Dark matter microbes

Why the Commission proposal is insufficient for the world of tomorrow

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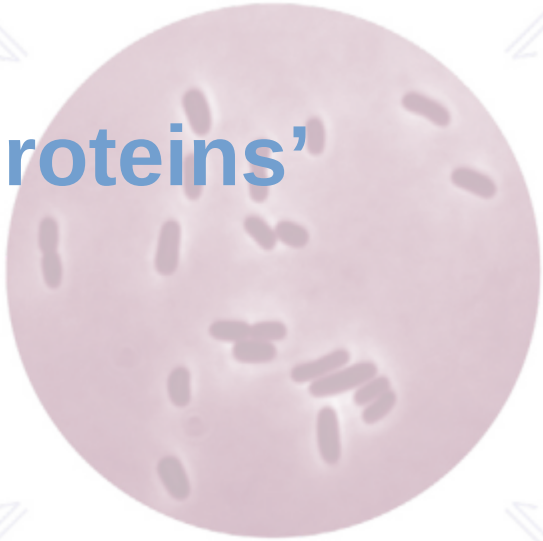
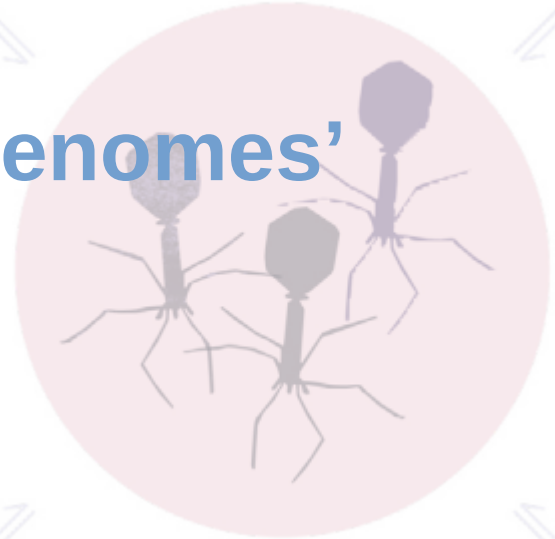
The creation of ‘dark matter proteins’



“a genuine **‘dark matter’ protein**, exhibiting potent **cytotoxicity without significant matches in existing** sequence or structural **databases** (...), thereby transcending the confines of established biological knowledge”.

Huang & Lin (2026)

The creation of ‘dark matter genomes’



„generative models capture evolutionary constraints in DNA sequences with enough fidelity to **produce complete bacteriophage genomes divergent from those observed in nature** and with prespecified traits.”

King et al. (2026)

Manipulation of interactions between species

“Signaling pathways between microbes and plants will allow the passage of information across kingdoms (…). For example, the plant could signal to the bacteria a need to produce antimicrobials or insecticides (...). These **engineered crops will communicate with microbes** (…) designed to perform **growth-enhancing functions through microbial pathway engineering** (…).”

Clauer et al., 2025

Genetic engineering in the open environment

“These tools enable editing of microbial communities for understanding and control. Here, we show that individual **organisms within microbial communities can be targeted** for site-specific genome editing, enabling manipulation of species **without requiring previous isolation** or engineering.”

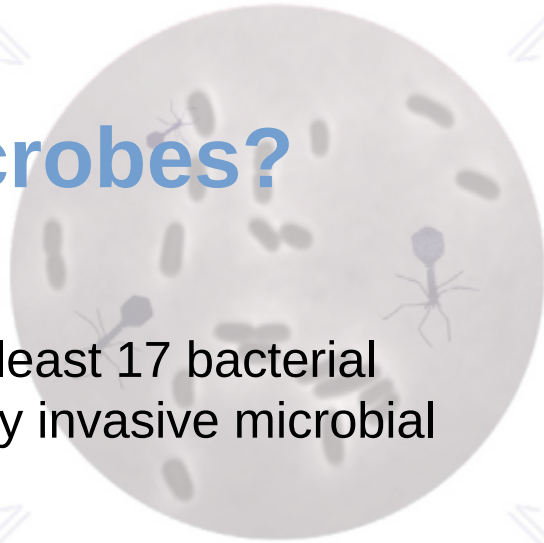
Rubin et al., 2022

Automation and acceleration

“The ultimate goal is not just to model metabolism, but to allow it to **self-optimize within a design cycle**. (…) In biological sequence design, we advance from exploiting natural variation to **de novo generation of functional code.**”

