SCK•CEN

STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

Restriction of microbial growth and activity in a geological repository for radioactive waste

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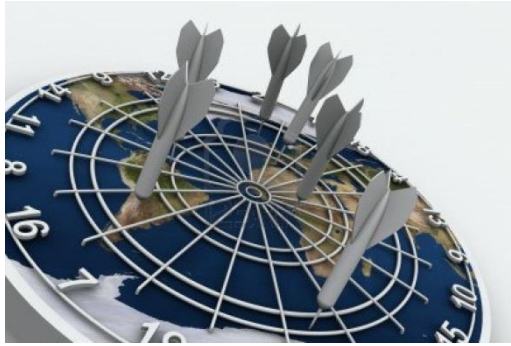
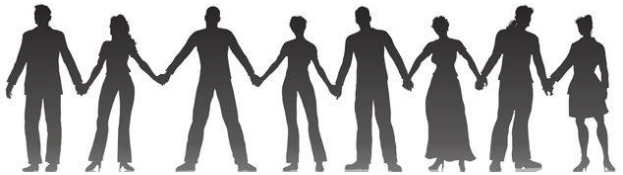
Expectations on the outcome of WG5



- Destination
  - Define scientific and technological priorities
  - Identify common interests



- Companions
  - Building a strong international network
  - Complementing competences

- Travel
  - Set the basis for a strong TSWG and subsequent EC-proposal

- Paradise
  - Joint ‘Microbiology’ project
  - Sharing of expertise and data

SCK•CEN Microbiology Team

7 Scientists	**Natalie Leys** Paul Janssen Rob Van Houdt Felice Mastroleo Pieter Monsieurs Hugo Moors Katinka Wouters
5 Technicians	Ann Provoost Ilse Coninx Wietse Heylen Patrick Boven Liselotte Leysen

6 Doctorandi	Kristel Mijnendonckx (UCL) Hanène Badri (Umons) Sandra Condori Catachura (Umons) Jozef Dingemans (VUB) Joachim Vandecraen (KUL) Mohamed Ahmed Mysara (VUB)

= 19 pers

1 Consultant	*Mergeay Max*
Ca. 1-5	*scientific visitors/trainees/students*

+ Collaboration and interactions with the SCK•CEN Waste & Disposal Unit and Euridice-ESV

Expertise: research fields

Space

Nuclear Installations

MIC @ SCK•CEN

Towards better understanding of microbial behaviour when exposed to radiation, (radio)toxic compounds, and challenging environmental conditions

By detailed analysis of

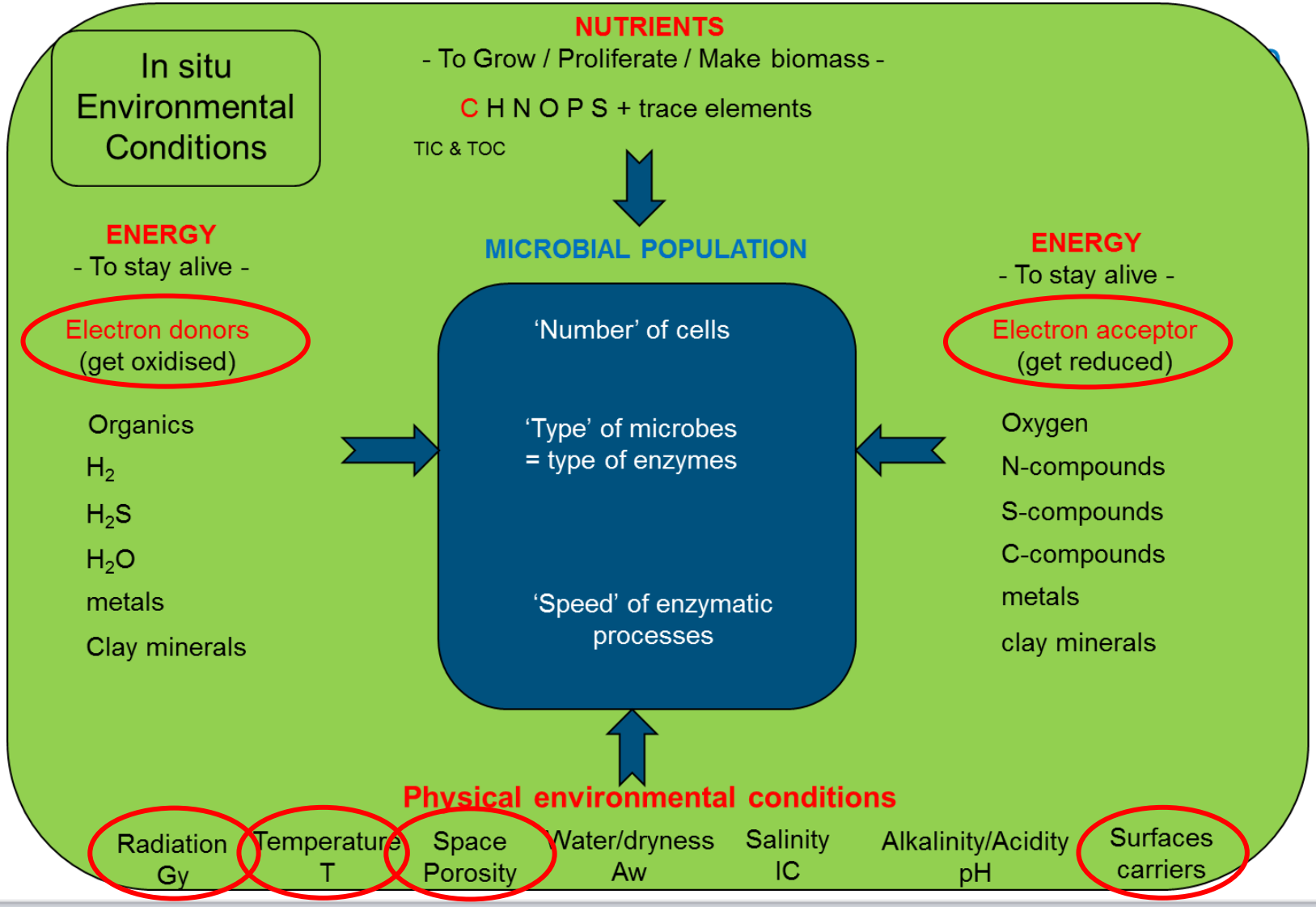
Bioprocess → **Community biodiversity** → **Cell physiology** → **Genetics & gene transfer** → **Gene expression & regulation** → **Bio-informatics**

