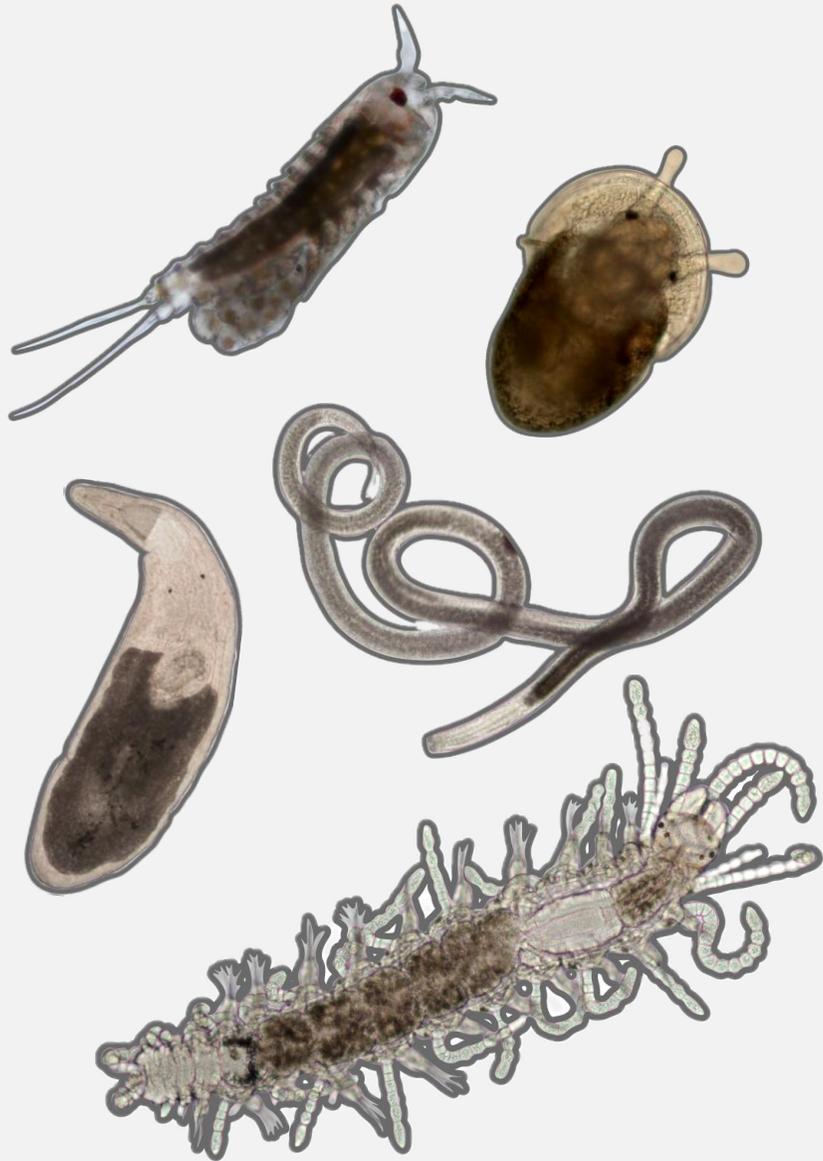


Laboratory mice and gut microbiota
Disease modelling

Microbiome research is dominated by vertebrates

“The Earth Microbiome Project is a systematic attempt to characterize global microbial taxonomic and functional diversity for the benefit of the planet and humankind.”





5,750 mammal species

1,242,040 species arthropods
(**223,567** of which are not insects)

117,358 molluscs

29,285 platyhelminthes (flatworms)

24,783 nematodes

20,509 echinoderms (sea slugs)

17,210 annelids (round worms)

