Antarctic cyanobacterial diversity in the BCCM/ULC collection as useful and sustainable resource for research

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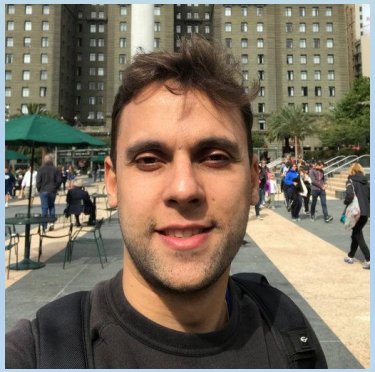
Curator



Technician

Manager
Bioinformatician

BCCM GREAT AT SMALL THINGS
BELGIAN CO-ORDINATED COLLECTIONS OF MICRO-ORGANISMS

1) Culture collections of microbial strains ('MicroBiological Resources Centers')

2) History and objectives of BCCM/ULC

3) Sustainable and useful resource for Antarctic research

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Two main roles

1. Conservation ‘ex-situ’ of microbial biodiversity, that sometimes might be under threat in its original biotope

→ Fundamental research on taxonomy, classification, biogeography, characterization s.l.

2. Possible applications of the preserved microbial biodiversity

→ Applied research on production of molecules of interest in biotechnology, pharmaceuticals, cosmetics, energy production….

→ Paid services to industry (identifications, caracterizations, analyses, …).

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"Biological resource centres are an essential part of the infrastructure underpinning life sciences and biotechnology. They consist of service providers and repositories of the living cells, genomes of organism, and information relating to heredity and the functions of biological systems"

OECD report : Biological Resource Centres: Underpinning the Future of Life Sciences and Biotechnology (2001)

→ 2007: OECD Best Practice Guidelines for Biological Resource Centres

Where to find them?

https://www.wfcc.info/

European Research Infrastructure

Microbial Resource Research Infrastructure

https://www.mirri.org/

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Microbial culture collections: '**living archives**' that ensure long-term access to the strains (also called 'biological resources') and their metadata in a **FAIR** manner.

Findable : most have a searchable catalogue on Internet and the strain identifier is unique

Accessible: most strains can be purchased for a nominal fee and the metadata is given in the catalogue. The price does not cover the real costs as the culture collections are generally subsidized by public authorities

Interoperable: the strains can be further cultivated and used, and the metadata is provided in formats allowing integration, comparison, analysis

Reusable: with suitable care, the strains can be kept in culture and used multiple times, as the metadata .

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Since 2006

From in-house research collection

To public collection

research-based

providing services

open for legitimate users

operating within a legal framework

integrated into the Belgian Coordinated Cultures of Microorganisms (BCCM)

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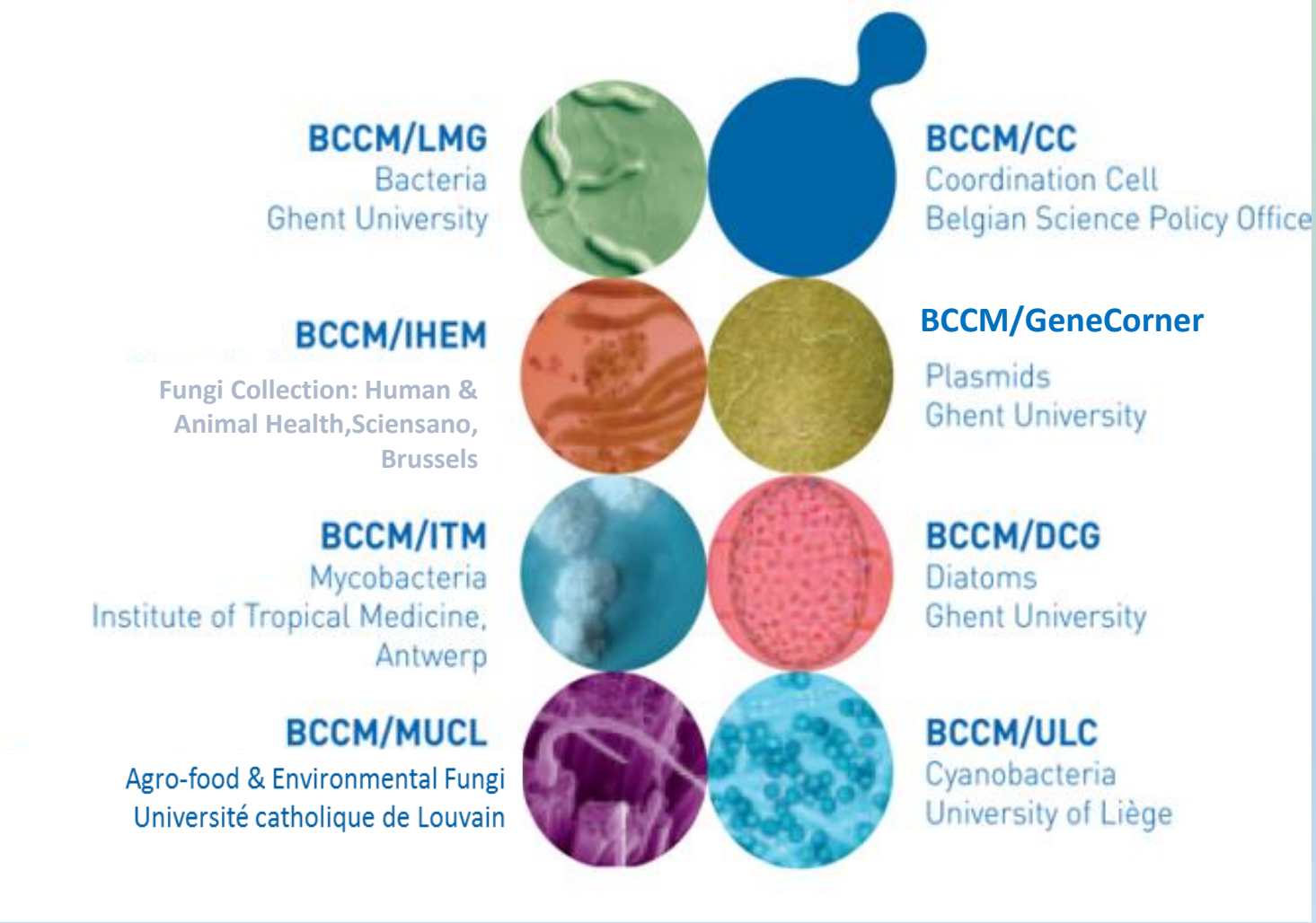
The BCCM Consortium

