



Linking modern science to traditional knowledge

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Director

Brazilian Biosciences National Laboratory

Brazilian Center for Research in Energy and Materials



Traditional Knowledge & Science + Technology: NOT Oxymorons



Global Workshop on
**Biodiversity,
Traditional Knowledge,
Health and Well-being.**

Brazil
July 25-28, 2023



This artificial dichotomy is another legacy of historical shortcomings that have disproportionately affected communities in the Global South. Exploring synergies and complementarities will be instrumental in designing thriving (health-related) bioeconomies.



Harnessing the Power of **Biodiversity** for a Healthier & Fairer Future

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CNPEM Campus

530.000 m²

Brazilian Synchrotron Light Laboratory (LNLS)

ilum
escola de
ciência

Brazilian Biorenewables National Laboratory (LNBR)

Engineering and Instrumentation Facilities

Brazilian Biosciences National Laboratory (LNBio)

~ 950 employees
~ 500 interns, fellows, post-doc

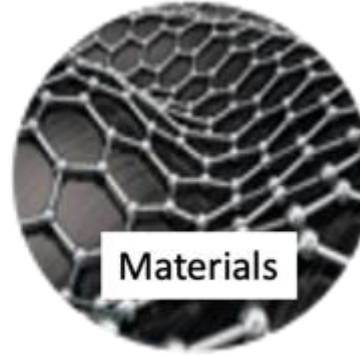
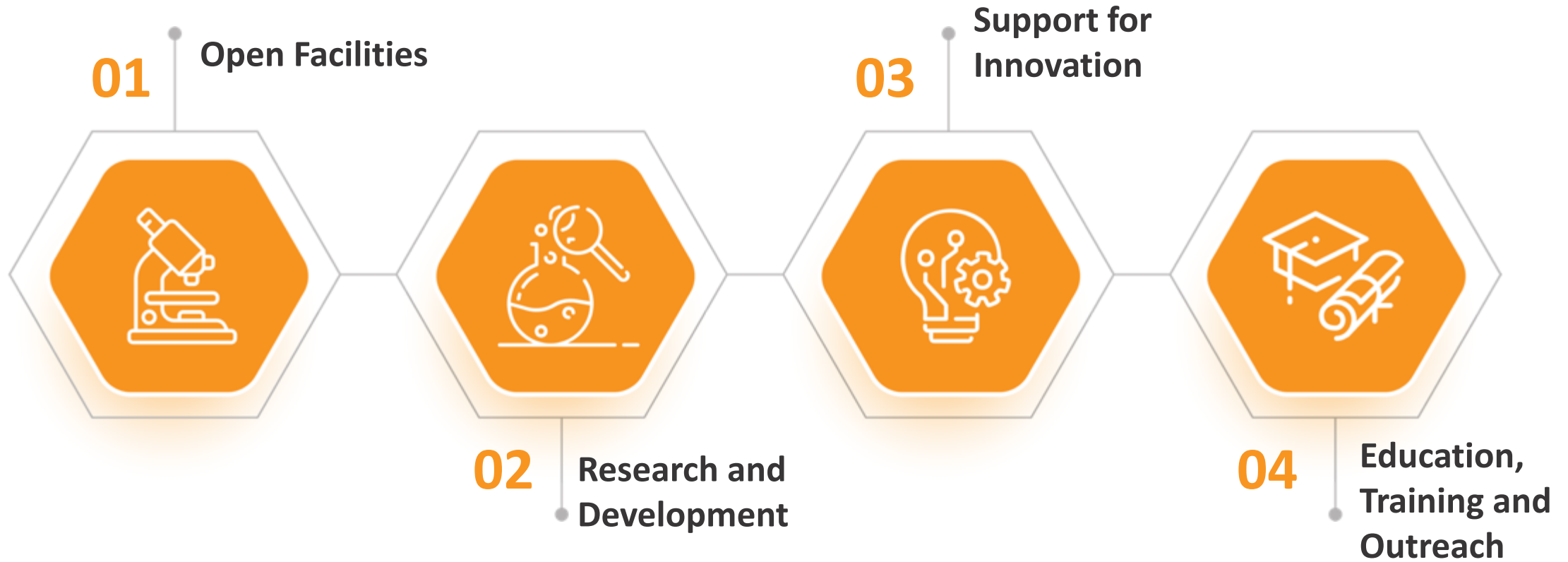
Interconnected activities