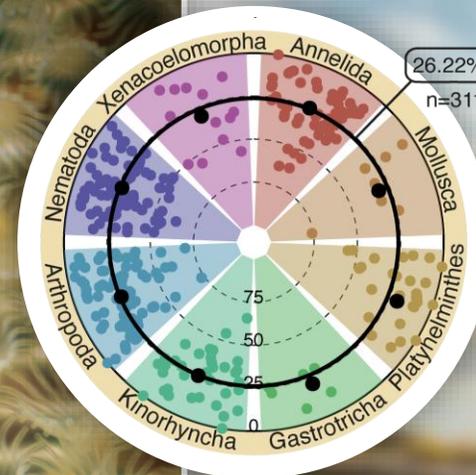
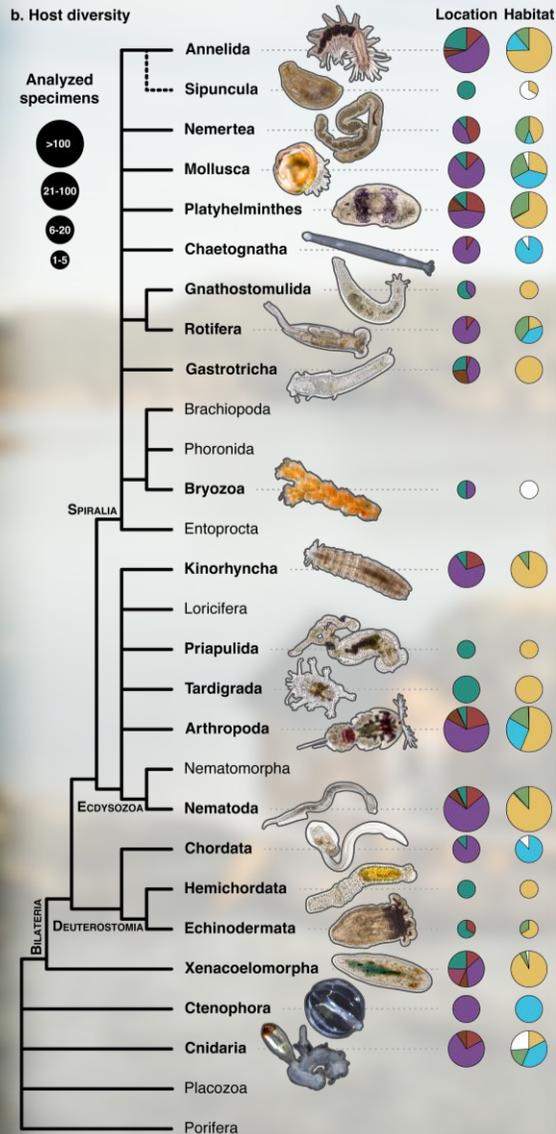
10,941 bryozoans



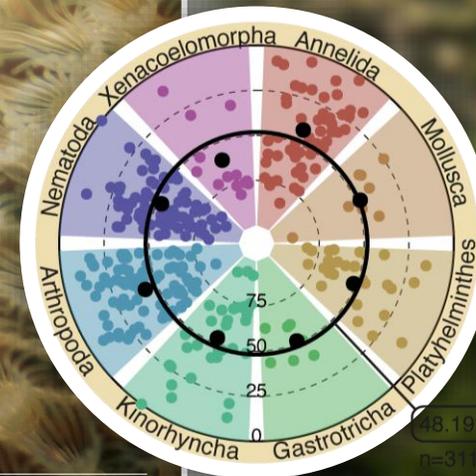
Hakai

📍 Quadra Island, British Columbia





Microbiome overlap between invertebrate and environment



Microbiome overlap between cohabitating invertebrates

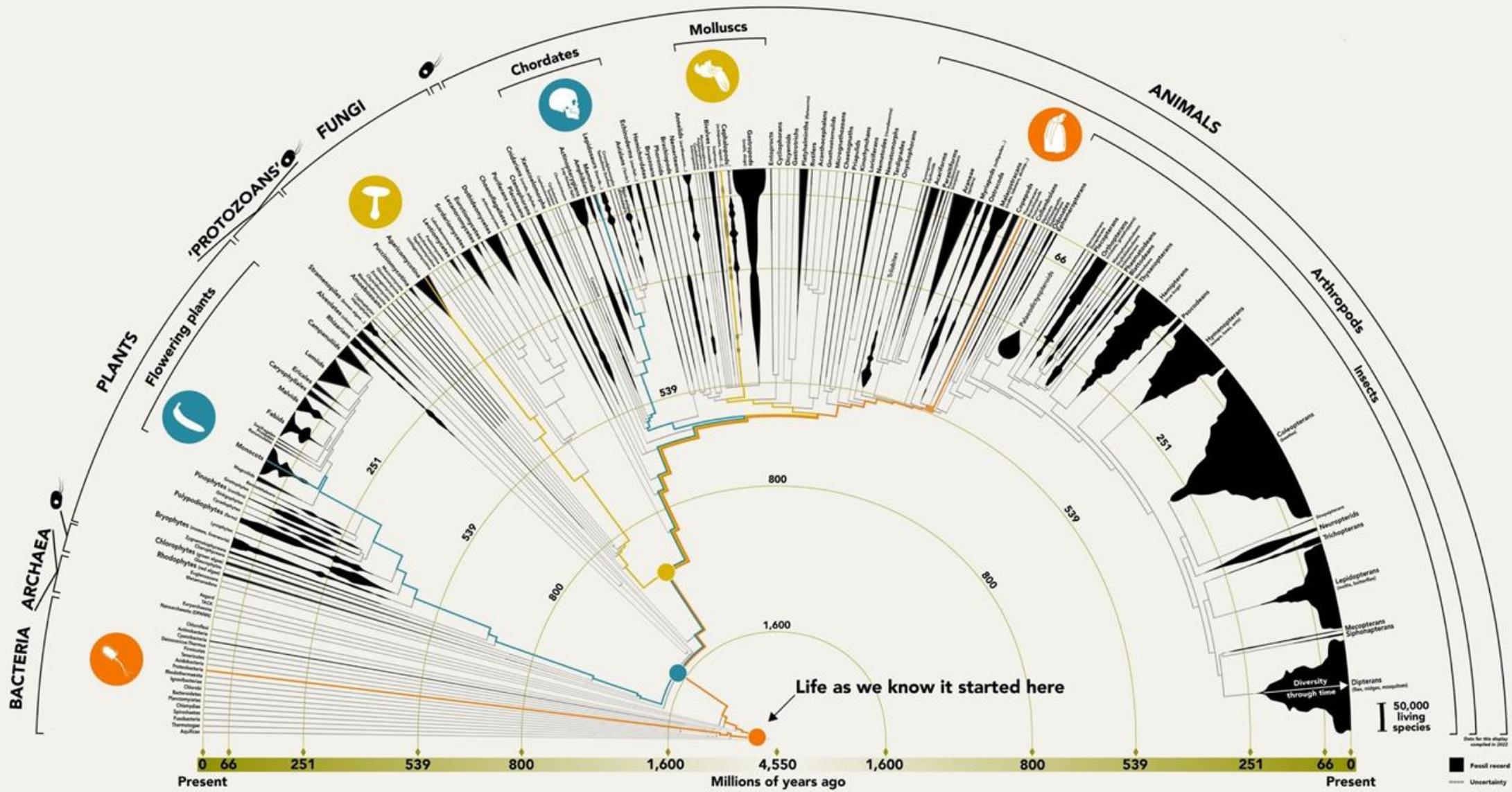
Our view of the tree of life is highly biased