7 decentralised culture collections, coordinated by a Central team at the Belgian Science Policy Office



https://bccm.belspo.be/

LRQA CERTIFIED
ISO 9001-2015

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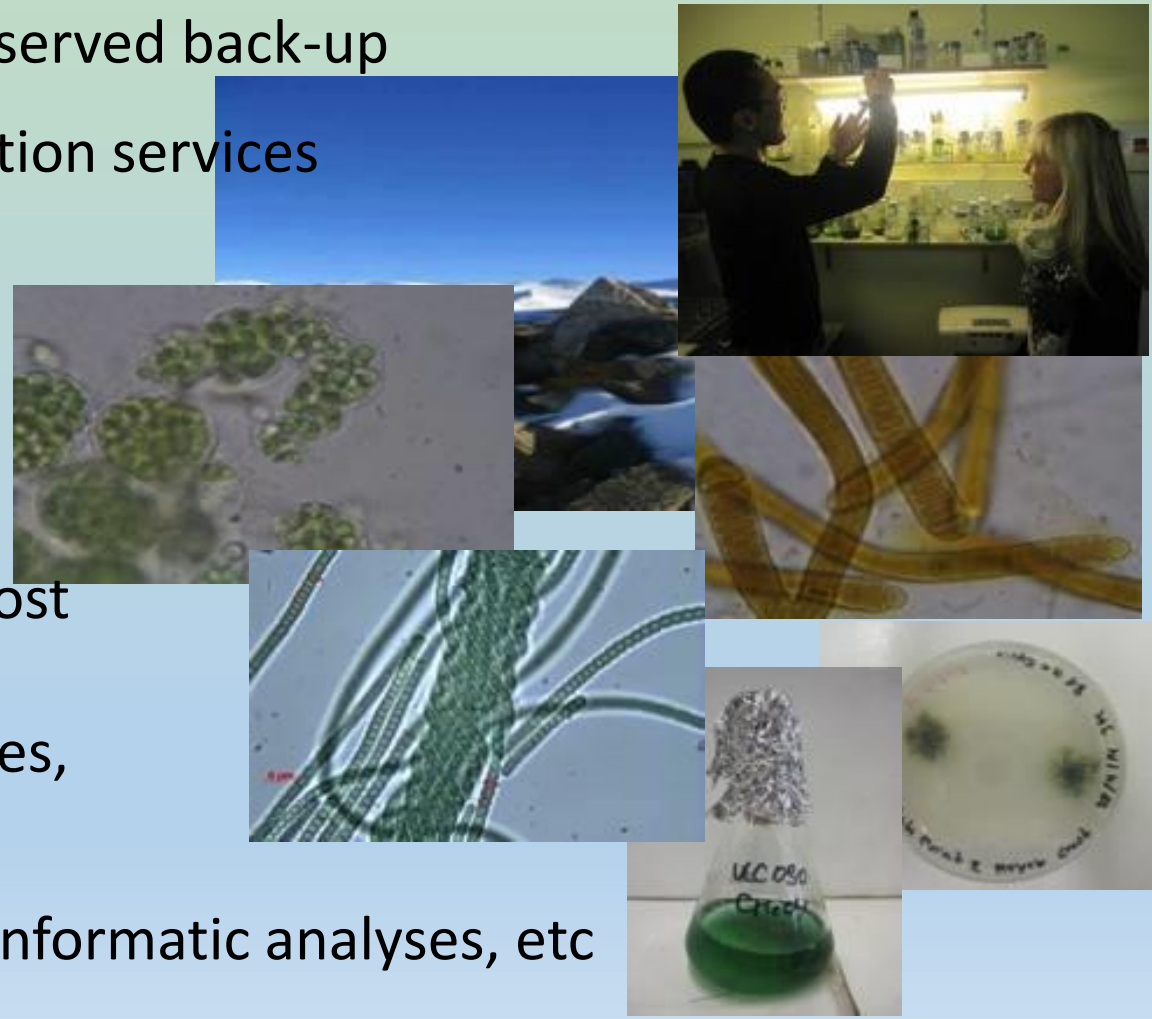
BCCM/ULC public collection of cyanobacteria

- > 400 unicyanobacterial strains, of which 140 of Antarctic origin
- Maintenance as living cultures, with a cryopreserved back-up
- ISO 9001 certification for deposit and distribution services
- New: possibility of safe deposit!



- **Geographic focus** : cyanobacteria from the Polar Regions

-**Taxonomic focus** : obtain representatives of most abundant orders (Chroococcales, Chroococcidiopsidales, Nostocales, Oscillatoriales, Pleurocapsales, and Synechococcales)

