



TOWARDS AN INTEGRATIVE VIEW OF EXPLANATION IN HUMAN GUT MICROBIOME RESEARCH

Aline Potiron, Johannes Kepler University Linz

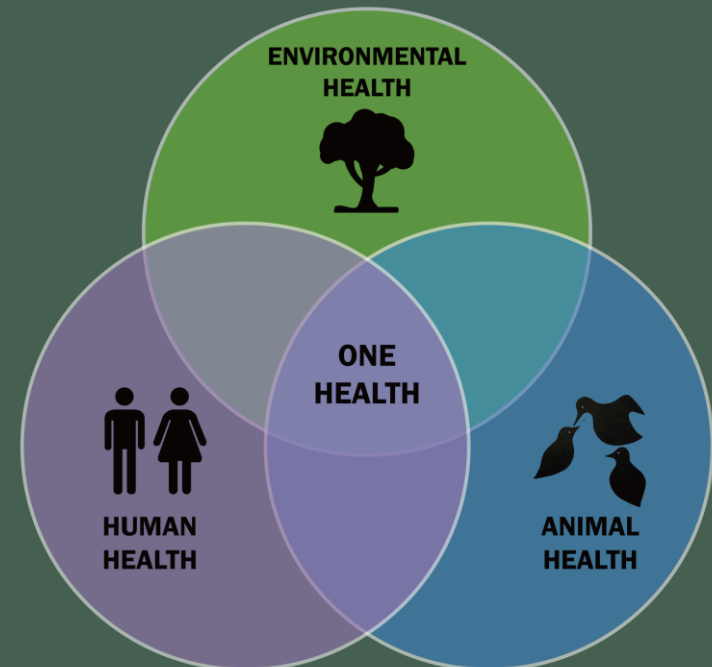
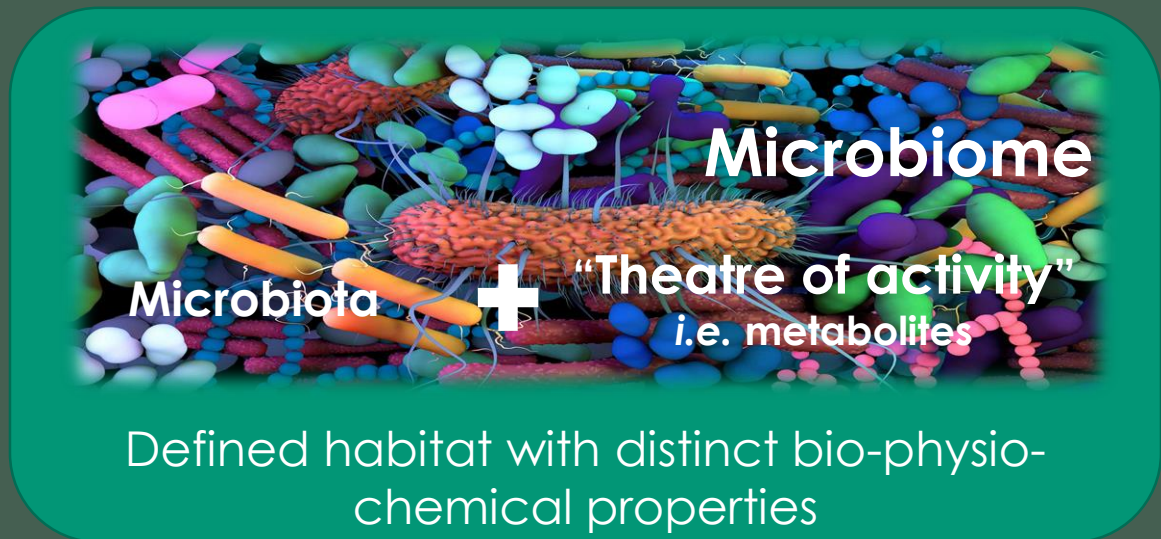


TOWARDS A PLURALIST VIEW OF EXPLANATION IN MICROBIOME RESEARCH

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Microbiomes and Explanations

- **The microbiota** – the microorganisms and their “**theatre of activity**” – all their activities in a given environment (Berg et al., 2020).



Microbiomes and Explanations



What types of explanations?

Causal explanations.

How to establish them? How to evaluate them?