UVX – first synchrotron light source in the Southern Hemisphere (Shut down in 2019)

Brazilian Nanotechnology National Laboratory (LNNano)

CNPEM MISSION





Sirius, the Brazilian Synchrotron Light Laboratory & 4th Generation Storage Rings in operation worldwide

SIRIUS
3 GeV - 2019



Campinas



ESRF-EBS
6 GeV - 2019



MAX IV
3 GeV - 2016



**~80 SYNCRONTRON LIGHT SOURCES
FROM 1st-4th GENERATION**




Orion

A strategic project of the federal government's New Growth Acceleration Program (PAC)

Sirius | Brazilian Synchrotron Light Laboratory (LNLS)

Laboratory complex for advanced pathogen research

Orion will be accessible to both Brazilian and international scientific communities for studying pathogenic agents such as viruses, bacteria, and fungi, and their impact on human health. It will feature Latin America's first maximum biological containment facility (BSL-4), and it will also be the first in the world to be connected to a synchrotron light source.

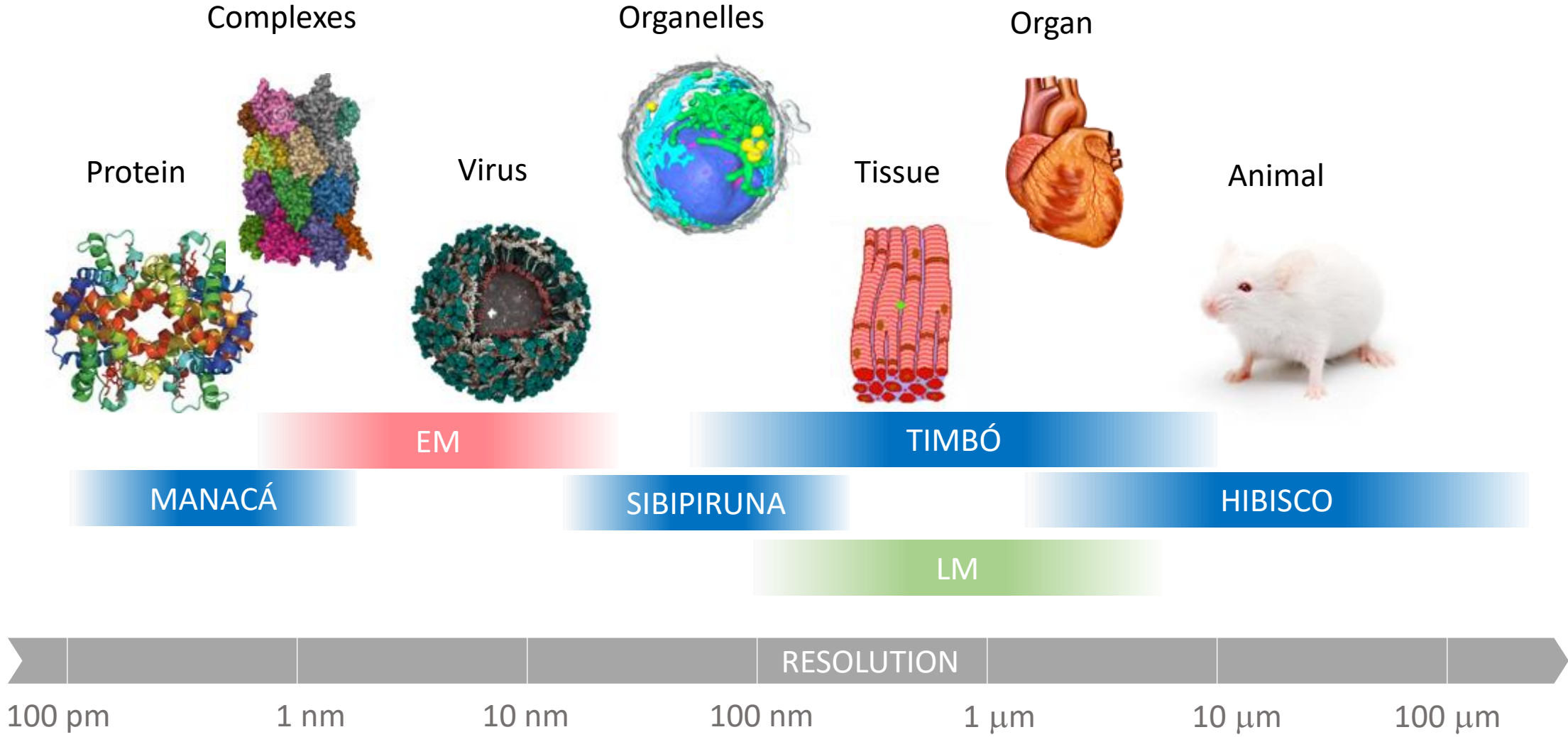


**Site chosen for
the BSL-4**



Orion construction site

Live imaging @Orion



LM = light microscopy and EM = electron microscopy.



**Brazilian Biosciences National
Laboratory (LNBio)**



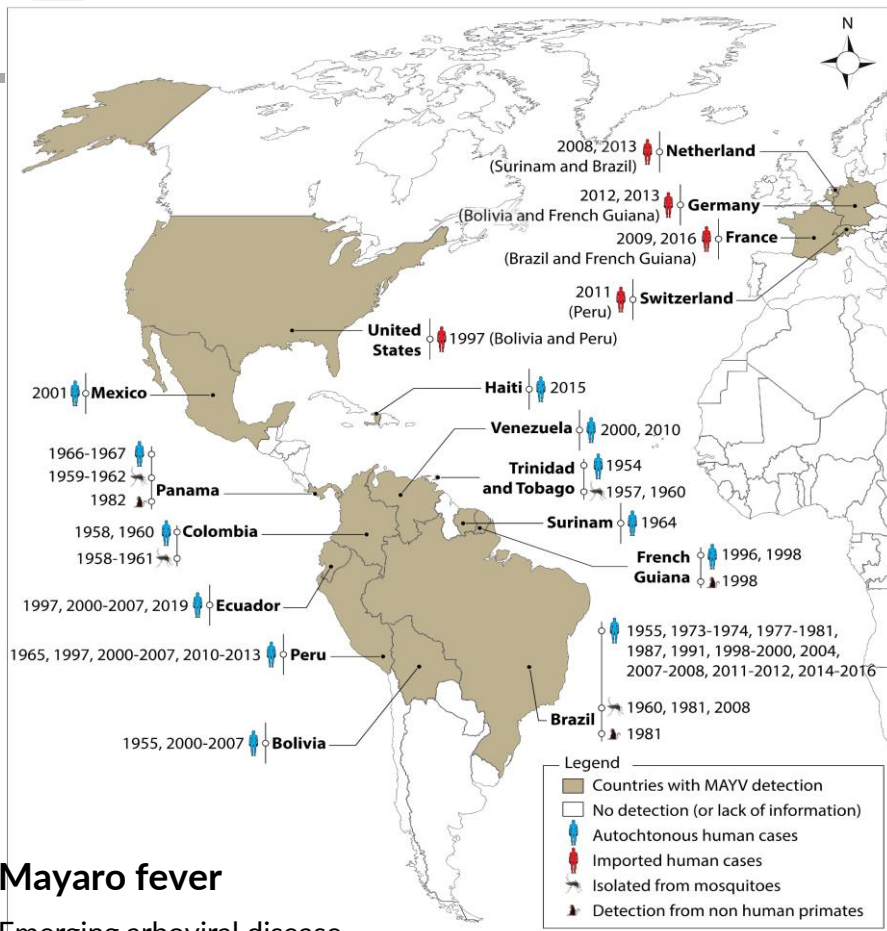
Brazilian Biosciences
National Laboratory

Working Mission

To use Integrative Biology to understand Health and Disease in the **Anthropocene**, supporting the development of healthcare solutions



Mayaro Virus (MAYV)