- **Paid services** like trainings, identifications,bioinformatic analyses, etc

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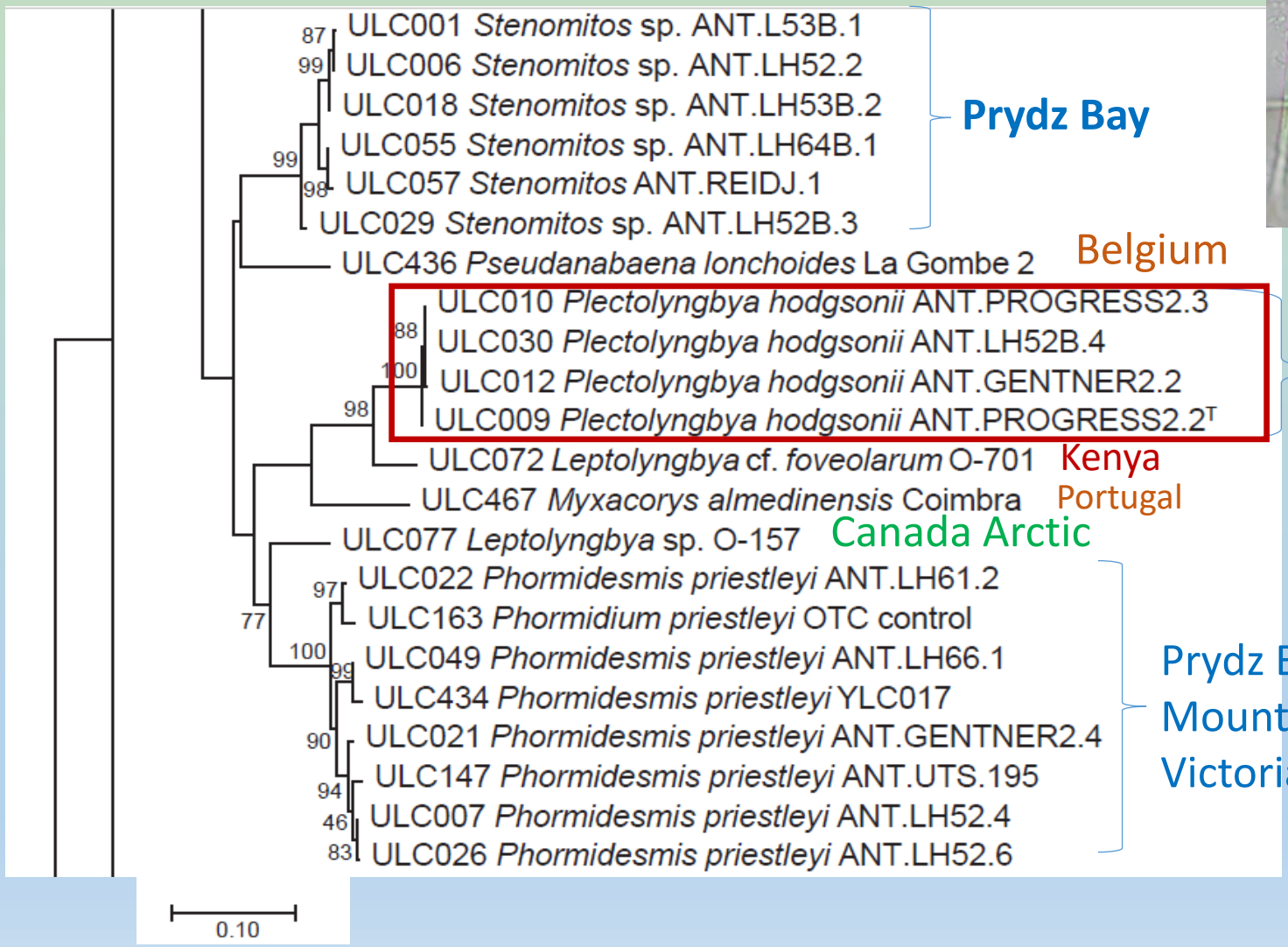
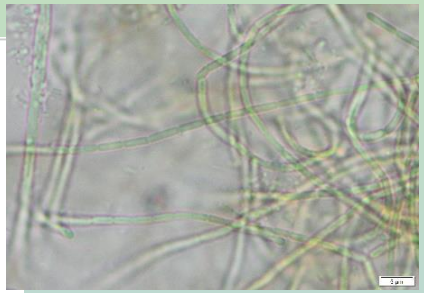
Large diversity of Antarctic strains in the BCCM/ULC collection

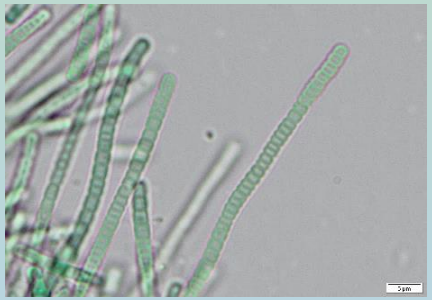
129 strains $\rightarrow$ 40 OTUs (99% 16S rRNA similarity)

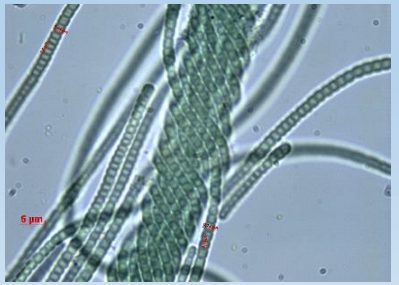
Example of this diversity: *Plectolyngbya hodgsonii*

Filamentous genera: 18 Antarctic and 1 Arctic strain









Polar Biol (2011) 34:181–191
DOI 10.1007/s00300-010-0868-y

ORIGINAL PAPER

Plectolyngbya hodgsonii: a novel filamentous cyanobacterium from Antarctic lakes

A. Taton · A. Wilmotte · J. Šmarda · J. Elster · J. Komárek

Potentially **endemic species**, only found in Antarctica (Pridz Bay, Schirmacher Oasis and Mc Murdo Dry Valleys)