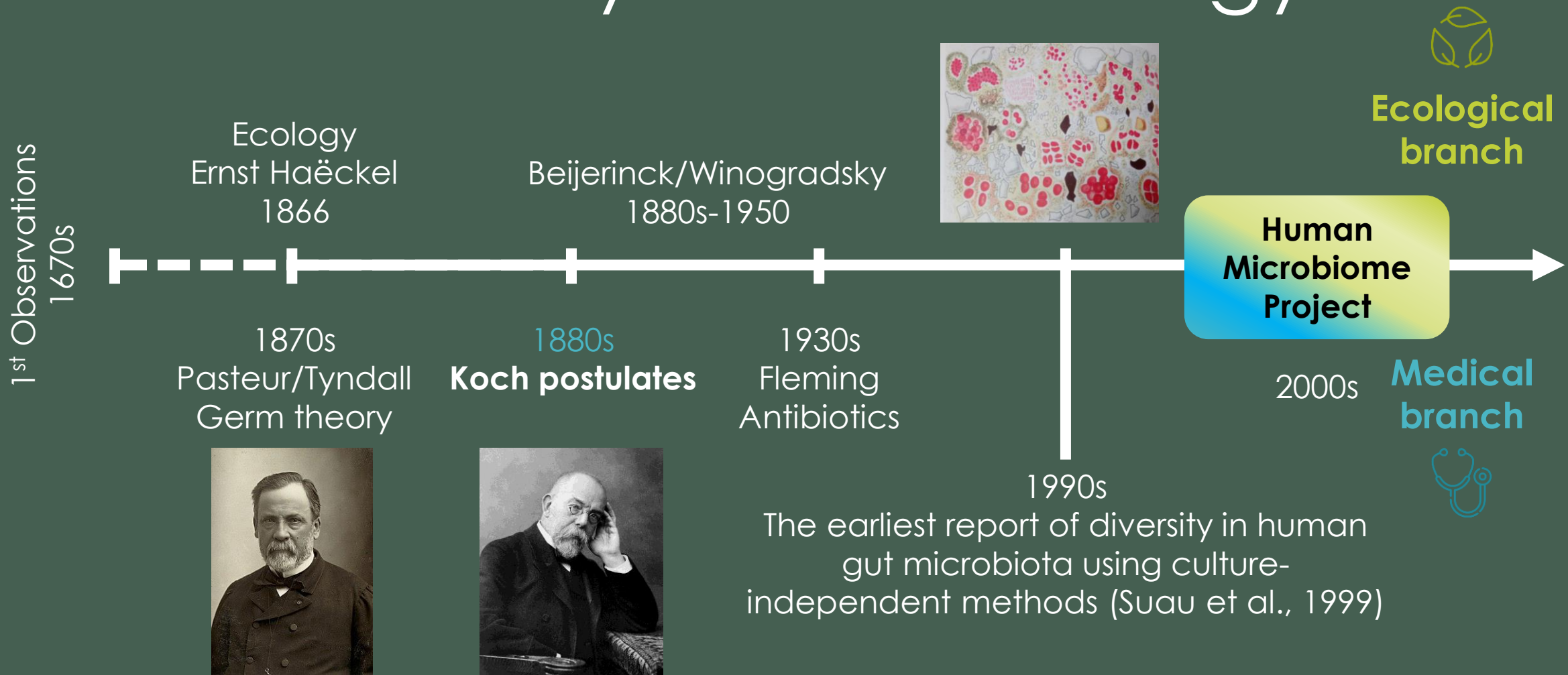
Koch's postulates and the interventionist framework.

This approach is legitimate but overlooks part of microbiology's history leading to an incomplete view of explanation in microbiome research.

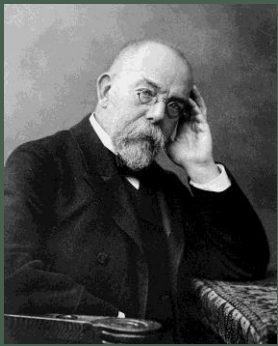
Aims

1. Show that microbiology is a medical AND ecological discipline by using the history of microbiology.
2. Argue that in the ecological branch of microbiology, explanations describes pathways, functions, and mechanisms by using an analysis of Sergei Winogradsky's work.
3. Suggest a pluralist view of causal explanation in human microbiome research based on the eikonic conception of explanation (Bokulich, 2018).