Mayaro fever

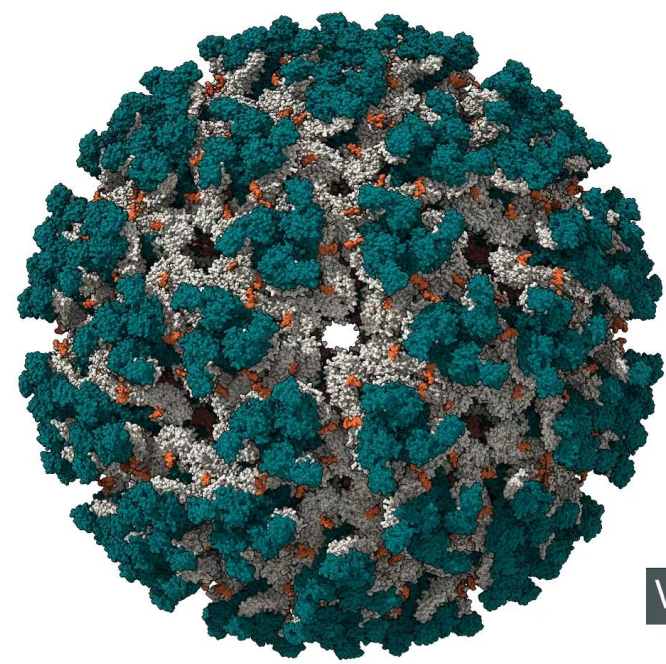
- Emerging arboviral disease
- Transmitted by mosquitoes
- Few studies
- No public monitoring or control policies
- Endemic to Central and South America
- Growing number of cases
- No vaccine or specific treatment

ARTICLE

<https://doi.org/10.1038/s41467-021-23400-9> OPEN

Cryo-EM structure of the mature and infective Mayaro virus at 4.4 Å resolution reveals features of arthritogenic alphaviruses

Helder V. Ribeiro-Filho^{1,3}, Lais D. Coimbra^{1,3}, Alexandre Cassago², Rebeca P. F. Rocha³, João Victor da Silva Guerra¹, Rafael de Felício¹, Carolina Moretto Carnieli¹, Luiza Leme¹, Antonio Cláudio Padilha², Adriana F. Paes Leme¹, Daniela B. B. Trivella¹, Rodrigo Vilares Portugal², Paulo Sérgio Lopes-de-Oliveira¹ & Rafael Elias Marques¹✉