Tree of life

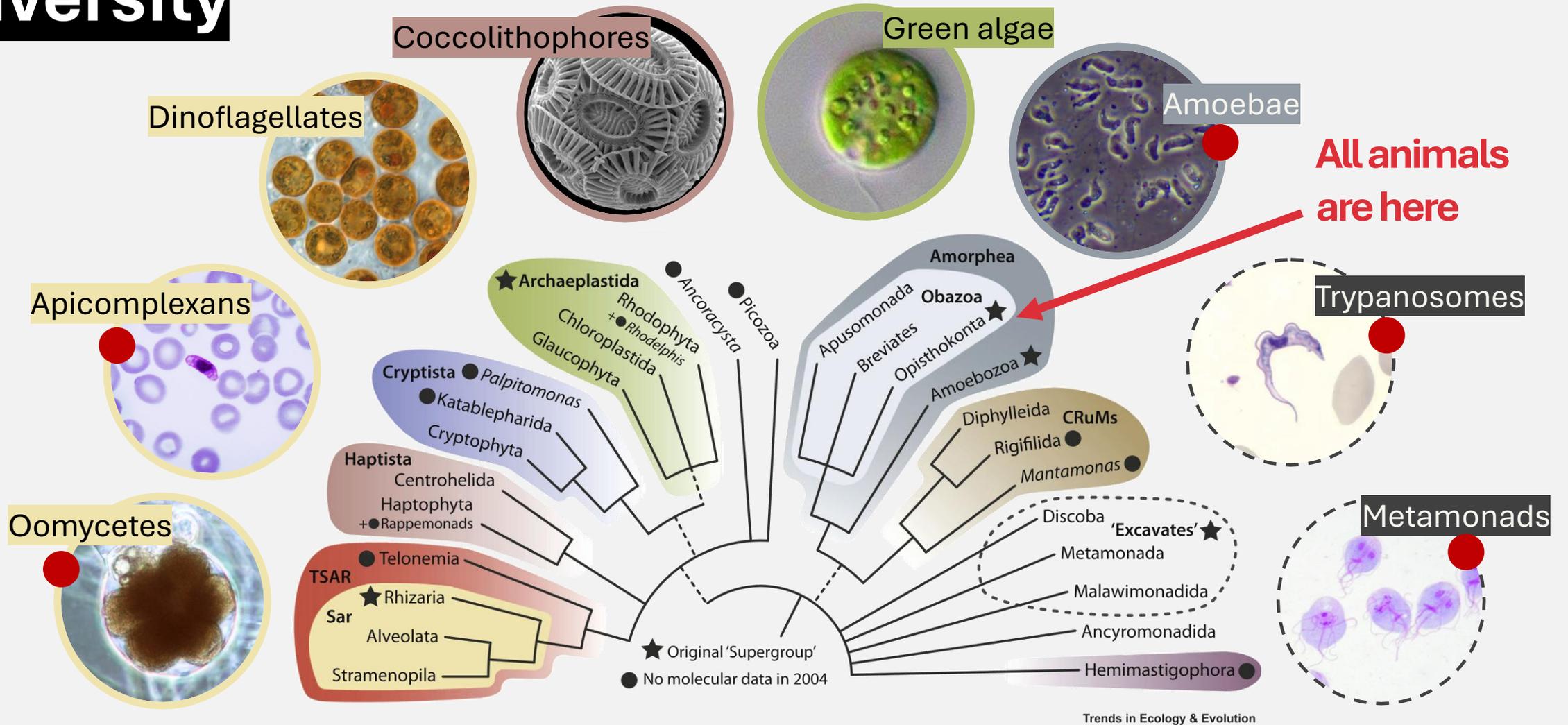
All life on Earth evolved from a common ancestor around four billion years ago. The branching structure we see today - from bacteria to humans, from worms to whales, and plants to people - is all descended from one common evolutionary root of life.