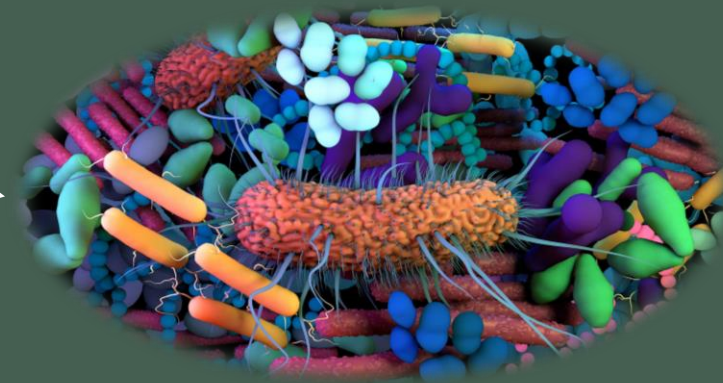
A Brief History of Microbiology



A Brief History of Microbiology

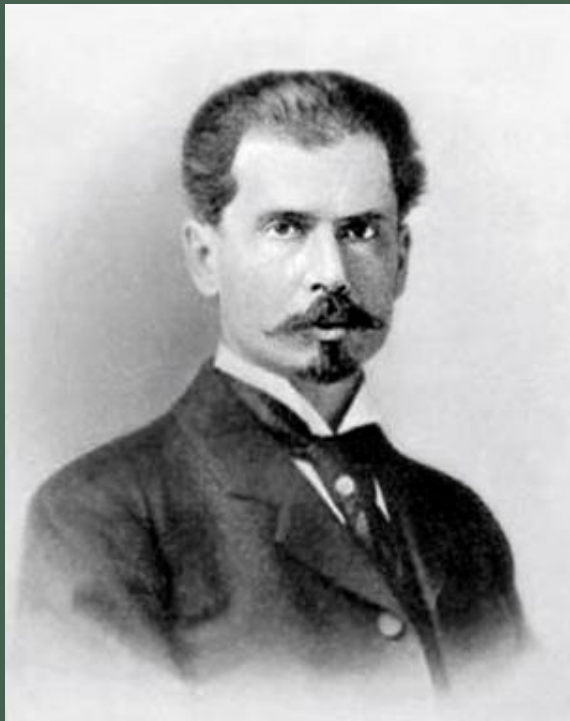


Interventionism



?

Explanation in Microbial Ecology



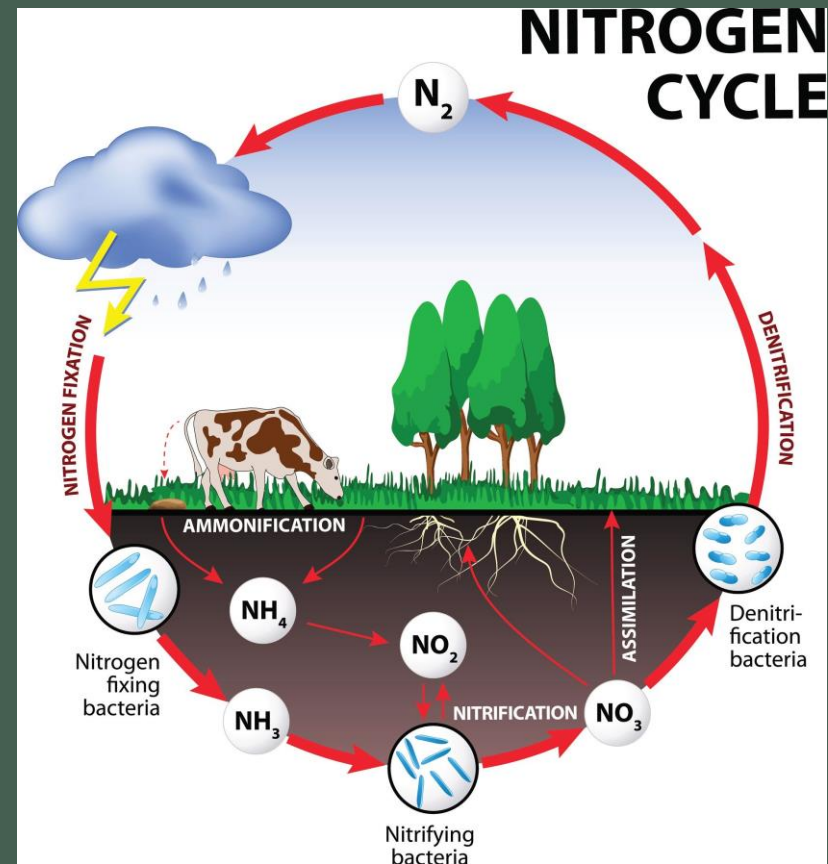
- Sergei Winogradsky: 1856-1953
- A collection of his work published in 1949 entitled *Microbiologie du Sol: Problèmes et Méthodes* (MS)

Explanation in Microbial Ecology

- What kind of phenomena are explained?