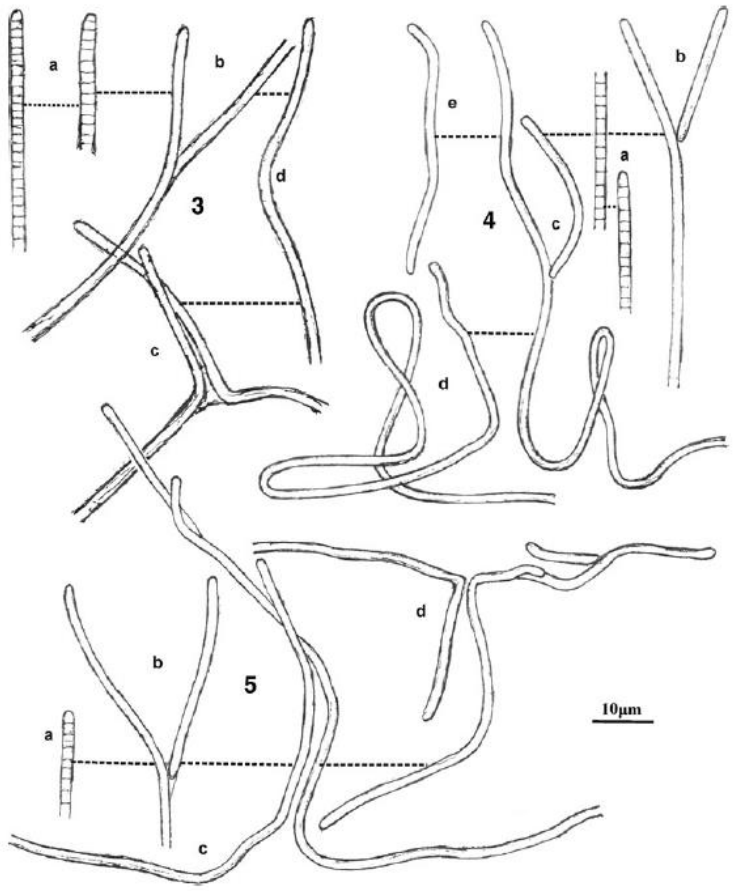


Fig. 3–5 *Plectolyngbya hodgsonii*: 3 = drawing of type material from the strain ANT.LPR3 (a detail of trichomes; b–c false branching of filaments; d simple filament); 4–5 = two different populations from Monolith Lake, James Ross Island (a detail of trichomes; b–d filaments, mostly with false branching; e germinating hormogonium). (Orig.)

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- **small** pieces of natural samples are sufficient to isolate a **large** number of strains,
- access to microbial biodiversity **without** the environmental costs of field trips and cumulative impact of sample collections, especially when the latter are impossible….

Moreover…

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Culture collections are important because

« we publish and then, we move labs, we change jobs, …..

or …. we perish »

Therefore, **important biological material and related information might be lost forever**.

Hi Annick,
Unfortunately I don't have them either in the move to _h about five years ago I think they did not move over.
Sorry about that...

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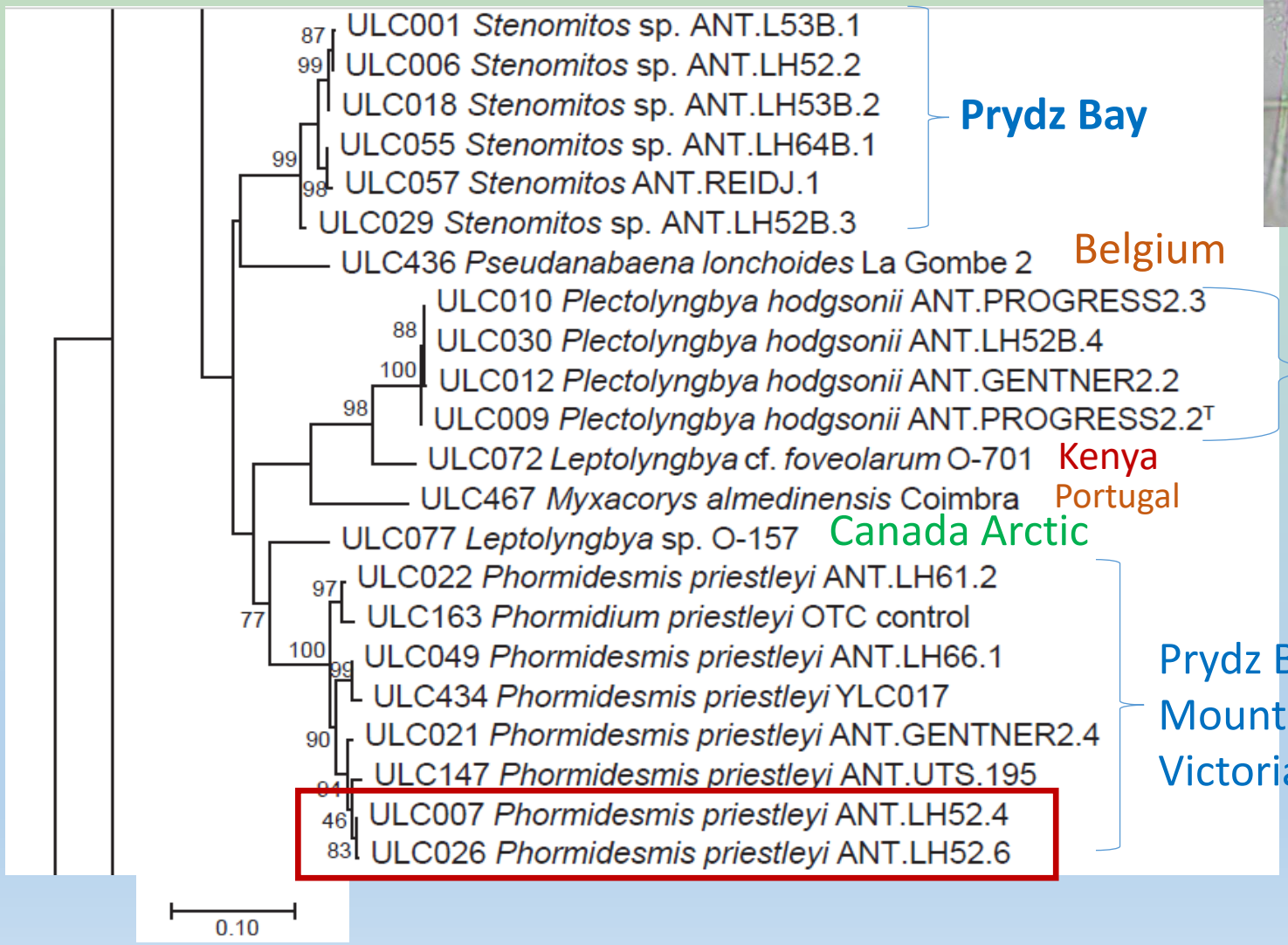
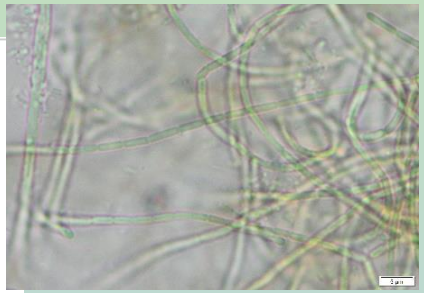
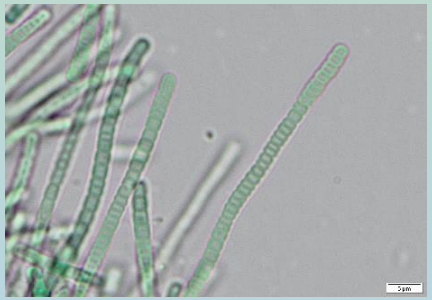
Session 26: Genomic insights into past and present Antarctic Biodiversity (Usnea)
11:50- 12.00 Valentina Savaglia: Life on the edge: resistance mechanisms to desiccation and re-wetting of two Antarctic *Nostoc* sp. strains from freshwater and terrestrial habitats