This diagram is just one way of representing these complex relationships, and it is based on species currently known to science. Our taxonomy, however, is far from complete, and the branching structure of life, at the earliest roots of the tree, is still largely unknown. As we trace back to these ancient origins, the complexity of the tree, measuring branching points, is still a mystery. We reach the beginning of the tree which is where life, as we know it, began.





Animals are a very small part of eukaryotic diversity



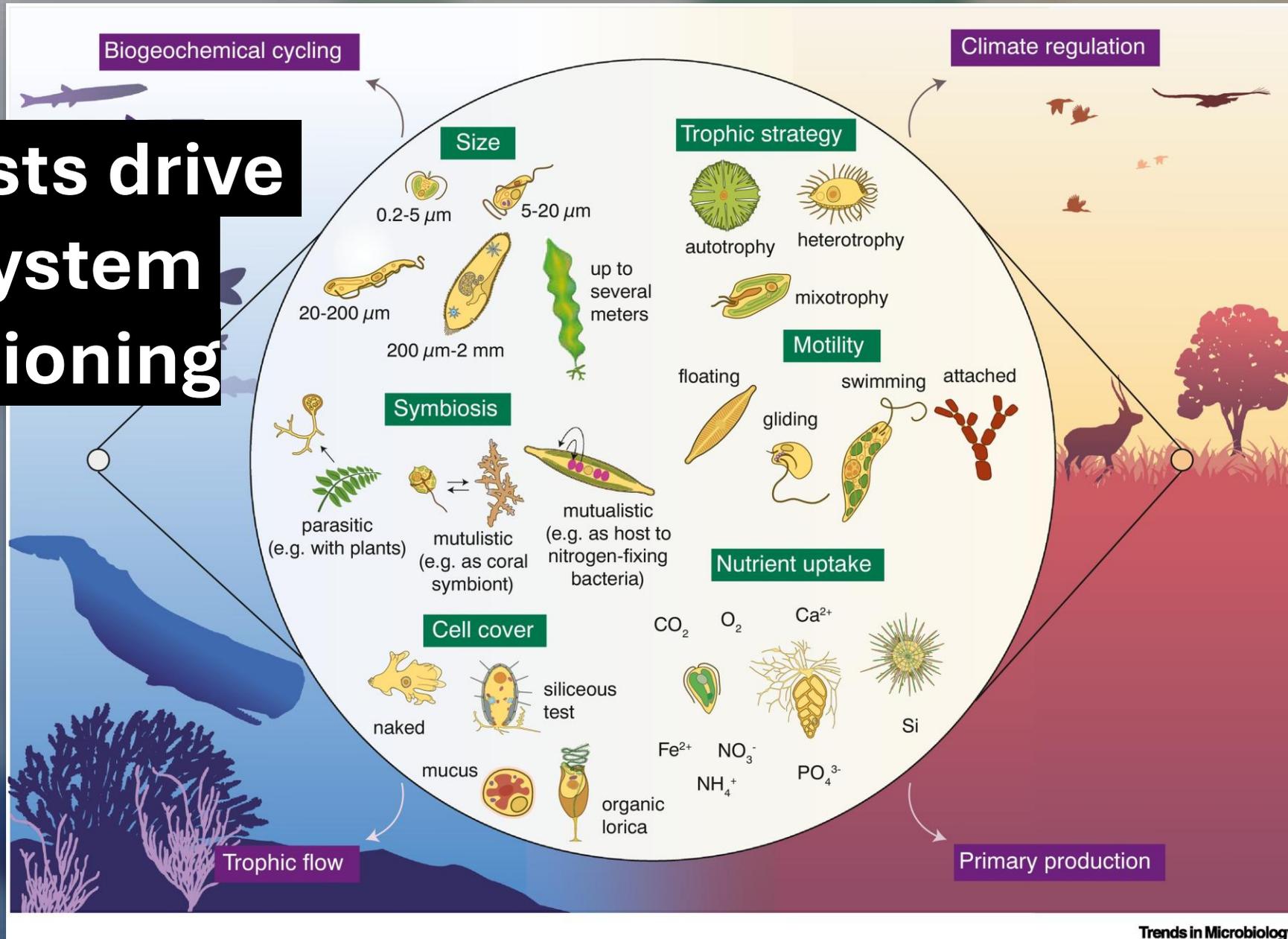
All animals are here

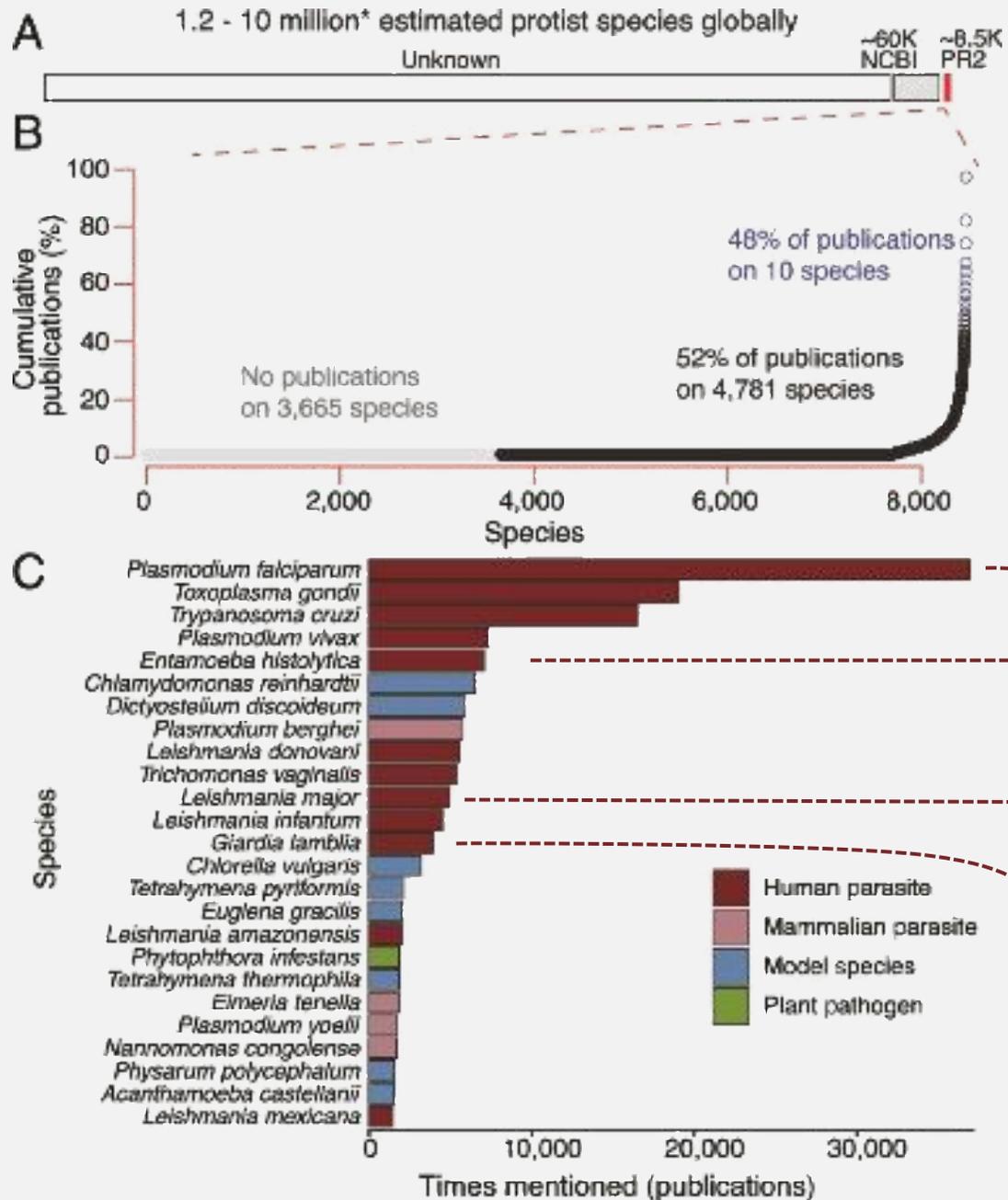
Metamonads

Protists = (mostly) unicellular eukaryotes

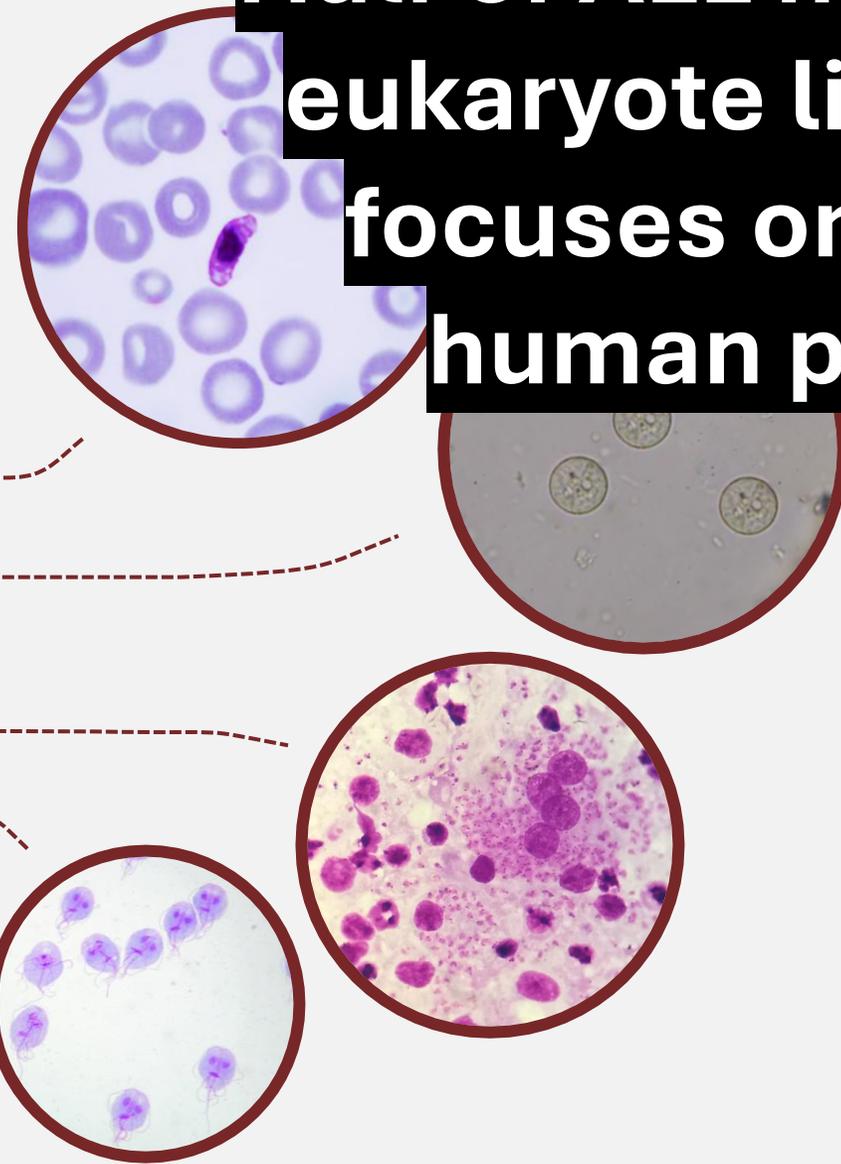
