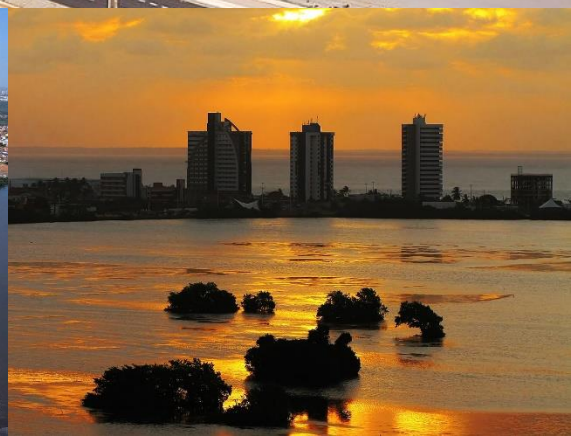
Federal University of Maranhão
Research Group in Biodiversity, Bioprospecting and Biotechnology

Cyanobacteria and microalgae: from diversity to biotechnology

Prof. Dr. Leonardo Teixeira Dall'Agnol
Buenos Aires, October 21, 2019

Where are we?

São Luís: World Heritage Site



Why cyanobacteria?

Cyanobacteria Phylum

One of the most diverse group of procatyotes

Morphology, physiology and metabolism

Nitrogen fixation and producers of bioactive compounds, biofuels and cyanotoxins

Brasil → Tropical region

Fonte: Google imagens

(WIEGAND; PFLUGMACHER, 2005; SANTANNA et al., 2008)

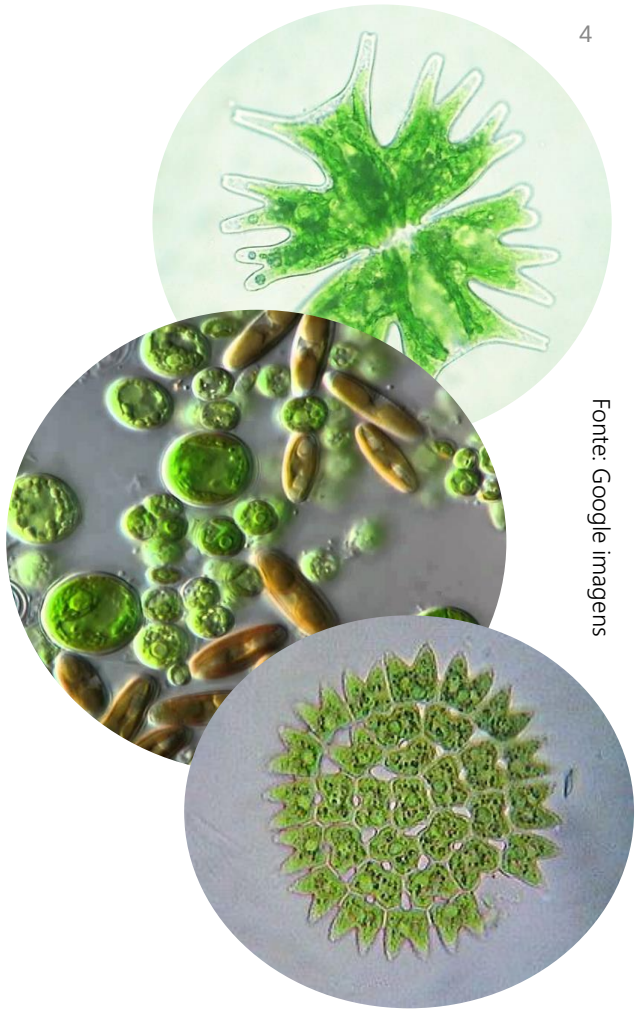
Why Chlorophyta?

