EBERHARD KARLS
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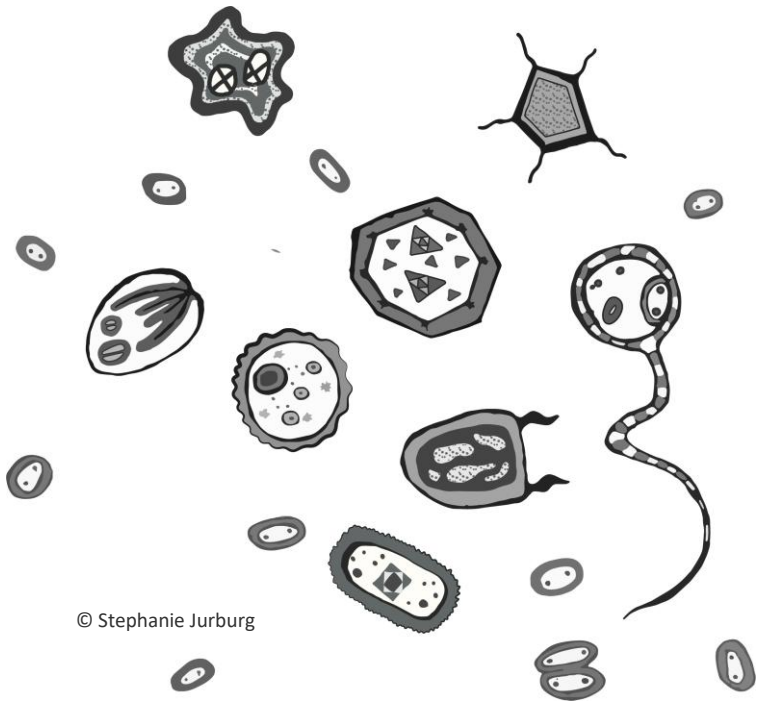
Environmental Release of GMMs

A science-base perspective on COM (2025) 1031



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Prof. Dr. Katja Tielbörger

GfÖ Gesellschaft für Ökologie e.V. für Deutschland, Österreich und die Schweiz

eef European Ecological Federation

(approval pending)

microorganisms - the big unknown

massive biodiversity, only a tiny fraction is known (1-42% of sequences)