Burki et al., 2020

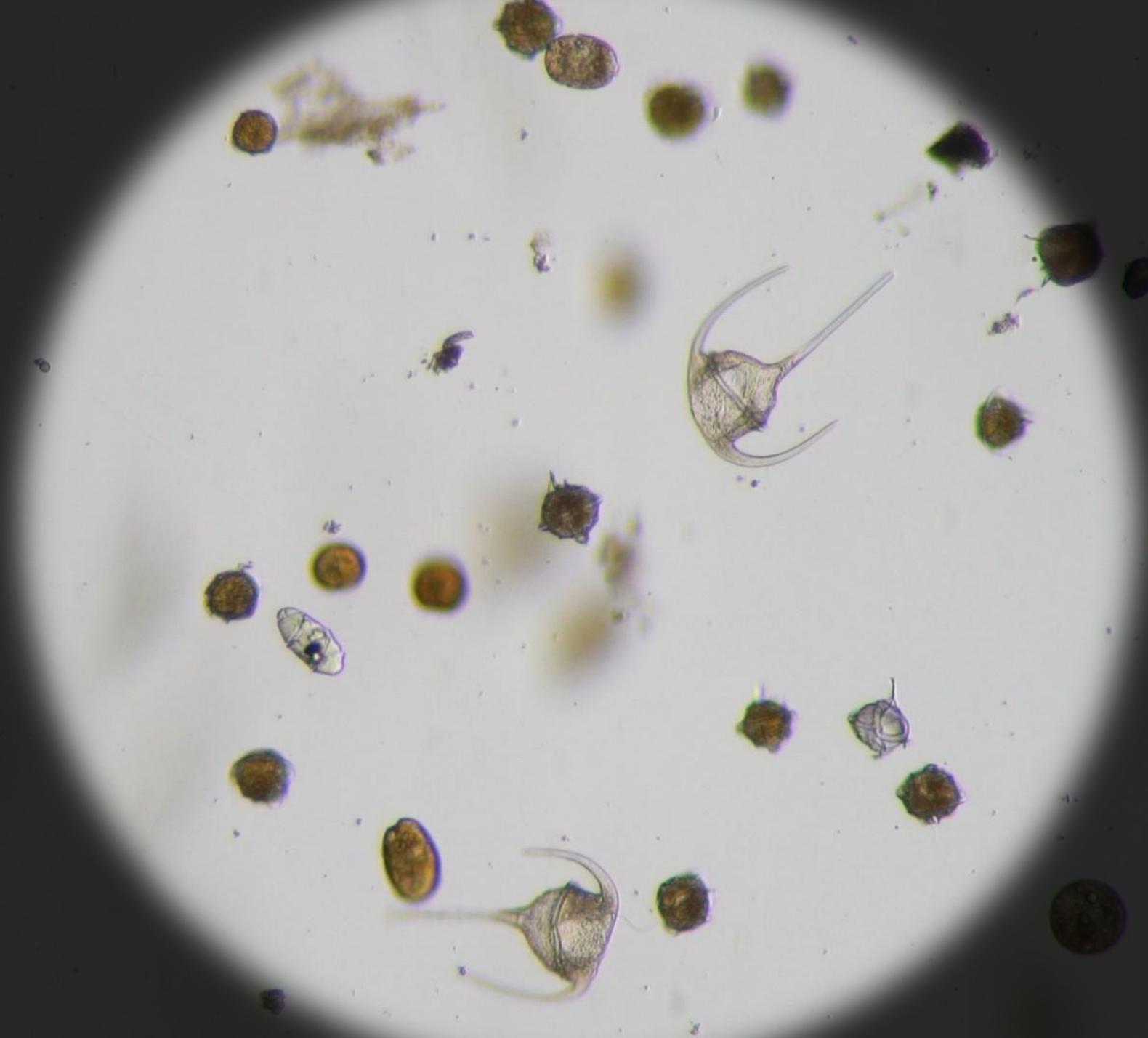
Protists drive ecosystem functioning





Half of ALL microbial eukaryote literature focuses on only 12 human parasites







Acantharian (Radiolarian)



Scyphosphaera absteinii
(Haptophyte)



Ornithocercus quadratus
(Dinoflagellate)

Warnowiid
(Dinoflagellate)

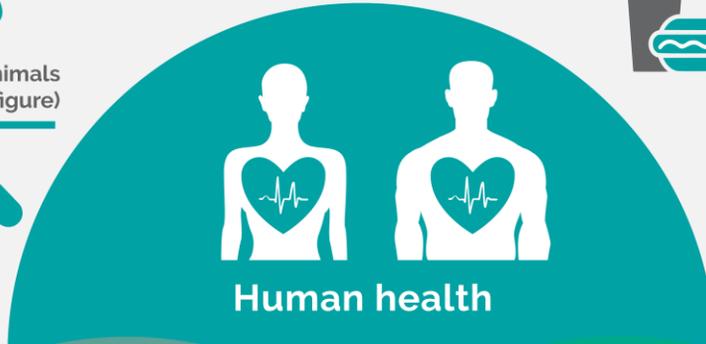