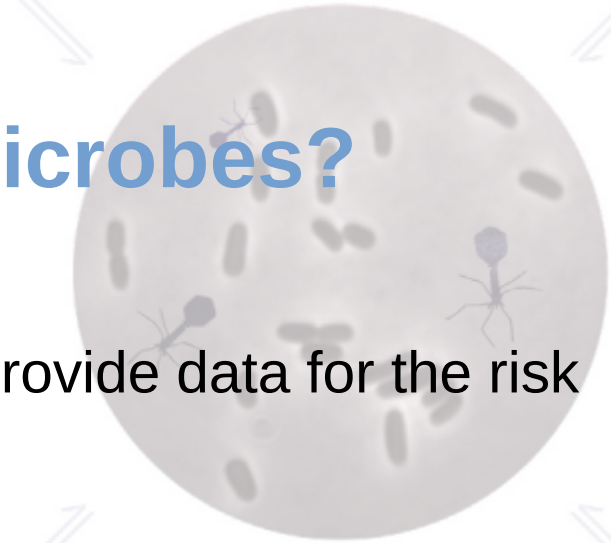
Ye et al. (2026)

How about safety of QPS microbes?



- The QPS (Qualified Presumtion of Safety) list includes at least 17 bacterial species that fully or partially meet the criteria for potentially invasive microbial species.
- At least 6 bacterial species are described as having a high adaptability to a wide range of environments and various habitats.
- Several bacterial species on the QPS list possess plasmids or other mobile genetic elements.
- Several QPS bacteria are capable of forming spores and can survive in the environment for long periods, their persistence cannot hardly be controlled or restricted.
- Three virus families with hundreds of species (including plant and insect pathogens) and, in future, also bacteriophages are included.

How about safety of QPS microbes?



Amongst other things, it may not be necessary to provide data for the risk assessment of

- toxicity, pathogenicity and infectivity,
- environmental safety,
- the risk of uncontrolled spread,
- the transfer of genes,
- unintended effects on other organisms, including humans and animals,
- the effects on soil networks.

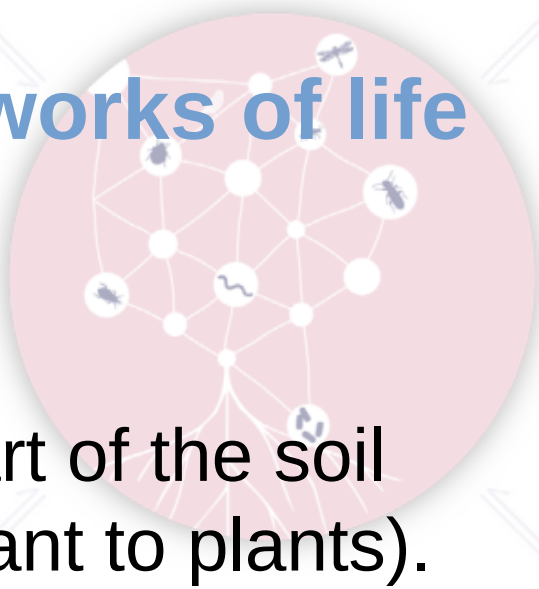
Staff working document of the EU Commission

How about ‘genes of concern’?

The concept of ‘genes of concern’ is not suitable for deciding in advance whether an environmental risk assessment is necessary or not.

In many cases, it is only possible to determine whether a particular genetic alteration is of a matter of concern AFTER a detailed risk assessment has been carried out, and not before.