Bacteria

Archaea

Eucarya

Oomycota

Green nonsulfur bacteria

Gram positives

Purple bacteria

Methanomicrobiales

Methanobacteriales

Methanococcales

Thermococcales

Thermoproteus

Pyrodictium

extreme Halophiles

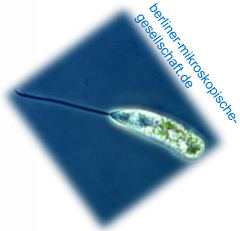
Animalia

Fungi

Plantae

Ciliates

Flagellates



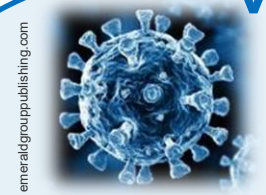
Cyanobacteria

Bacteroides

Thermotoga

Microsporidia

viruses

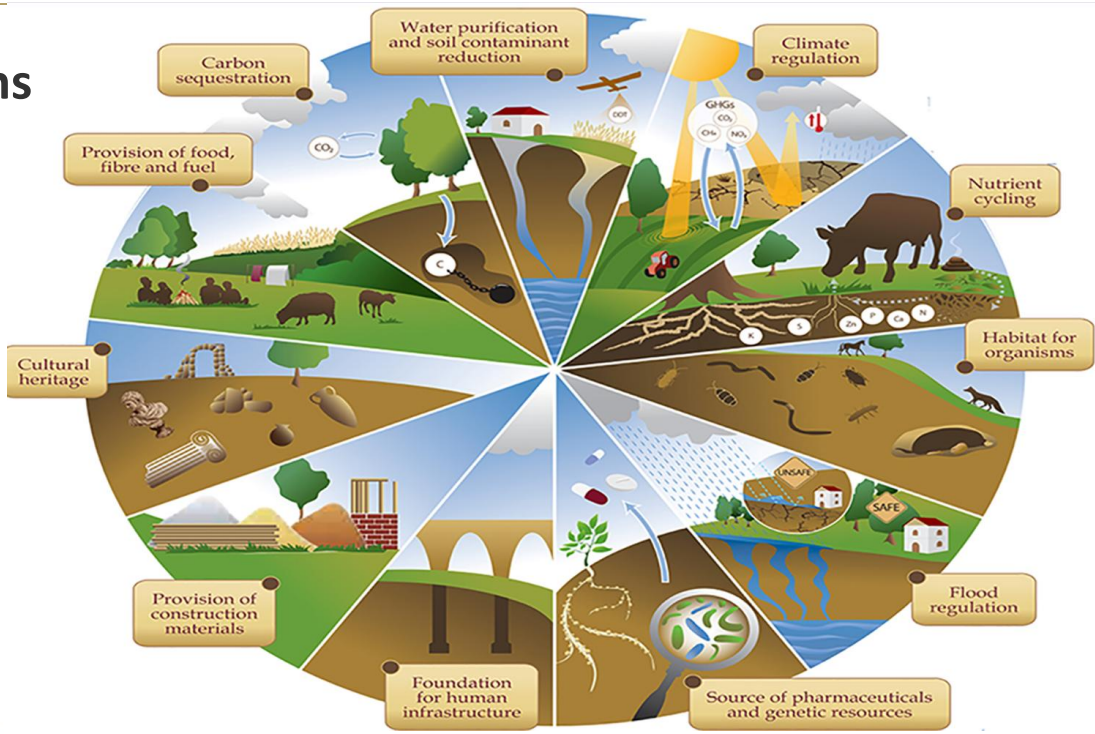


Woese et al. 1990

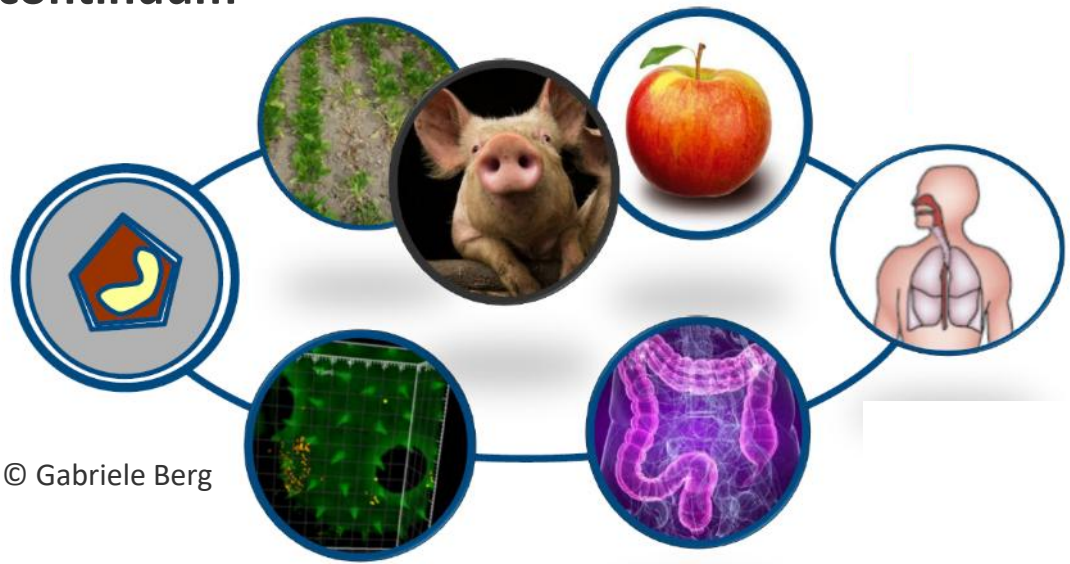
One Health: fundamental ecological & health functions

