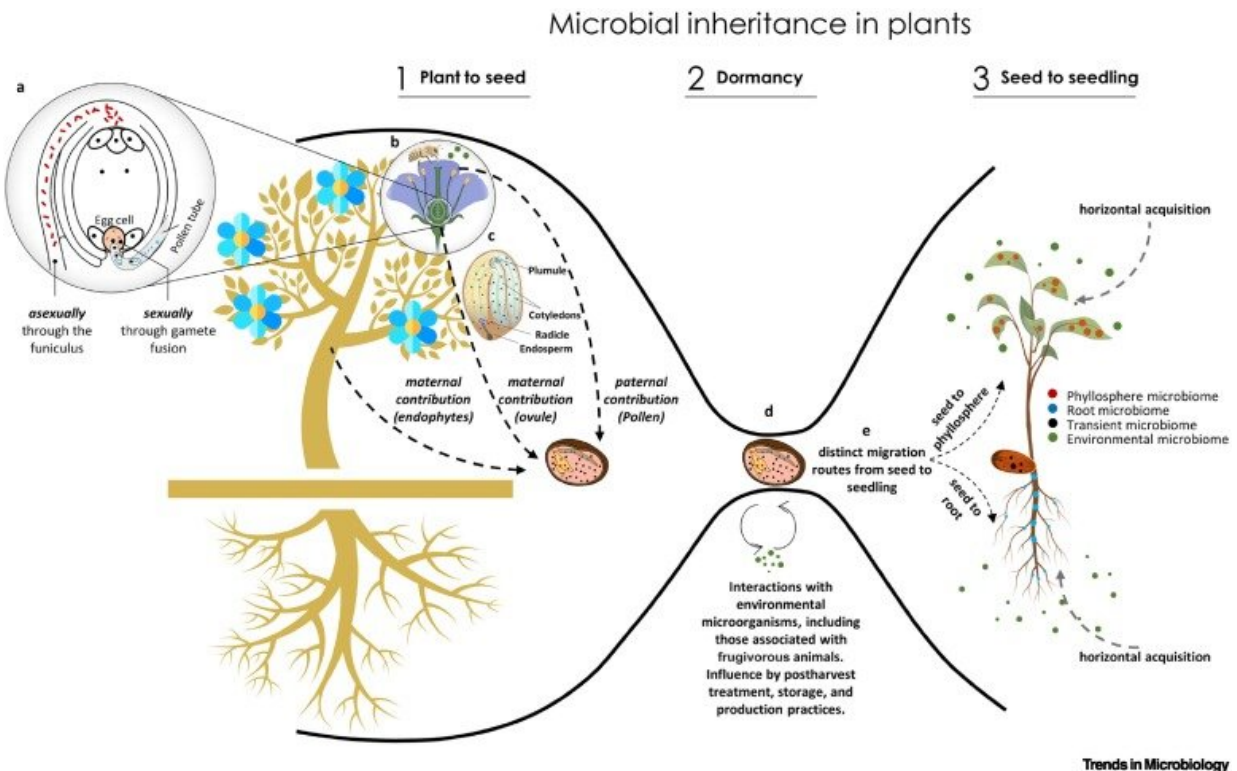


A journey across generations: Inheritance of the plant microbiome via seed

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A conceptual figure depicting the process of microbial inheritance in plants. The process encompasses three stages as indicated at the top of the figure: (1) from plant to seed, (2) dormancy, and (3) from seed to seedling. The first stage involves both sexual and asexual transmission. Processes highlighted are as follows. (A) the sexual and asexual transmission of microorganisms, as depicted in detail in the magnified circle. (B) The influence of environmental microorganisms and pollinators on the floral and seed microbiome. (C) The assembly and within-seed distribution of the microbiome from embryogenesis until seed maturation. (D) The interaction of the seed microbiome with the

environmental microorganisms during dormancy, including those microorganisms associated with seed-dispersing animals and postharvest treatments. (E) The transmission route of seed microorganisms to the seedling phyllosphere (red dots) and roots (blue dots), as well as the transient microbiome that does not migrate out of the seed (black dots). Broken gray arrows below and above the seedling indicate the colonization of the seedling by the environmental microbiome. Although horizontal acquisition from the surrounding environment is not part of microbial inheritance, it is depicted here since seeds naturally germinate in the soil and the inherited microbiome will interact with the environmental microbiome to shape the seedling's microbiome. Credit: *Trends in Microbiology* (2022). DOI: 10.1016/j.tim.2022.10.009

What defines us and other living organisms more strongly, genes or the environment? Only recently, researchers were able to prove experimentally that even microorganisms can be inherited from one plant generation to the next via the seed.

In an article just published open access in the journal *Trends in Microbiology*, scientists examine the process of microbial inheritance via the [seed](#) in more detail and identify factors that significantly influence the assembly of the plant [microbiome](#). With their basic work, the authors create an important milestone of microbiome research.

Experimental studies suggest that [plants](#) not only inherit genetic traits with their seeds, but also a complex microbiome consisting of fungi, bacteria and archaea.

"The knowledge of microbial inheritance opens up the possibility for researchers worldwide to develop a whole new understanding of the natural world and expand our ability to influence it. Plant microbiomes have a huge impact on plant health, resistance, growth and even nutrient uptake. Unfortunately, we know very little about how these communities

of microorganisms find their way from one plant generation to the next," says Dr. Ahmed Abdelfattah, group leader on Microbiome Management at the Leibniz Institute for Agricultural Engineering and Bioeconomy and first author of the publication.

In 2021, Dr. Abdelfattah and a team of scientists were able to experimentally demonstrate microbial inheritance via the seed for the first time. He therefore took a closer look at microbial inheritance in plants together with his colleagues from Stockholm University, Graz University of Technology and Potsdam University.

In their paper, they divide the inheritance process into three stages: "from plant to seed," "seed [dormancy](#)" and "seed to seedling" and shed light on the factors affecting the microbial transmission in each stage.

In the first stage, "from plant to seed," the plant species, its environmental conditions during seed maturation, and its reproductive form are among the central influencing factors. In the second stage, the type and the design of "seed dormancy," among other factors, play a central role, as the microbiome of seeds that have to be stored temporarily behaves differently from the microbiome of a seed that naturally rests before it begins to germinate.

During [germination](#), in turn, the microorganisms have to find their way into the appropriate plant tissue, where transmission pathways but also [genetic factors](#) could be important.

"If we understand how microbial inheritance works and how we can influence it, there is enormous potential for applications. This knowledge could help restoring ecosystems and optimizing agriculture by, for example, transferring beneficial [microorganisms](#) to seeds through coating or by incorporating the microbiome into storage conditions or work processes," concludes Dr. Abdelfattah.

More information: Ahmed Abdelfattah et al, From seed to seed: the role of microbial inheritance in the assembly of the plant microbiome, *Trends in Microbiology* (2022). [DOI: 10.1016/j.tim.2022.10.009](https://doi.org/10.1016/j.tim.2022.10.009)

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