 **60%**
of human infectious diseases originate in animals
(WOAH figure)

 Environmental health and diets impact human health

Emergence of antibiotic-resistant microorganisms


 Human activities lead to contamination of the environment by toxic substances

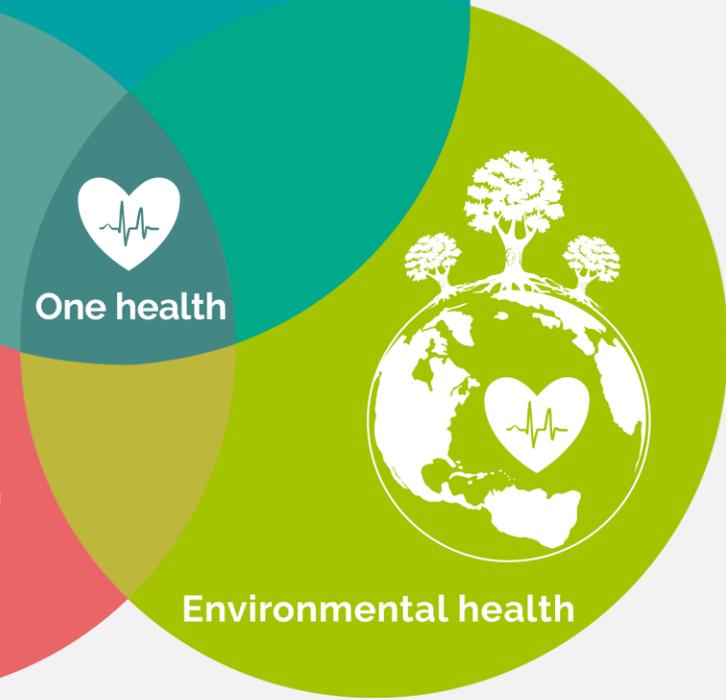
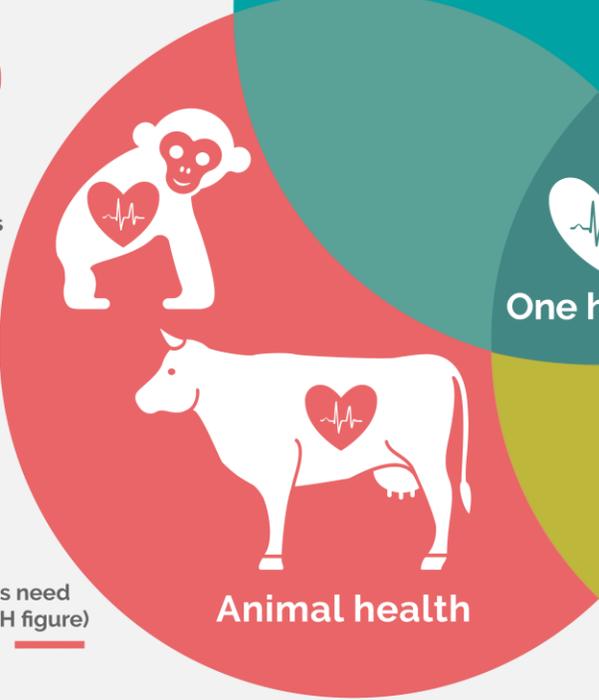