soil (microbial) ecosystem functions

Anikwe & Ife 2023, Front. Soil Sci



One Health: environmental microbe-plant-animal-human continuum



© Gabriele Berg

microorganisms → much higher safety standard than in e.g. plants

a) tremendous **uncertainties/knowledge gaps**
b) tremendous **importance for humans & environment**
c) difficult to observe, **no 'taking back'**

ecology-based development & application of appropriate methods for case-by-case

a) environmental (risk) assessment

b) monitoring adapted to unique biology of organisms

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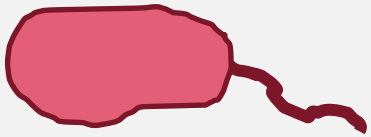
GMMs & 'low risk' and QPS: **microbes differ among….**

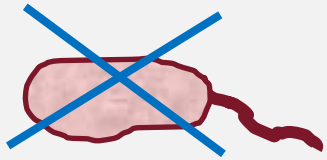
time
(rapid evolution)

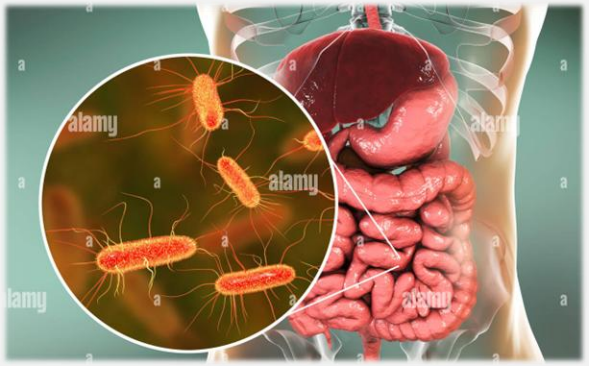


GMM

environments

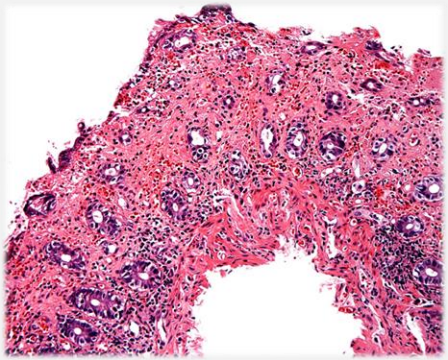
legacies





E. coli in human gut
→ natural component

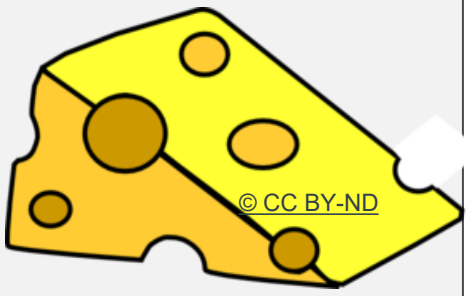
strains



(https://www.surgpath.theclinics.com)