Chlorophyta Philum

Freshwater and sea algae

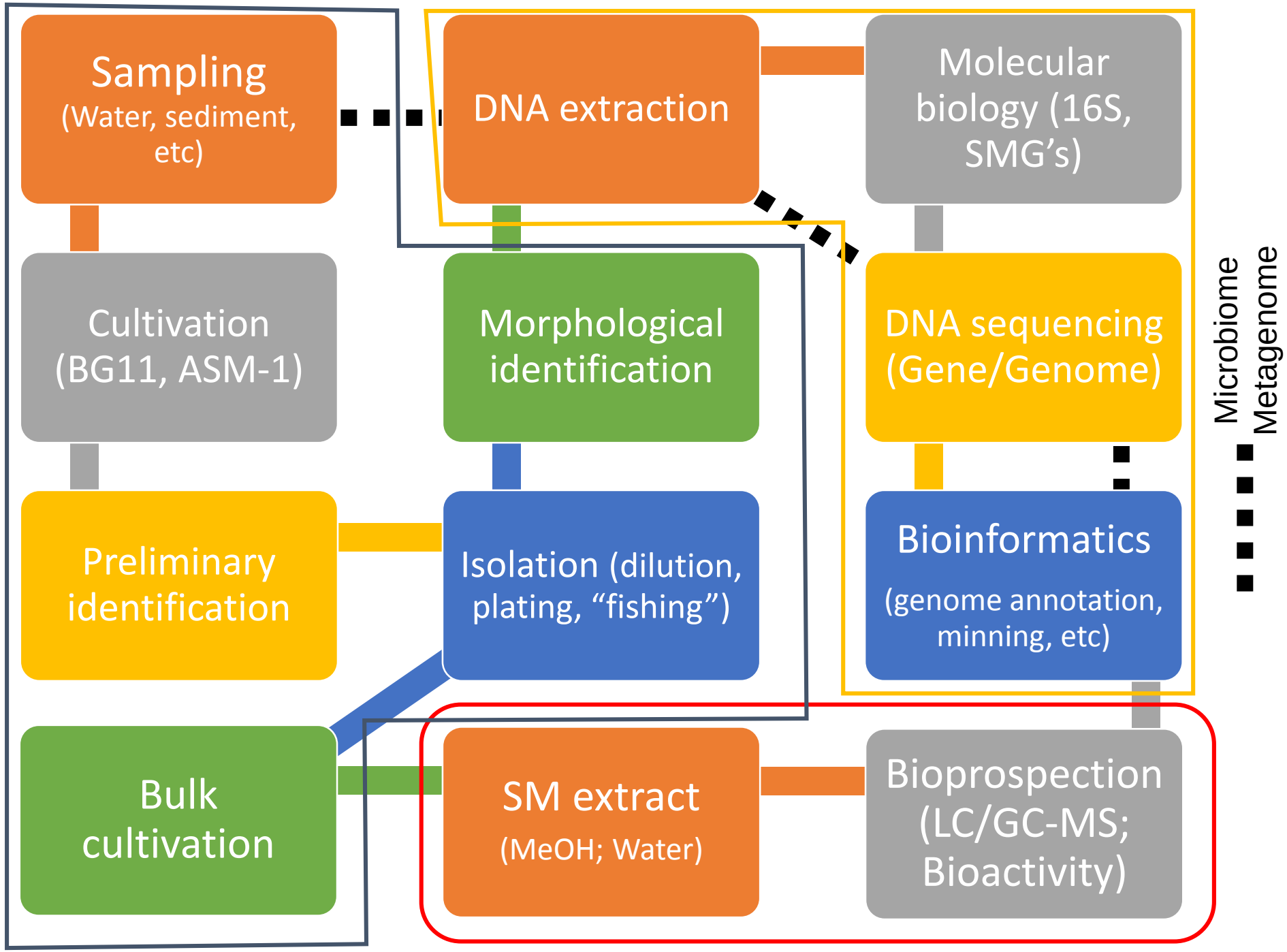
Chlorophyll as principal pigment and starch as reservoir

Heavy metal resistance (bioremediation), bioactive compounds production and biofuels