We should be careful with the networks of life … being part of it

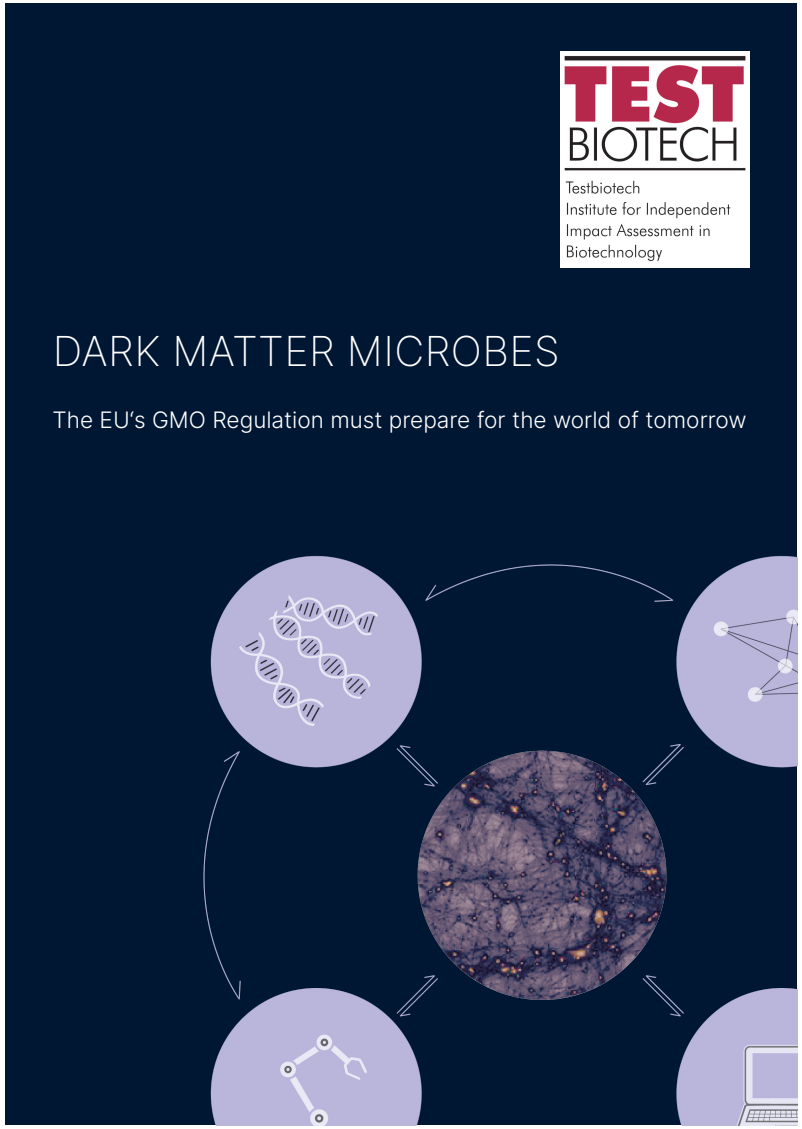


- 12 bacterial species listed as QPS are part of the soil microbiome (and are therefore also relevant to plants).
- 35 bacterial species are found in the gut of bees and in bee products such as honey.
- 27 bacterial species are part of the human gut microbiome.
- Many species are found in the microbiomes of soil (in plants), animals and humans, thus bridging the various spheres of life right up to humans.

We should be careful with the networks of life … being part of it

Species or taxonomic unit of the QPS organisms	Constituent of		
	Bee microbiomes & bee products	Human microbiome	Soil (plant) microbiomes
Bacillus amyloliquefaciens	●	●	●
Bacillus atrophaeus	○	○	●
Bacillus clausii / Shouchella clausii	●	●	○
Bacillus coagulans	●	●	○
Bacillus licheniformis	●	○	●
Bacillus mojavensis	●	○	●
Bacillus paralicheniformis	●	○	●
Bacills pumilus	●	○	●
Bacillus sonorensis	●	○	●
Bacillus subtilis	●	●	●
Bacillus vallismortis	●	○	●
Bacillus velezensis	●	●	●
Lacticaseibacillus casei	●	●	○
Lacticaseibacillus paracasei	●	●	○
Lacticaseibacillus rhamnosus	●	●	○
Lactiplantibacillus argentoratensis	●	○	○
Lactiplantibaccilus pentosus	●	●	○
Lactiplantibacillus plantarum	●	●	○

Thanks for your attention!



https://www.testbiotech.org/publikation/dark-matter-microbes-report/