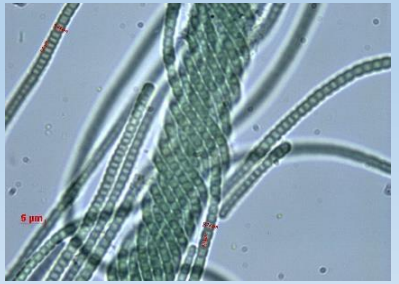
2 examples of our genomic research

Filamentous genera: 18 Antarctic and 1 Arctic strain

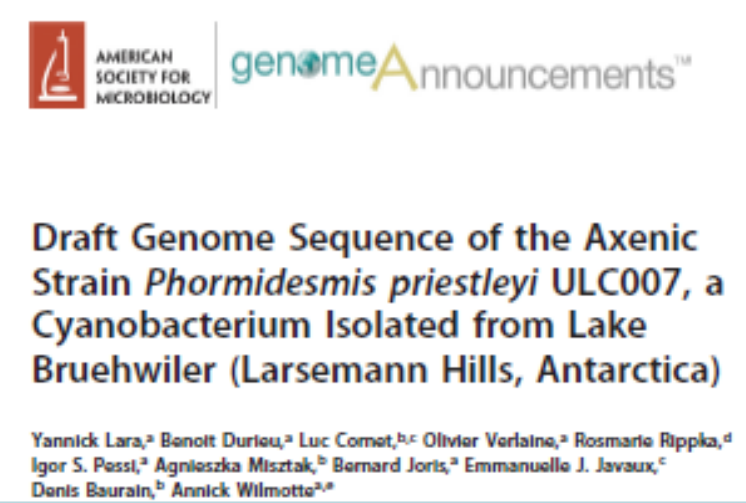








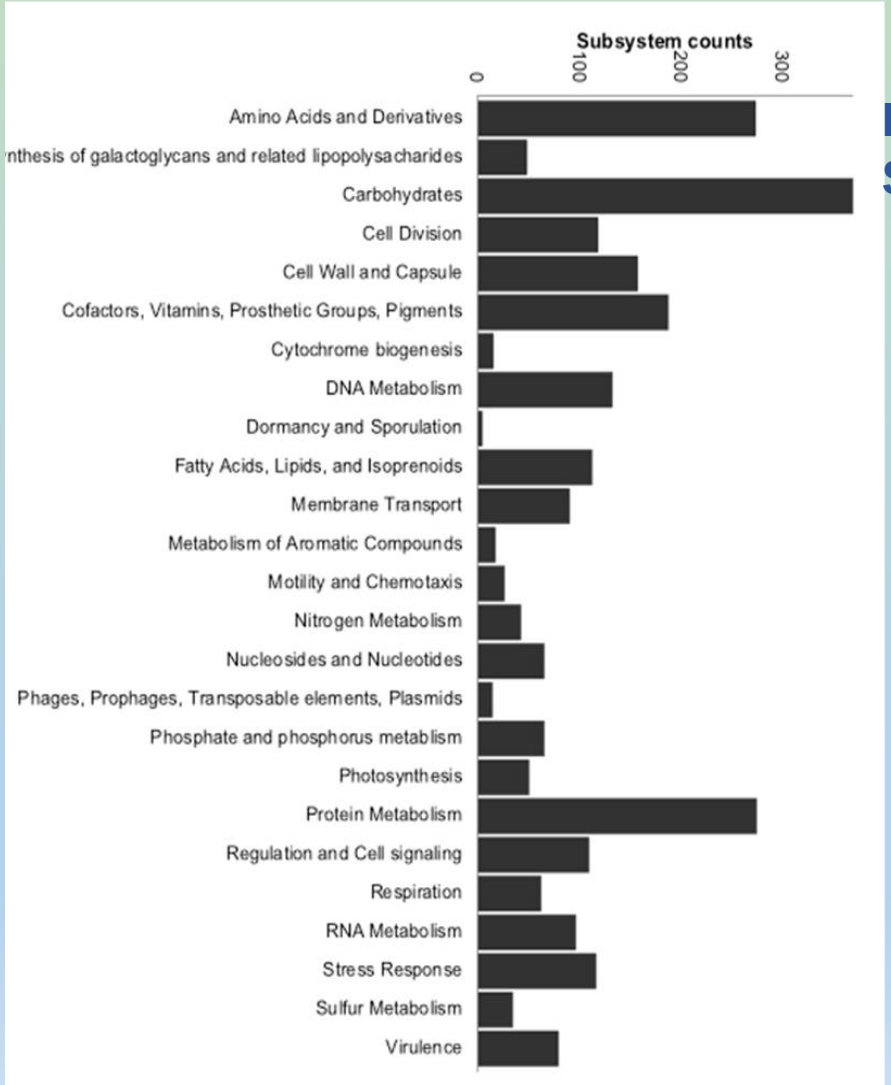
Phormidesmis priestleyi BCCM/ULC007*:* first genome sequence of Antarctic cyanobacterial strain