E. coli strain O157:H7
→ toxic (colitis)

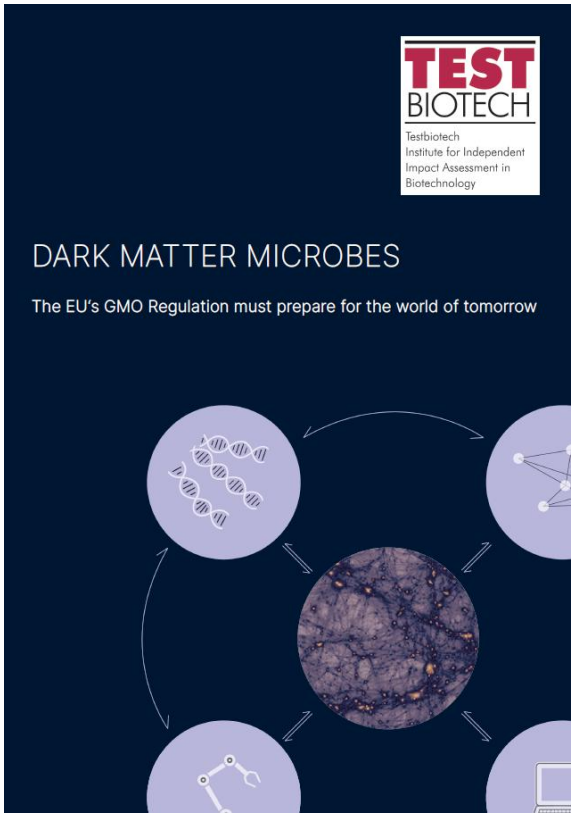
"parental" organism



food & feed

vs. **environment**
(but see C. Then: QPS in environment)

Frontiers of AI x Genetic Engineering



- **NGT**
- **AI x GE also for QPS!**
- **new-to-nature viruses**
- **mirror life**
- (...)

→ legislation not adapted to rapid progress

why much public concern about AI (human-controlled agent)

why no concern about **AI-generated GMMs**?
(self-spreading, living, uncontrollable organisms)

low-risk category and QPS - recommendations

1) Based on **a priori**, **case-by-case** risk assessment BEFORE release

2) Based on GMM product, ***NOT*** the parental organism

→ **reject 'low risk** (fast track)**' category**: no scientific basis

genes of concern = **outdated**, name of category = immaterial

→ **do not relax existing safety criteria (Directive 2001/18/EG)**

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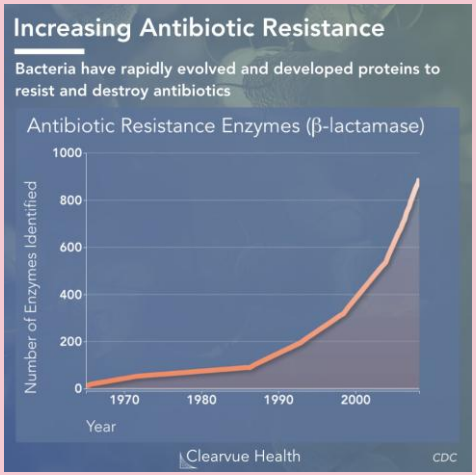
GMMs & monitoring: **microbes DO NOT STAY….**