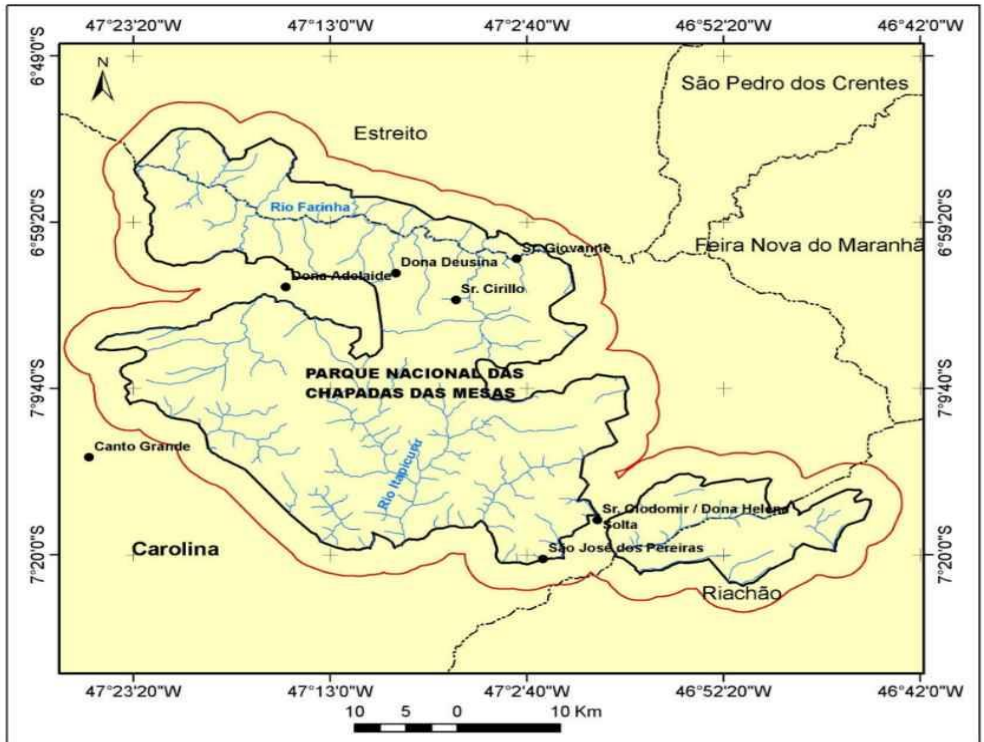


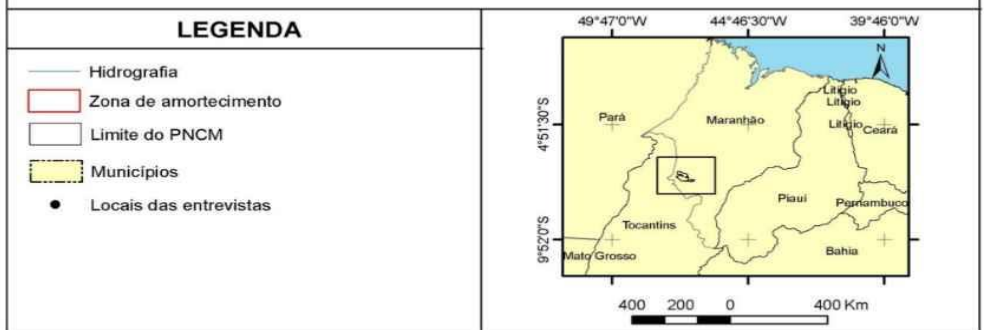
Fonte: Google imagens

(REYNOLDS, 1984; NOT et al., 2012; PAL; CHOUDHURY, 2014)


Sampling
(Water, sediment, etc)
DNA extraction
Molecular biology (16S, SMG's)
Cultivation (BG11, ASM-1)
Morphological identification
DNA sequencing (Gene/Genome)
Preliminary identification
Isolation (dilution, plating, "fishing")
Bioinformatics
(genome annotation, minning, etc)
Bulk cultivation
SM extract
(MeOH; Water)
Bioprospection (LC/GC-MS; Bioactivity)
Microbiome
Metagenome

Chapada das Mesas National Park



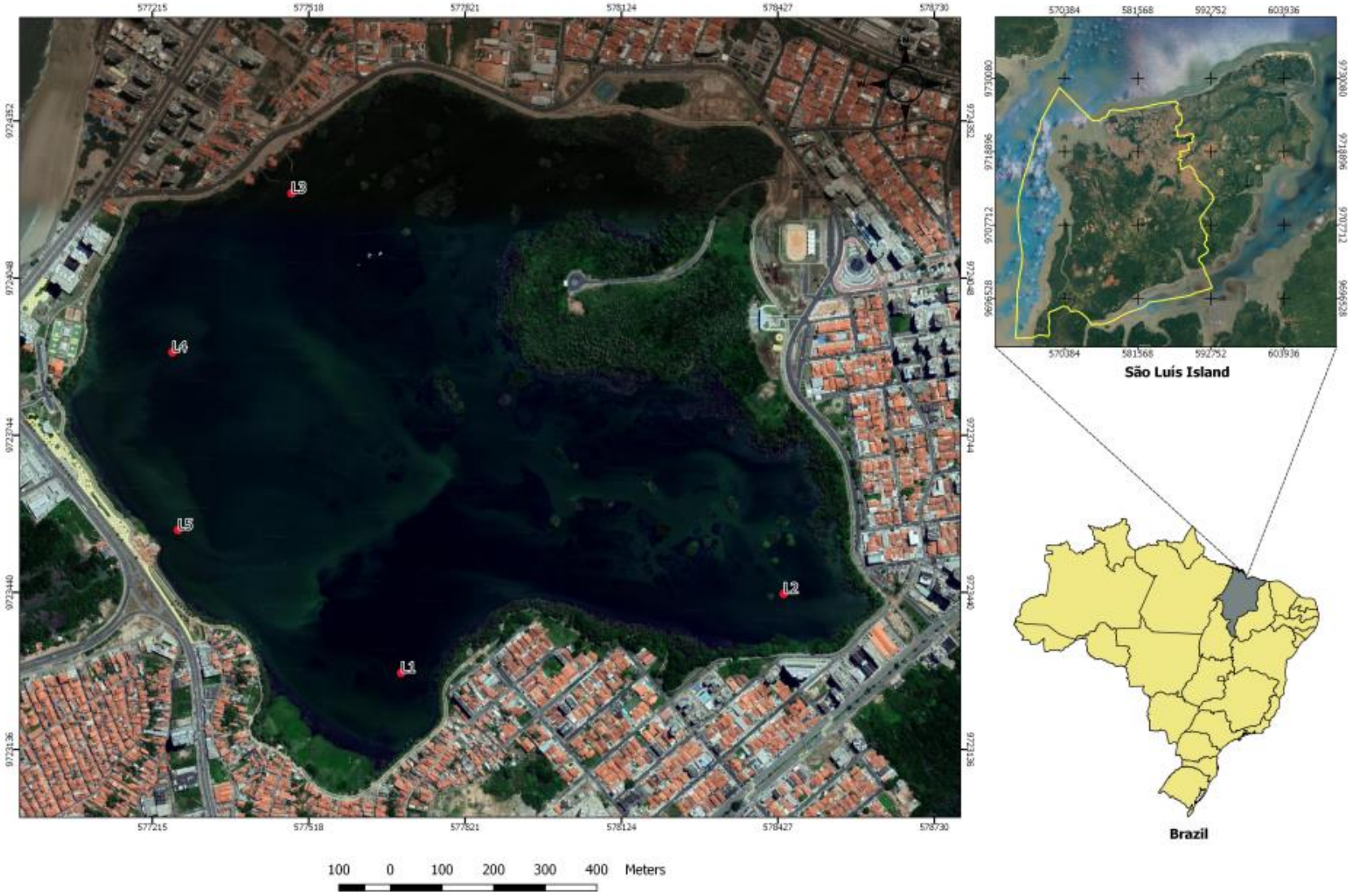


Datum South América - SAD 69;
Meridiano de Origem: 45° W Gr.23S
Elaboração: José Fernando Rodrigues Bezerra;
Quésia Duarte da Silva, Ana Rosa Marques
Base de dados: Mosaico LandSat 2013;
SRTM-EMBRAPA, 2005; CPRM, 2013; IBGE, 2005.