To exploit the full benefits of microbes in biotechnologies
To manage microbial hazard and environmental safety

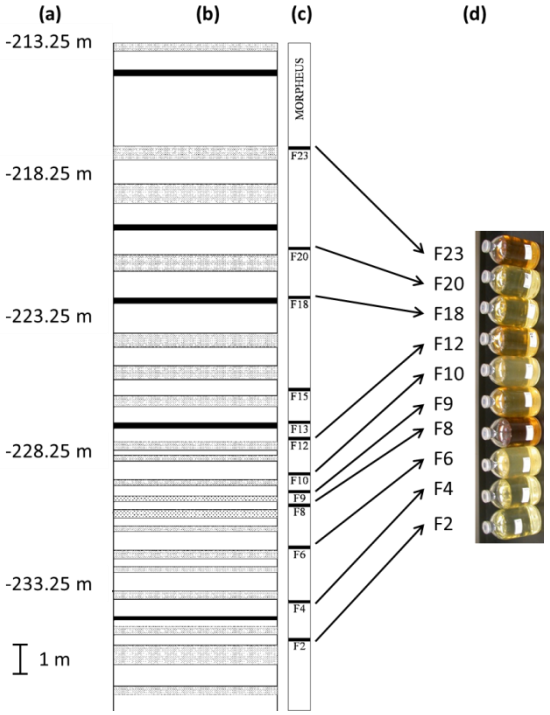
Environment

Human body

Expertise: Boundaries of Microbial Life

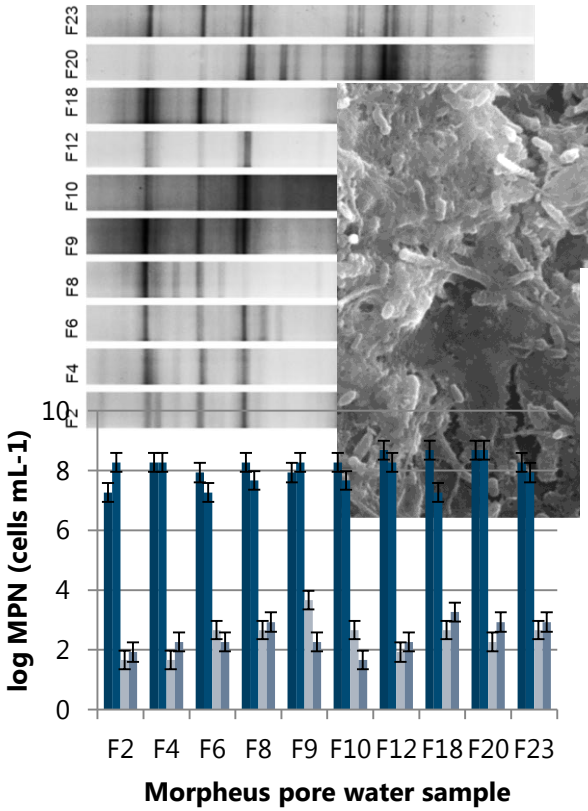


Expertise: Microbial Community Typing

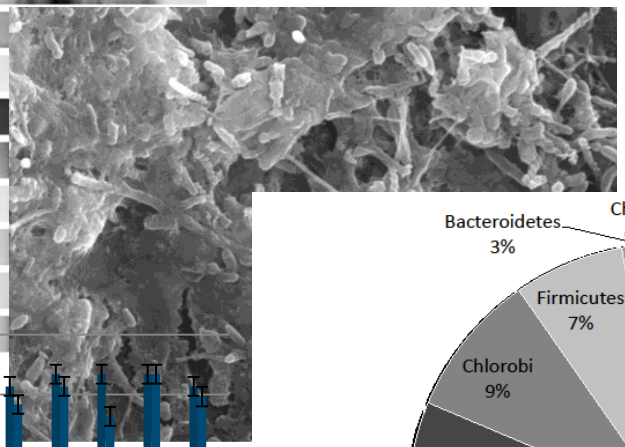


Piezometer sampling

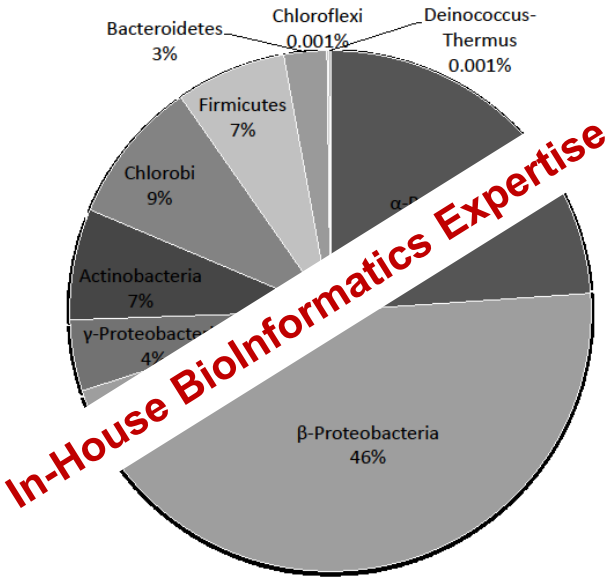
PCR-DGGE



SEM



Targeted cultivation



In-House BioInformatics Expertise

Metagenomics

Wouters K, Moors H, Boven P & Leys N (2013) Evidence and characteristics of a diverse and metabolically active microbial community in deep subsurface clay borehole water. *FEMS Microbiol Ecol*. xx-xx (published online ahead of print).