“The search for living agents should always be preceded by knowledge of the phenomena taking place in the natural environment.” (MS, 839).

- He is not looking for entities in the first place but for **the flow of material or energy**.

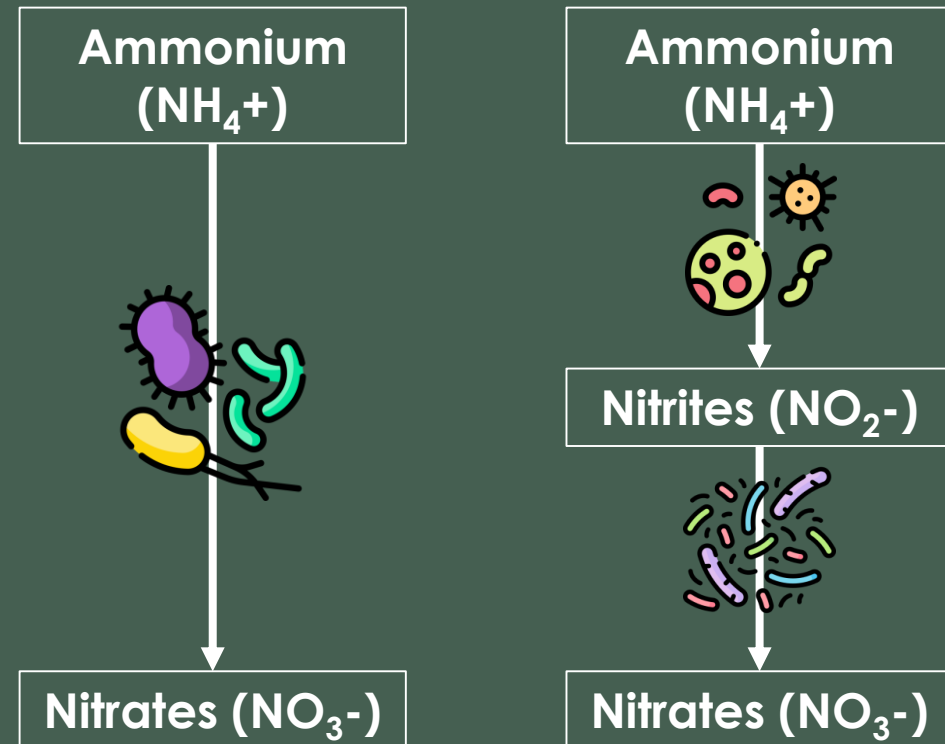


Explanation in Microbial Ecology

- How are those phenomena explained?

“As a result of all the experiments, the conclusion that these are two autonomous functions, each exercised by its own ferment, appears necessary.”
(MS, 252).

- **Functions** – in a similar sense as Cummins' causal-role function.