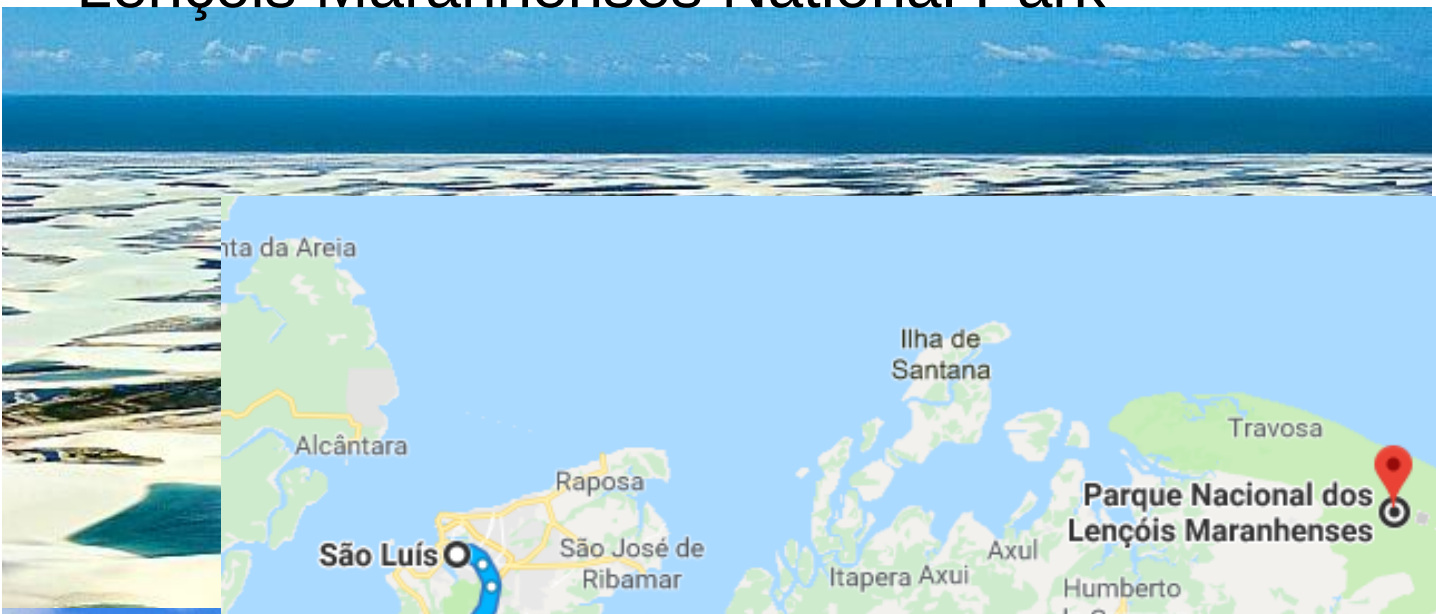
FAPEMA UEMA GEDERES GEOMAP

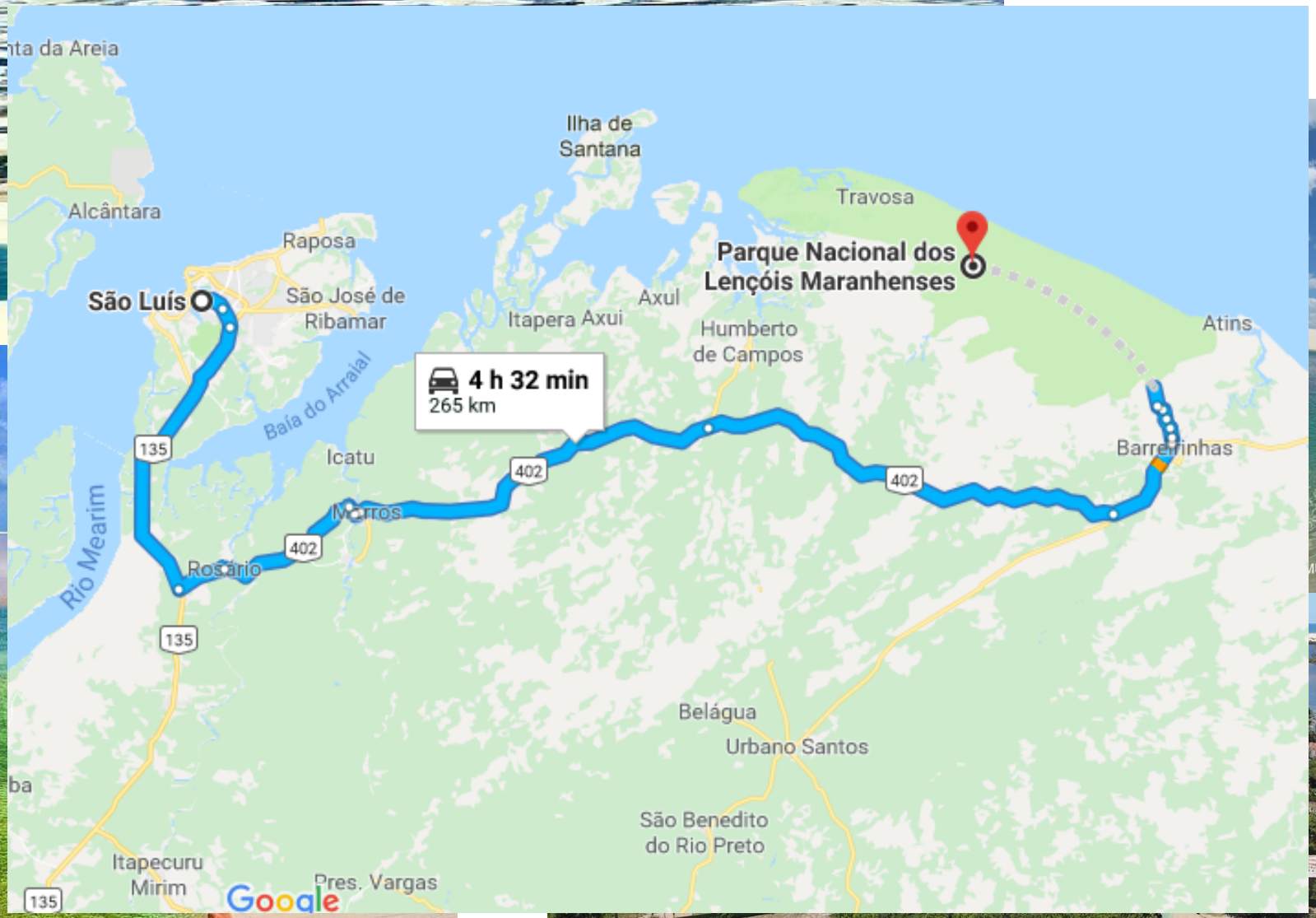
FIGURA 1 - LOCALIZAÇÃO DO PARQUE NACIONAL DAS CHAPADAS DAS MESAS

Jansen Lagoon – São Luís



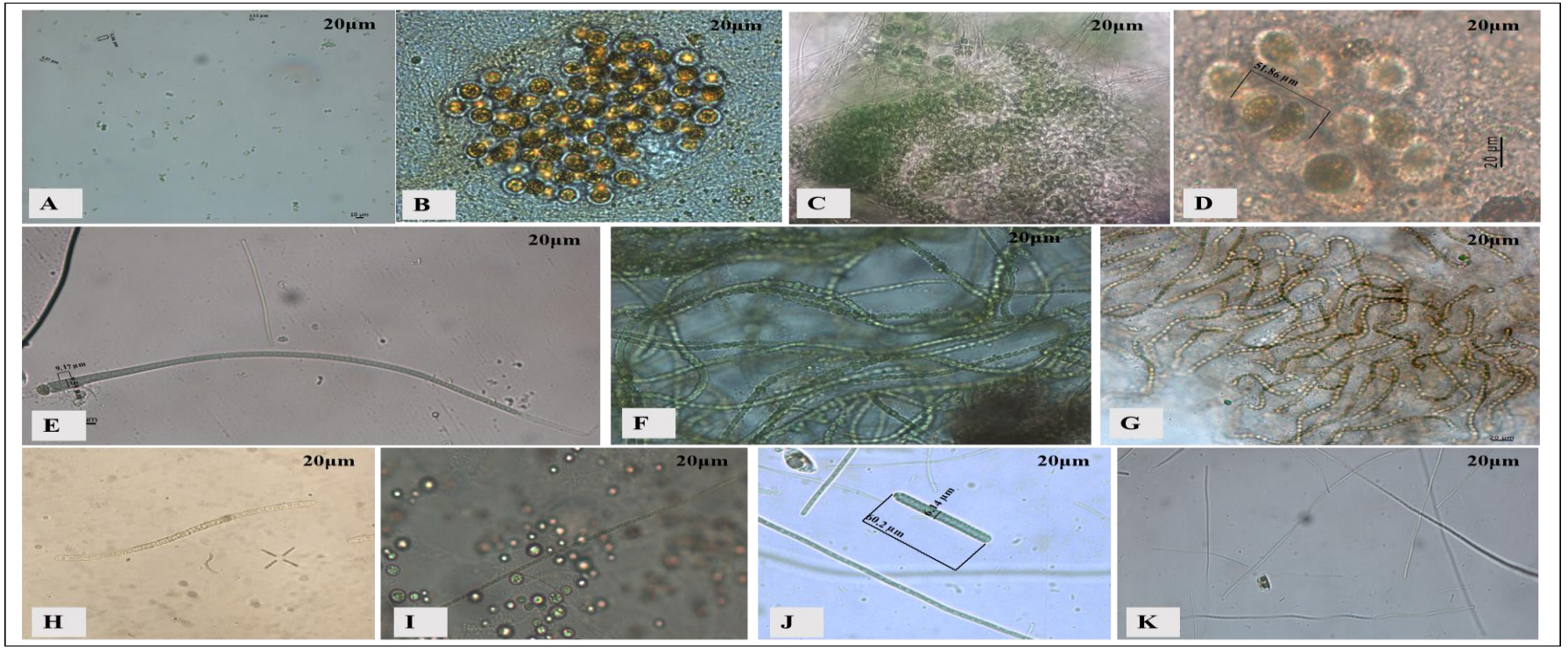