Total length : 5 684 389 bp

Annotation:

5,604 PEGs (protein encoding genes) of which 4,785 PEGs already known



RAST: Rapid Annotations using Subsystems Technology

Aziz et al., BMC Genomics, 2008

Number of ULC007 genes in each subsystem

2 Antarctic and 1 Brazilian strains of the genus *Laspinema*

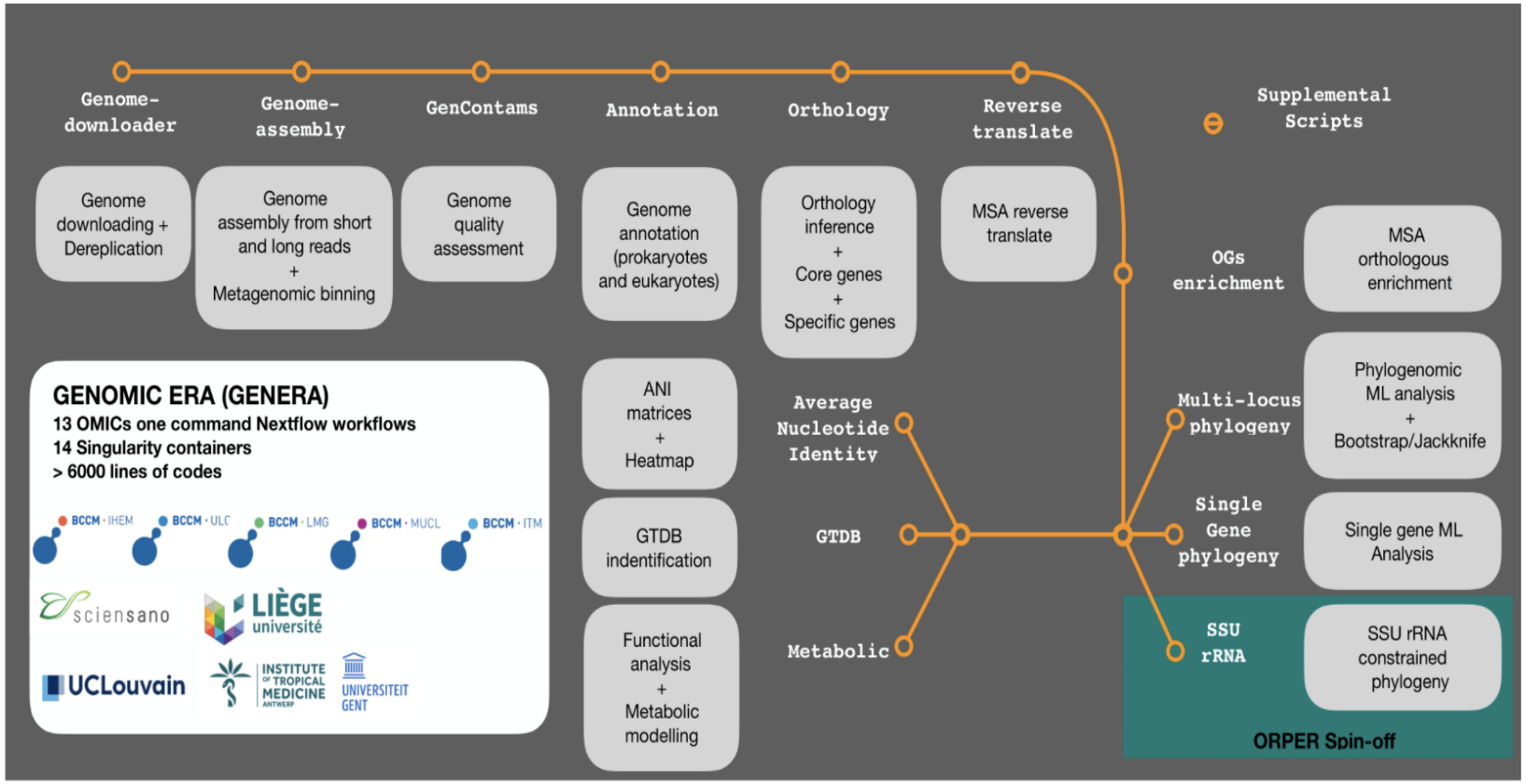
Genome sequencing with MiSeq (Illumina) + Minion (Nanopore)