 **20%**
of global animal production losses are due to animal diseases
(WOAH figure)

Diseases and pests are estimated to cause up to
40%
of global crop losses
(FAO figure)

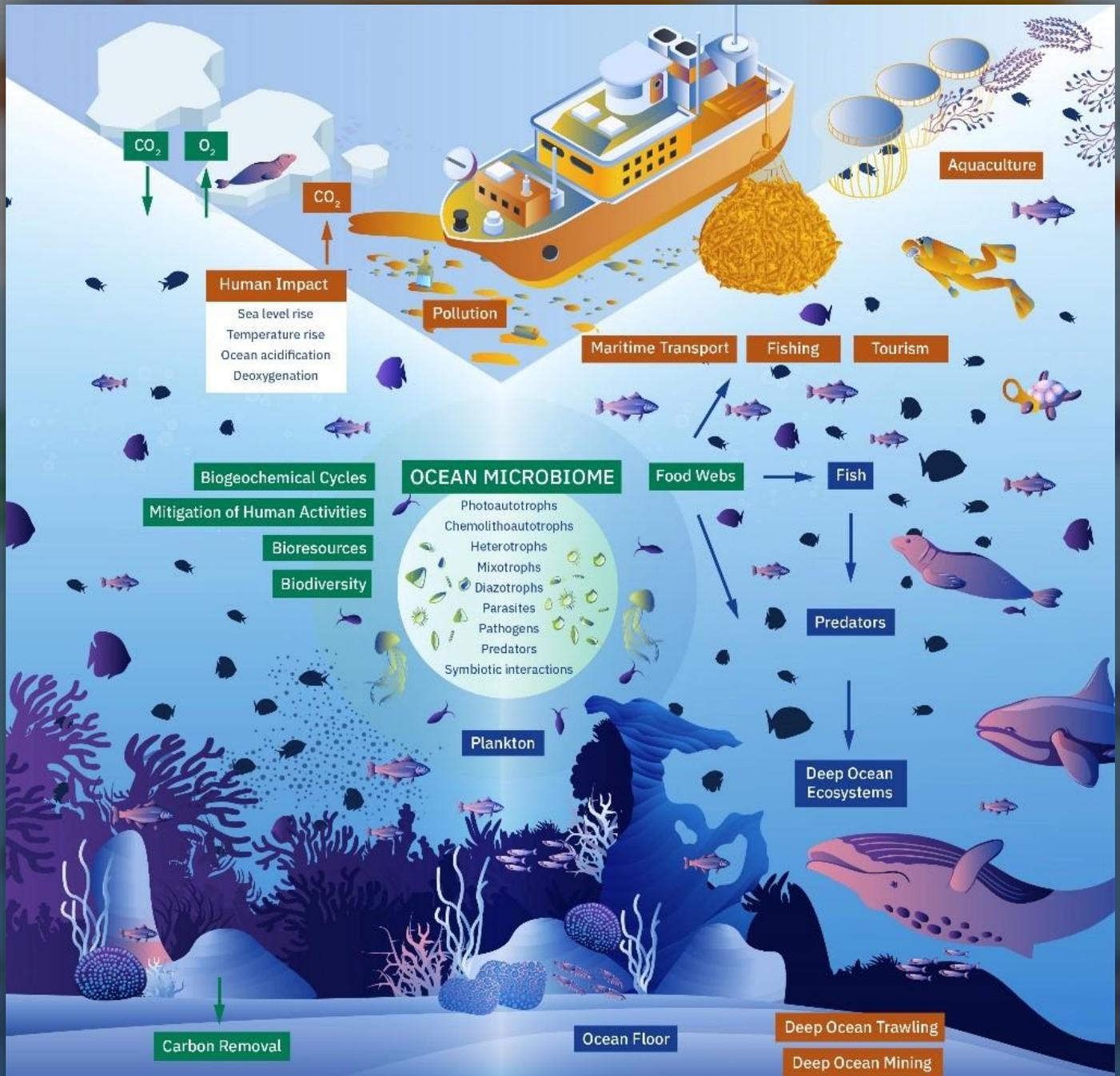
 **75%**
of cultivated plant species need to be pollinated (WOAH figure)

Deforestation increases the risk of exposure of humans and livestock to new pathogens



One health





The logo for the One Health Surveillance Partnership Agreement (OHSPA) features a stylized, white, interlocking circular symbol on the left, followed by the letters 'OHSPA' in a white, sans-serif font, all contained within a black rectangular box.

One Health Surveillance Partnership Agreement

Delivering science-backed, policy-driven innovation to environmental monitoring



Research
England



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Cefas

With thanks to...

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Carly Daniels



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Hakai

GORDON AND BETTY
MOORE
FOUNDATION



**SENTINELS
OF CHANGE**

Some of this work took place on the traditional, ancestral and unceded territory of the x^wməθk^wəy'əm (Musqueam) Skwxwúmesh (Squamish), and Səlílwətaʔ/Selilwitulh (Tseil-Waututh) Nations.



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