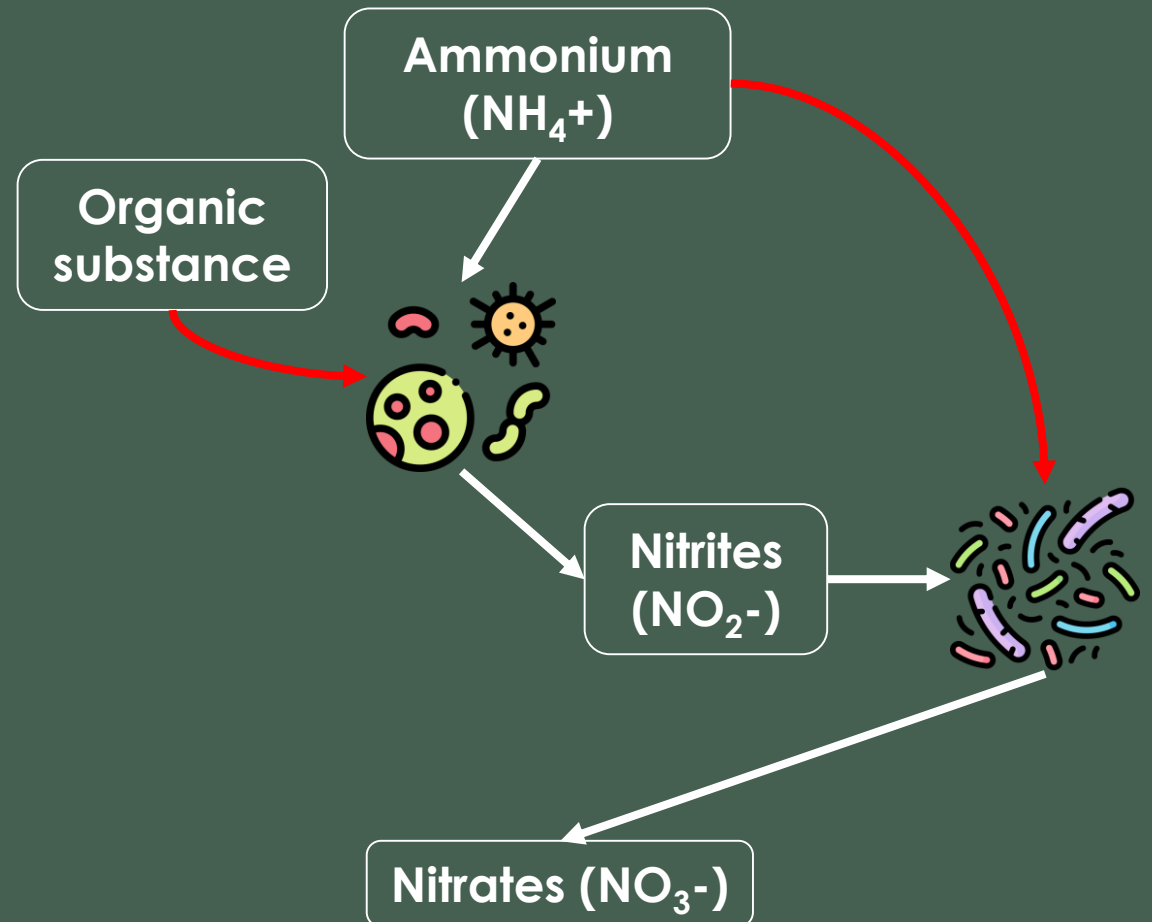


Explanation in Microbial Ecology

- How are those phenomena explained?

“Even assuming that one day we succeed in isolating all the representatives of this microflora, we would only arrive at a collection of cultures that could not, however complete it is, inform us about the activity of this microflora, where individual activities combine or thwart each other, and where the biological environment could reduce activities to everything other than pure culture” (MS, 415)

- **Mechanisms**



A Pluralist View of Explanation

Eikonic conception of explanation
(Bokulich, 2018)



Vincent van Gogh's "The Starry Night" by Melanie Sullivan of Missouri. *American Society of Microbiology.*

- Explanation is an epistemic activity that involves representations of the phenomena to be explained.
- Different representations are possible.
- Several accounts of explanations can be accommodated.

A Pluralist View of Explanation

Medical branch



- Host disease – e.g., obesity
- Smaller scale
- Shorter time scale
- Two systems – host vs. microbiome
- Ontologically decomposed in individual microorganisms and mechanisms
- Type-level phenomenon and causes
- Particular ontology of disease

Ecological branch



- Flow of material and energy
- Bigger scale
- Tendency toward a longer time scale
- One system
- Ontologically decomposed in functions and mechanisms
- More local phenomenon
- Ontology of pathways and cycles – e.g., obesity as an energetic state.

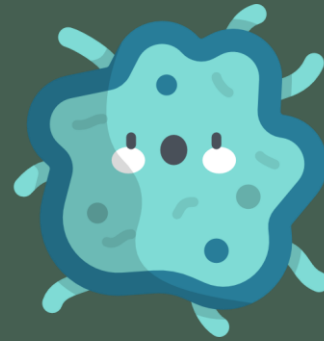
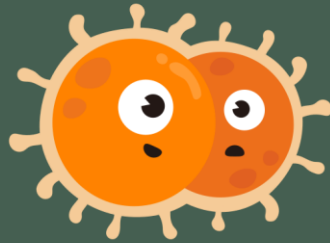
A Pluralist View of Explanation

- Why is my approach pluralist?
- Several causal explanations of the same natural phenomena are equally valid in microbiome research.
- How to solve the issue of evaluating causal relationships?
 - Adequation between the representation chosen and the research question – e.g., should the medical branch try to represent diseases as pathways like in the ecological branch for the questions they are asking? Should new representations be imagined?
 - Adequation between the explanans and the explanandum – e.g., Does functional analysis *A* a good explanation of phenomenon *B*?

Conclusions

- **Aim 1:** Microbiology is also an ecological discipline & Human microbiome research is at the crossroad between a medical and an ecological approach of microbiology.
- **Aim 2:** Explanations in microbial ecology are made of pathways, functional analysis and mechanisms.
- **Aim 3:** Pluralist view of causal explanation that
 - Considers the multipath history of human gut microbiome research
 - Broadens our understanding of explanation in this discipline
 - Gives new tools to evaluate causal explanation

Thank you!



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