WHAT they are

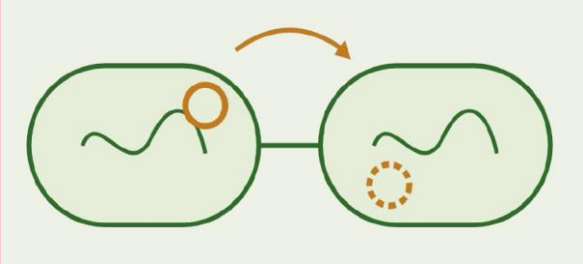


rapid evolution

WHERE they are

long-distance dispersal

WHO they are



horizontal gene transfer

→ **genes & GMMs can not be contained or called back!**

→ challenges for **MONITORING**

MONITORING requirements if GMM do not stay…

WHAT they are

rapid evolution

frequent, organism-specific intervals

include functions

WHERE they are

long-distance dispersal

(very) **far beyond area of release**

include resident communities and interacting organisms

WHO they are

horizontal gene transfer

include GMM *and* modified genes

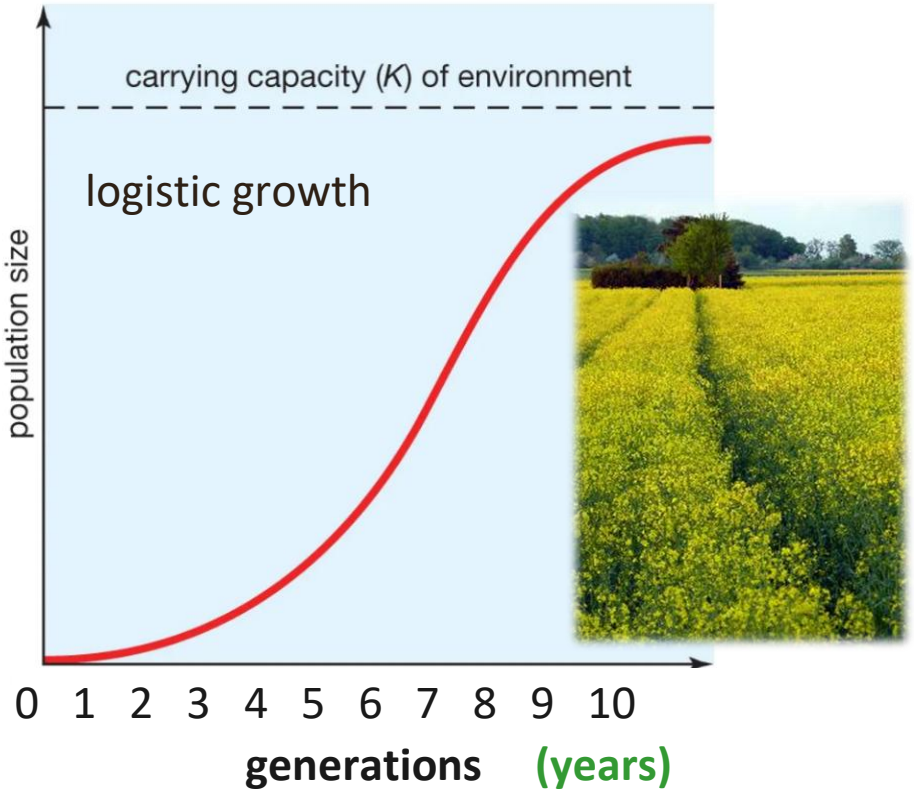
→ **methods** are still **to be developed** (jointly **with ecologists!**)

→ **monitoring must never be waived**

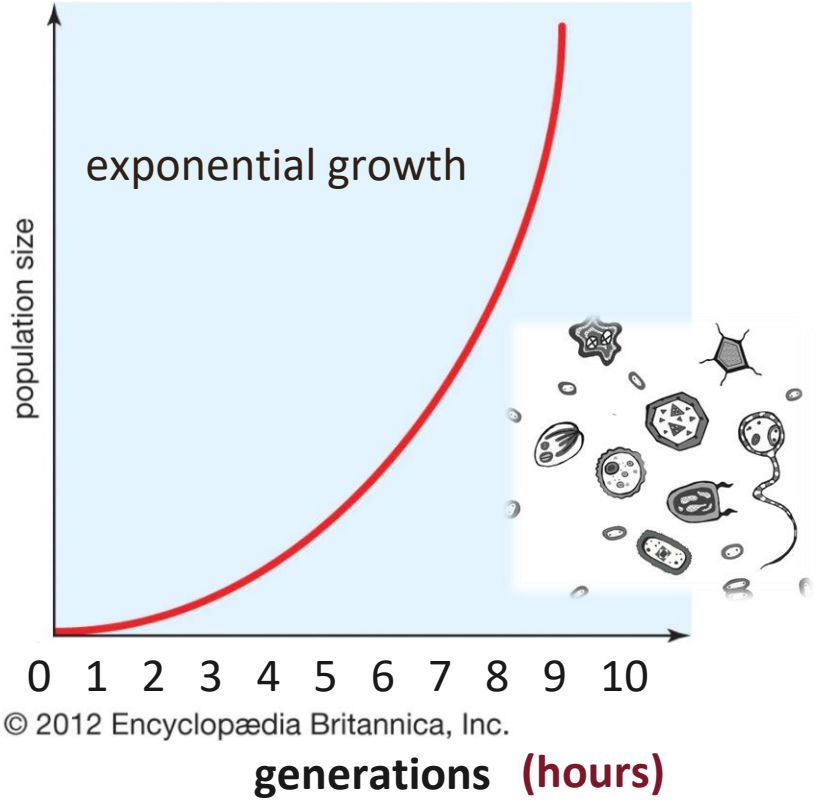
→ release must be **time constrained**

TIME CONSTRAINT requirements

plants - constrained population (e.g. field)



microorganisms (initially)