Contribution to Competent Safety Case

Microbes will be present and active, and will interact with waste, repository and host rock environment, during excavation, exploitation, and storage.

→ Need to reduce uncertainties about:

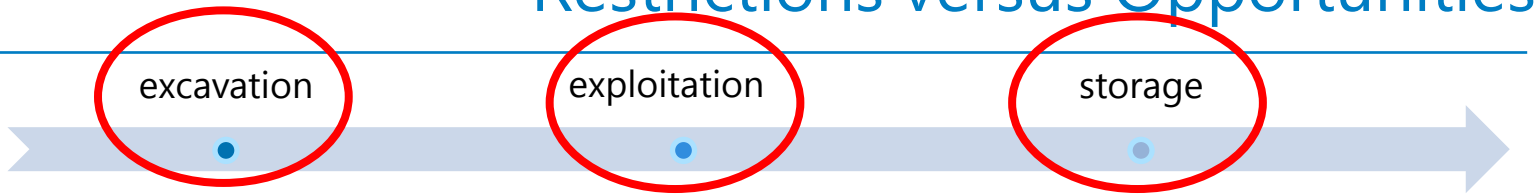
- the microbial communities present in waste, repository and host rock

- the microbial bioprocesses that can occur at *in situ* conditions

- the impact of those processes on the water & surface geochemistry

- the impact of those geochemical changes on the waste, repository and clay environment