Lençóis Maranhenses National Park





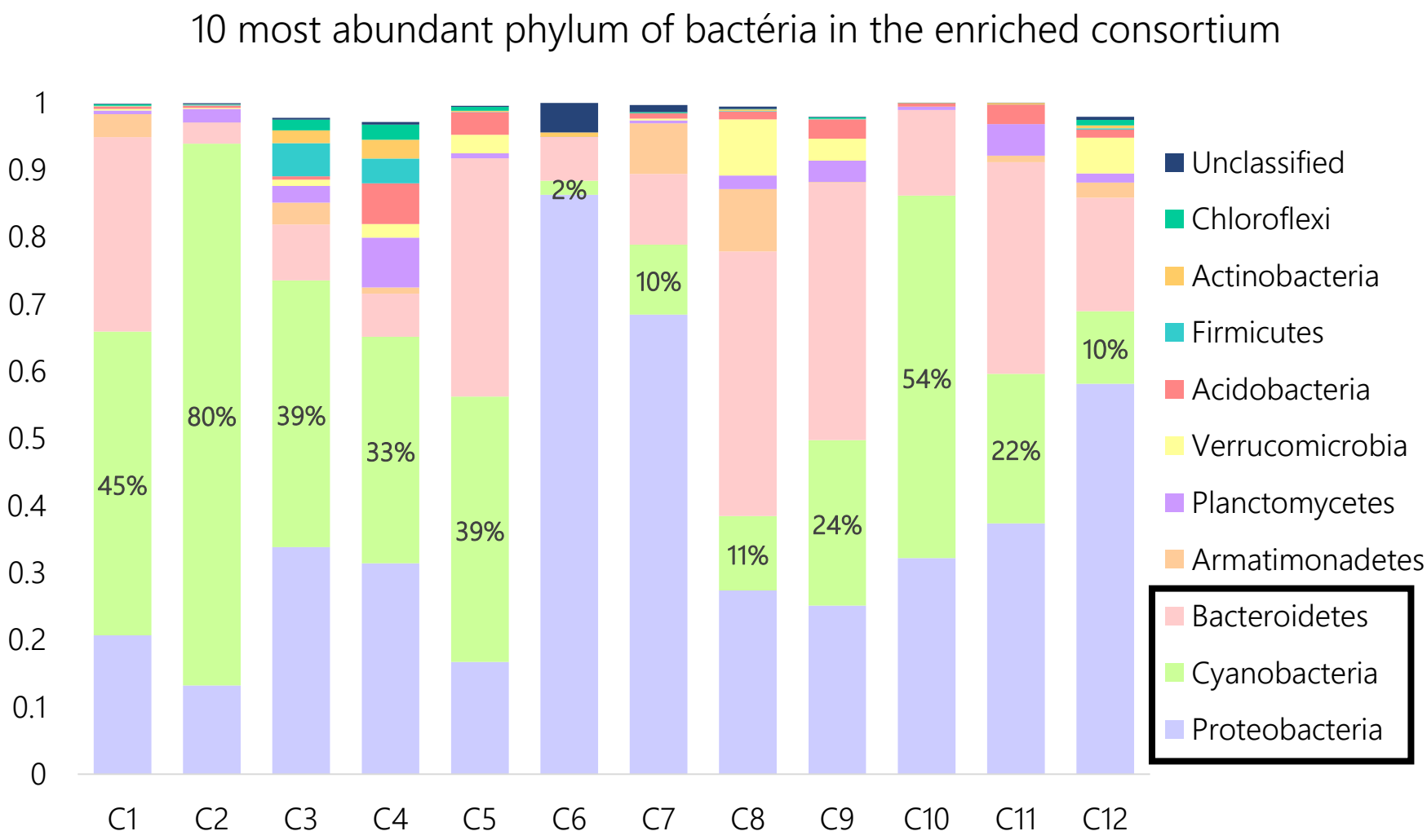
Isolated Cyanobacteria and Microalgae

Diversity



A - *Synecocystis aquatilis*, **B** - *Microcystis botrys*, **C** - *Microcystis* sp., **D** - *Chroococcus turgidus*, **E** - *Calothrix fusca*, **F** - *Anabaena* sp_1, **G** - *Anabaena* sp_2, , **H** - *Planktothrix* sp., **I** - *Phormidium* sp., **J** - *Oscillatoria limosa*, , **K** – *Geitlerinema amphibium.*