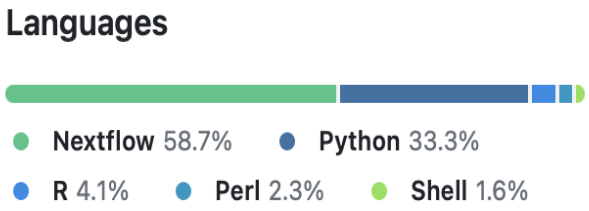
ULC096: 7,1 bp

ULC102: 7,2 bp

ULC722: 8,1 bp

GEN-ERA workflows for genome sequencing





https://github.com/Lcornet/GENERA

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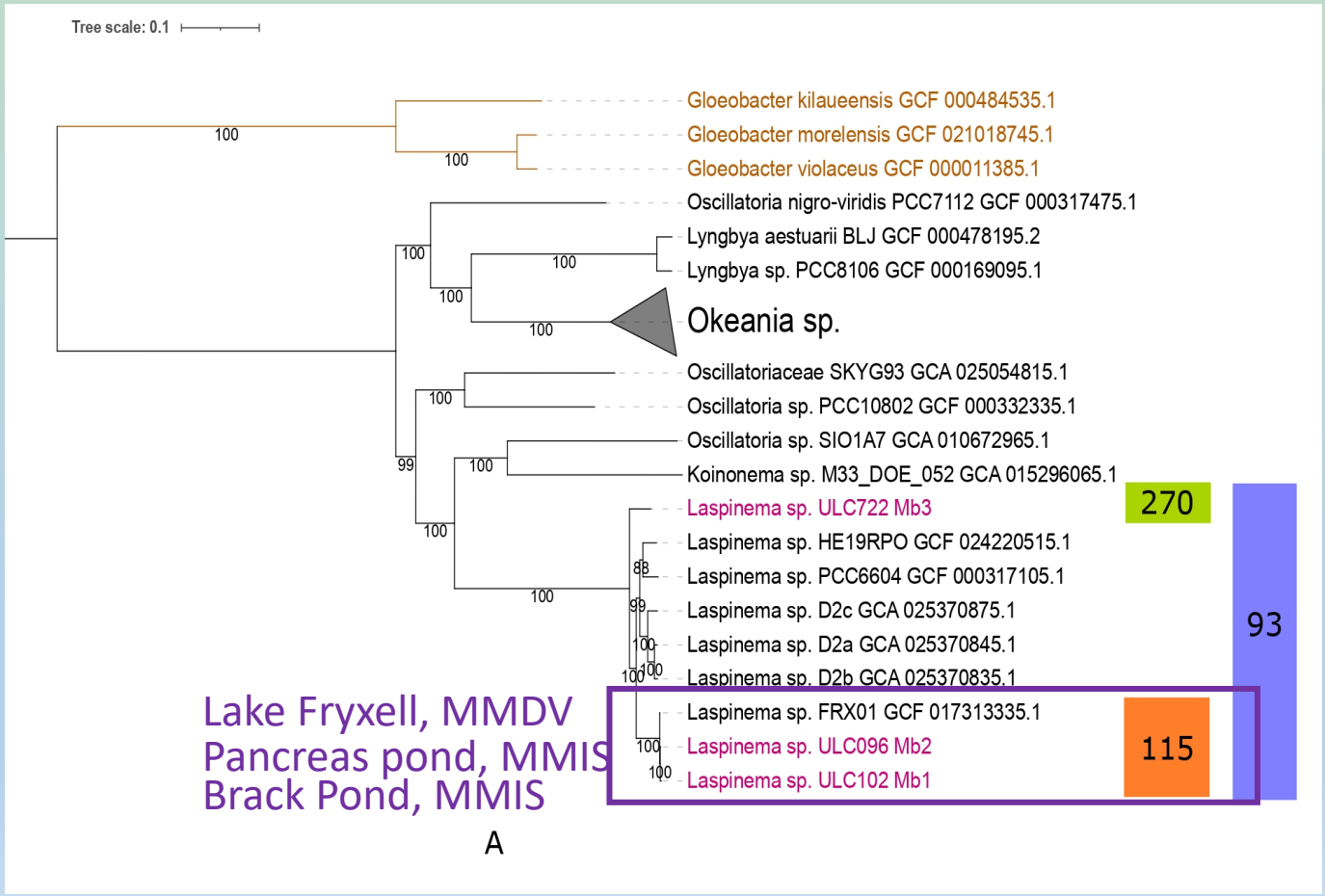
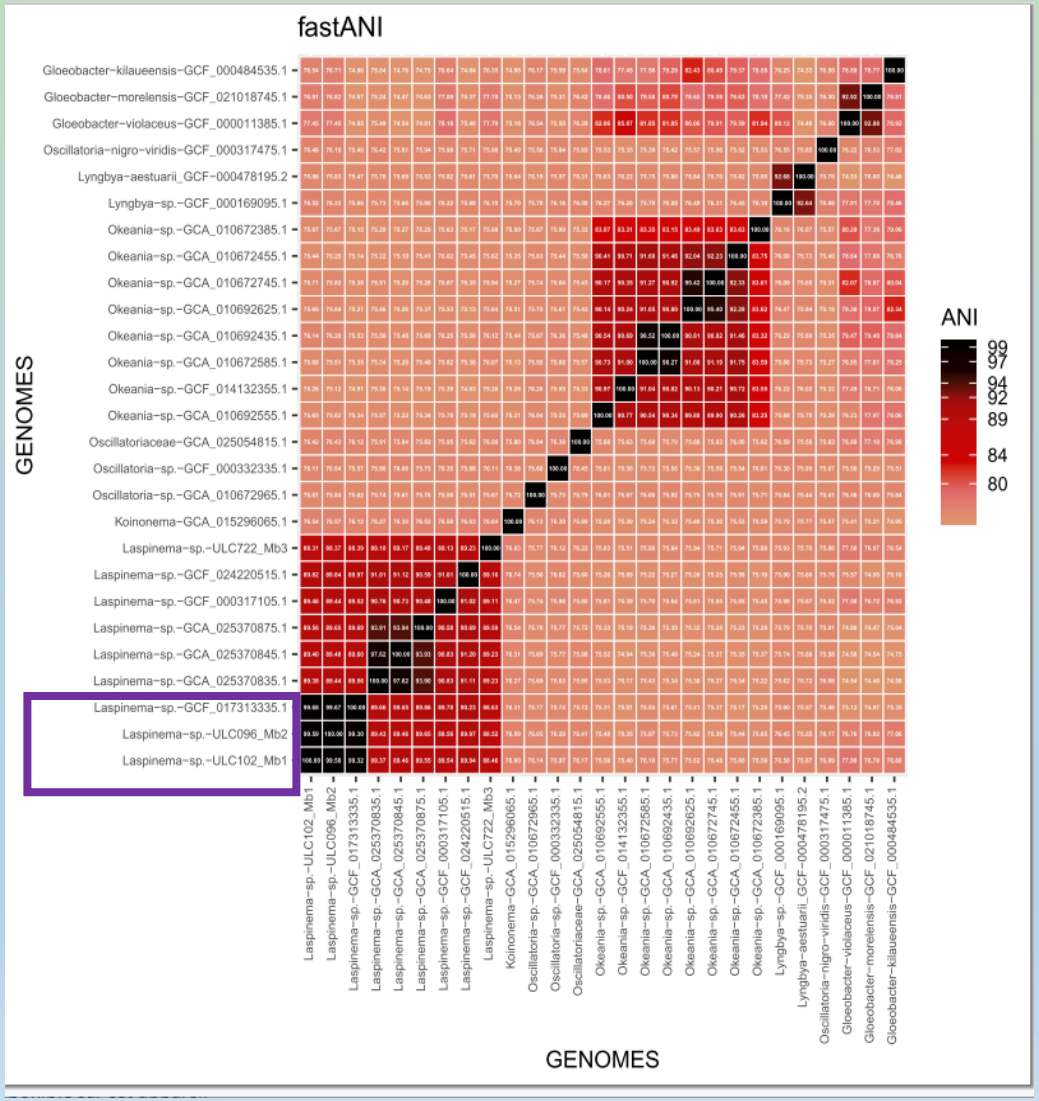