→ time limitation must be **specific for organism** (generation time)

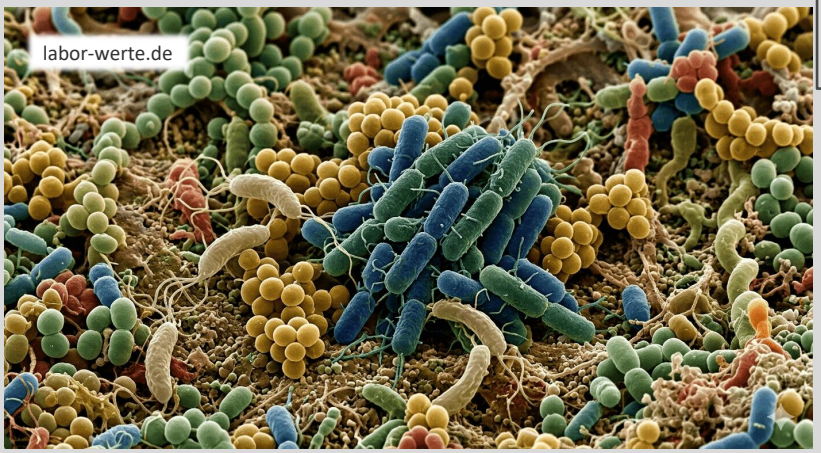
→ adaptive regulatory system: regular review *vs.* new scientific evidence

without ecological knowledge, GMM functionality is highly unlikely

N-fixation: limited in nature – **more is NOT more**

reducing toxic substance , e.g. PHB S Jurburg pers comm.

petri dish



nature: competition, predation (…)

→ request evidence for beneficial effects & low risk PRIOR to release

Desired effects: attestedly effective, low/no risk methods

Ecological intensification (example)

diversity increases

- **yield** (& income)
- **yield stability**
- **pathogen resistance**
- **nutrient use efficiency** (...)

myriads of publications:
e.g., insurance effect or portfolio-effect
(Markowitz 1952, Yachi & Loreau 1999, Tilman et al. 2014)

Intercropping © Claudia Kriegebaum

ONE example among many (see G. Berg: diversification of microbiomes)

→ prioritize scientifically-sound methods

→ enable EU to spearhead a true agricultural revolution

Summary - Do not take the last step first!

STEP 1: EU first

→ spearheading: **prioritize attested science-based EU-made solutions** for economically & ecologically sustainable development

STEP 2: (ecological) **science first**

→ **develop appropriate methods** for risk assessment, detection & monitoring

STEP 3: safety first

→ apply **appropriate** case-by case **environmental risk** (& benefit) **assessment,** prior to assigning unsustained **categories (QPS, low risk, genes of concern)**

STEP 4: sustainability first

→ release only if STEP 3 says and no better alternatives exist

→ **always** do appropriate post-release **monitoring**

STEP 5: allow continuous innovation

→ organism-specific **time restriction:** allows learning (new scientific developments)

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(EEF) **GFÖ Letter to MoEPs**

Static safety categories are immaterial for dynamic, unpredictable **living systems** (microbe-environment interactions)**!**

→ **mandatory case-by-case assessment & monitoring** (Dir. 2001/18/EG)

https://gfoe.org/images/aktuelles/European_ecological_scientists_opinion_on_COM_2025_1031_relaxing_safety_criteria_for_GMM_release.pdf

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