Chapada das Mesas Microbiome



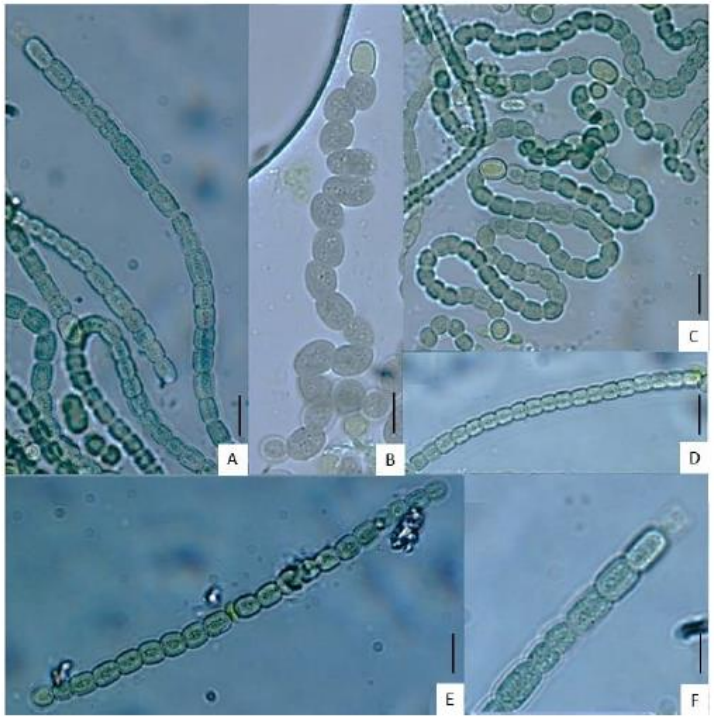
Nostoc GBBB01

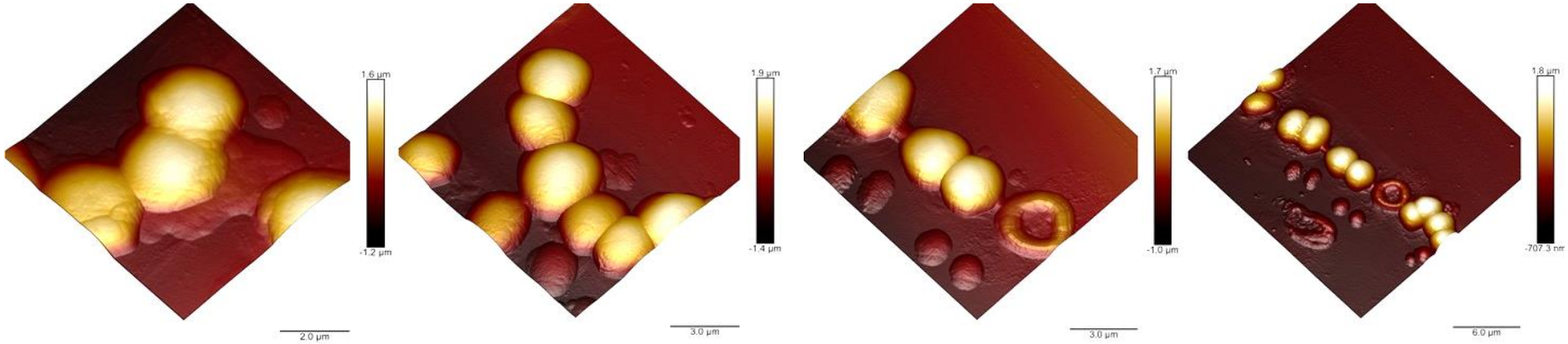
Size: 8,1 Mb

Genes: 6.597

CDS: 6.513

CRISPR Array: 11





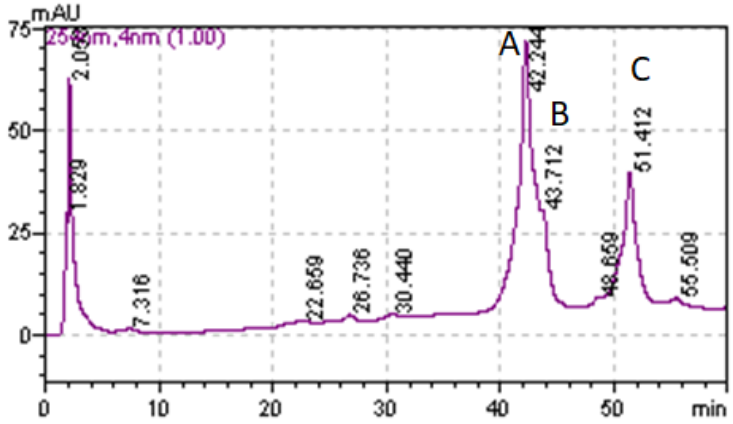
Nostoc GBBB01 Genome minning

Identified secondary metabolite regions

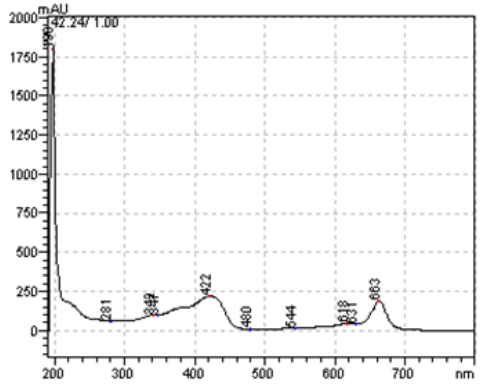
Region	Type	From	To	Most similar known cluster		Similarity
Region 1.1	lanthipeptide, bacteriocin	249,934	278,053			
Region 3.1	hglE-KS, T1PKS	1	43,551	Heterocyst glycolipids	other	85%
Region 4.1	transAT-PKS, PKS-like, T1PKS, NRPS	219,857	296,419	Nosperin	t1pks+transatpks	100%
Region 5.1	hglE-KS	188,102	235,244	Heterocyst glycolipids	other	57%
Region 6.1	NRPS-like	4,521	42,369	Nostophycin	NRPS	36%
Region 6.2	NRPS	131,648	188,291	6,6'-oxybis(2,4-dibromophenol)	other	28%
Region 8.1	bacteriocin	79,394	90,050			
Region 10.1	bacteriocin	59,760	69,993			
Region 11.1	LAP	1	20,452			
Region 12.1	terpene	40,272	61,102			
Region 13.1	NRPS	42,578	88,043			
Region 21.1	NRPS	16,901	62,840			