Maximum likelihood phylogeny of the *Laspinema* genus

Color bars: number of specific genes

Antarctic strains

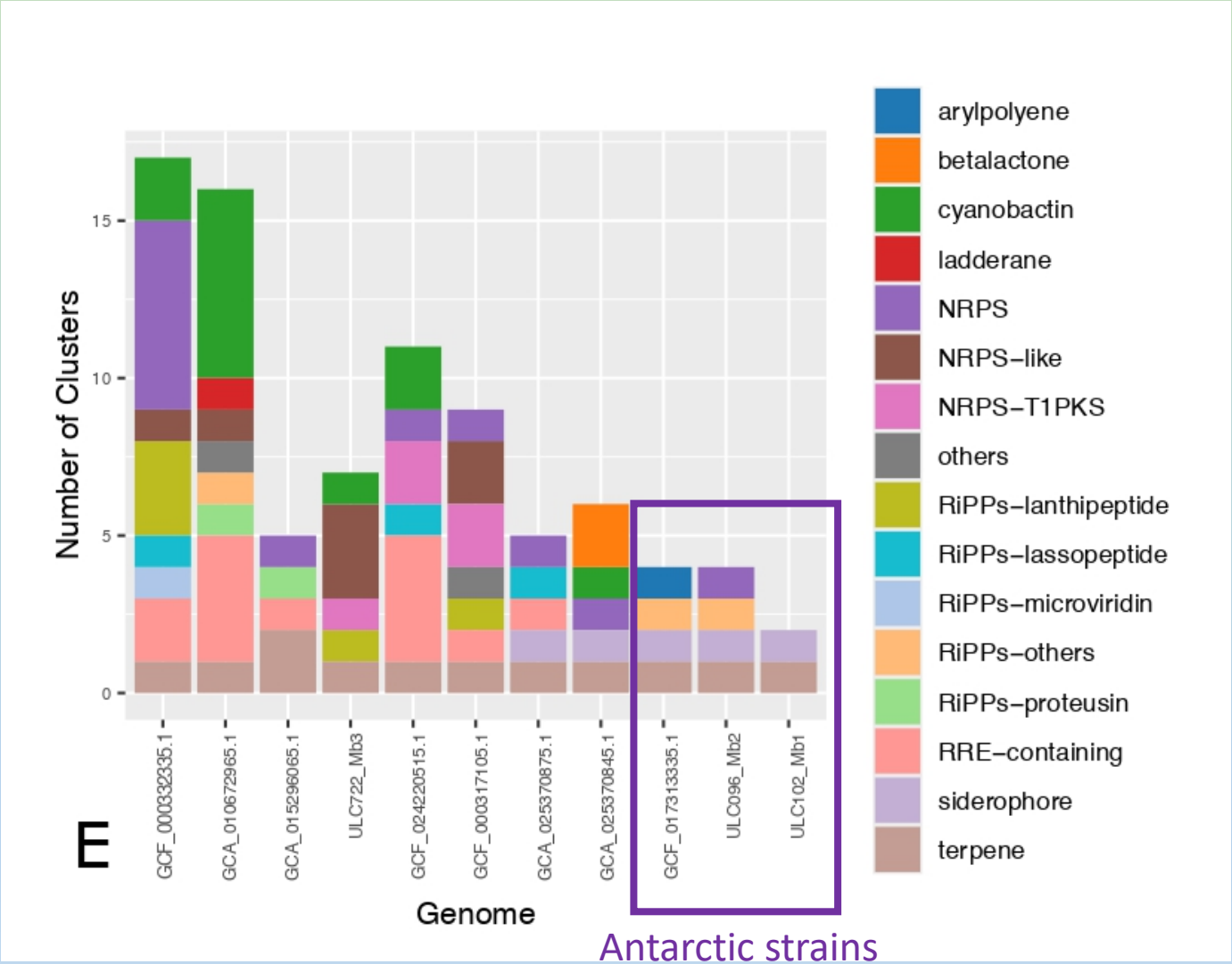
The three **Antarctic *Laspinema*** strains belong to **one species** and are **distinct** to the other strains



3 Antarctic strains

ANI: Average Nucleotide Identity between genomes

Search for gene clusters encoding secondary metabolites



(AntiSMASH)

→ Antarctic *Laspinema* strains seem to have less potential for synthesis of secondary metabolites

Thanks for your attention!

LIÈGE université

Post-doctoral fellowship on Cyanobacterial research in Polar biotopes (University of Liège)

Dr Annick Wilmotte (awilmotte@uliege.be)

A meeting during the SCAR2024 OSC is possible