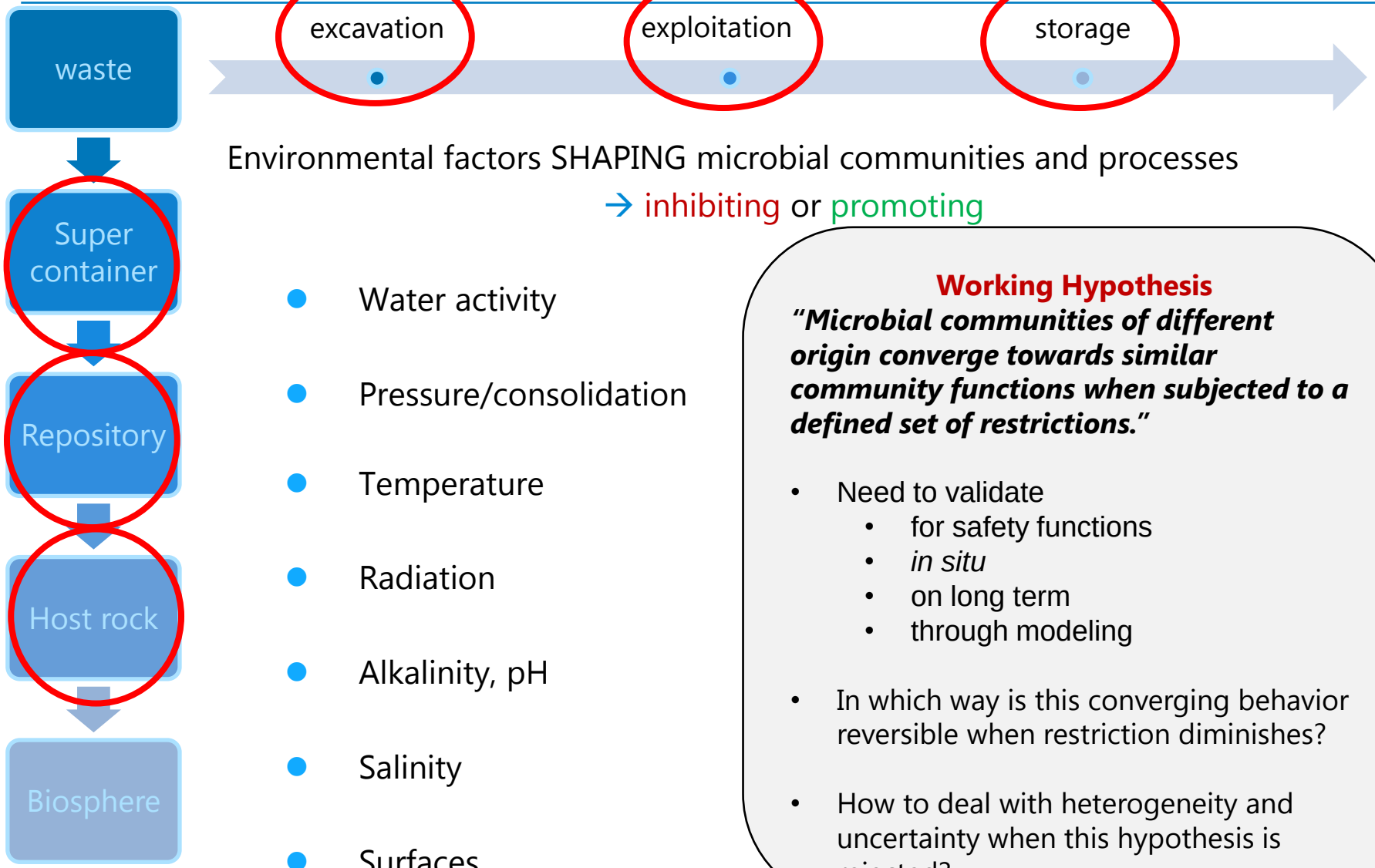
Restrictions versus Opportunities



Physical conditions SHAPING microbial communities and processes
→ inhibiting or promoting

- Water activity — clay, borehole, granite
- Pressure/consolidation — nanopores, fractures, voids
- Temperature — 16°C → 80°C
- Radiation — background →25Gy/h
- Alkalinity, pH — pH 8 → pH 13
- Salinity — nitrate plume
- Surfaces — engineered interfaces, equipment

Restrictions versus Opportunities



Environmental factors SHAPING microbial communities and processes

→ inhibiting or promoting

- Water activity
- Pressure/consolidation
- Temperature
- Radiation
- Alkalinity, pH
- Salinity
- Surfaces

Working Hypothesis

"Microbial communities of different origin converge towards similar community functions when subjected to a defined set of restrictions."

- Need to validate
  - for safety functions
  - *in situ*
  - on long term
  - through modeling
- In which way is this converging behavior reversible when restriction diminishes?
- How to deal with heterogeneity and uncertainty when this hypothesis is rejected?