Region 22.1	terpene	12,929	33,915			
Region 22.2	LAP, cyanobactin	52,795	81,596	Trichamide	cyanobactin	45%
Region 23.1	NRPS, T1PKS	2,710	96,723	Nostopeptolide	NRPS	50%
Region 25.1	NRPS	56,990	106,169			
Region 28.1	terpene	57,180	78,112			
Region 32.1	phosphonate	78,701	102,828			
Region 34.1	NRPS-like	1	33,055	Anabaenopeptin NZ 857 / nostamide A	NRPS	100%
Region 34.2	microviridin	53,617	73,910	Microviridin K	other	25%
Region 73.1	terpene	1,216	19,697			

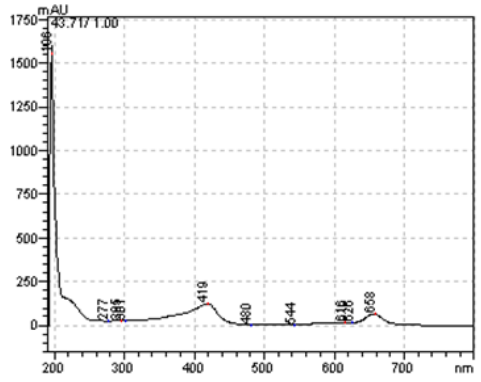
Nostoc GBBB01

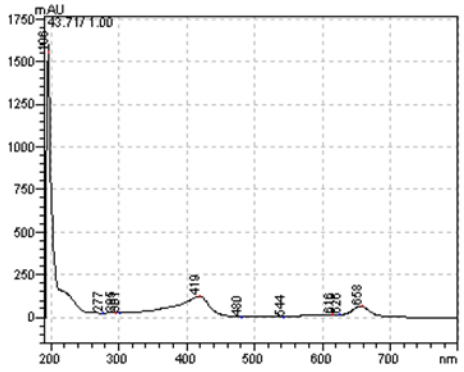
High Performance Liquid Chromatography (HPLC)



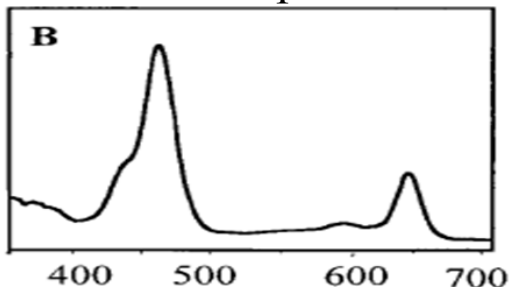
A, B, C peaks: Chlorophyll







Standard spectra



(Xu, 2001; Lanfer-Marquez e Sinnecker; 2008; Rodrigo et al., 2015).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I SIMPÓSIO DE INTERNACIONALIZAÇÃO ACADÊMICA

De 2 à 3 de dezembro de 2019

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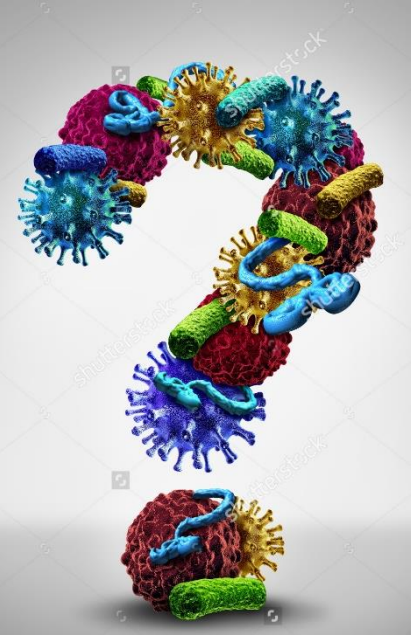

Thank you!

leonardo.td@ufma.br

@ltdallagnol