Vírus Mayaro

Feature

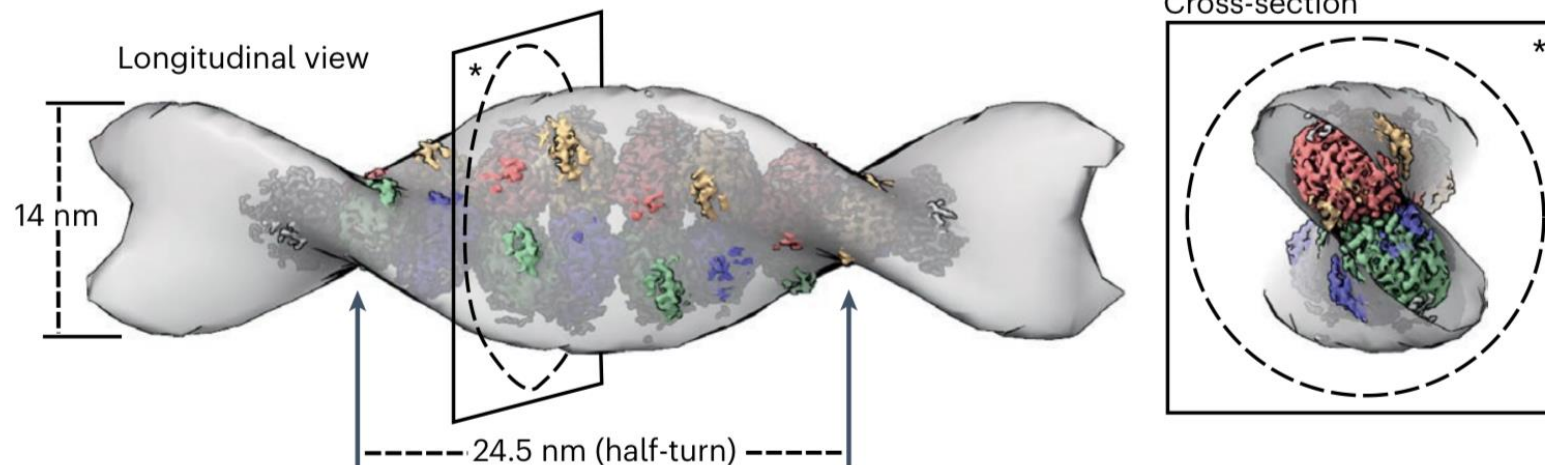
NSMB's 30th anniversary

<https://doi.org/10.1038/s41594-024-01248-z>

Looking back at 30 years of *Nature Structural & Molecular Biology*

 Check for updates

Over the past 30 years, *Nature Structural & Molecular Biology* (NSMB) has covered an enormous breadth of subjects in the broad field of molecular and structural biology. Here, some of the journal's past and present editors recount their editorial experience at NSMB and some of the more memorable papers they worked on.



nature > nature structural & molecular biology > articles > article

Article | Published: 19 October 2023

Molecular mechanism of glutaminase activation through filamentation and the role of filaments in mitophagy protection

[Douglas Adamoski](#), [Marília Meira Dias](#), [Jose Edwin Neciosup Quesñay](#), [Zhengyi Yang](#), [Ievgeniia Zagoriy](#), [Anna M. Steyer](#), [Camila Tanimoto Rodrigues](#), [Alliny Cristiny da Silva Bastos](#), [Bianca Novaes da Silva](#), [Renna Karoline Eloi Costa](#), [Flávia Mayumi Odahara de Abreu](#), [Zeyaul Islam](#), [Alexandre Cassago](#), [Marin Gerard van Heel](#), [Sílvia Roberto Consonni](#), [Simone Mattei](#), [Julia Mahamid](#), [Rodrigo Villares Portugal](#), [Andre Luis Berteli Ambrosio](#)  & [Sandra Martha Gomes Dias](#) 

Nature Structural & Molecular Biology **30**, 1902–1912 (2023) | [Cite this article](#)

The work is an example of the mechanistic insights that can be gleaned at all scales. With increasing developments in cellular cryo-ET, I hope that more structural biologists will implement it in their experimental arsenals, combining the power of in vitro and in vivo approaches to investigate mechanisms through different lenses.

Advanced Health Technology Clusters at LNBIO-CNPEN



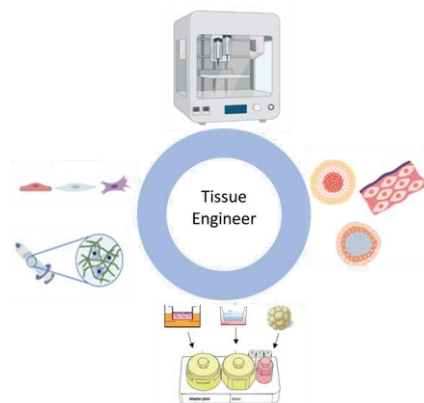
Drug Discovery

- DD project execution
- Method development for Natural Products
- Chemical libraries



Immunobiologics

- mAb discovery & cell lines for biologics
- Vaccines, VLPs, aptamers, viral vectors R&D



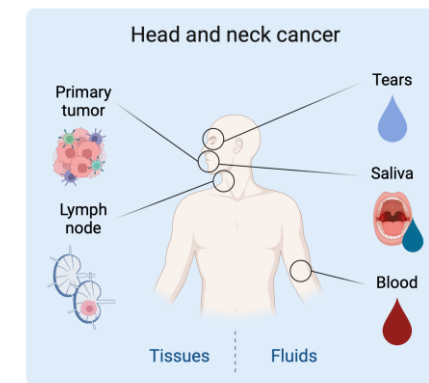
Tissue Engineering

- 3D model development
- Microfluidic devices
- Regenerative medicine



Gene Editing

- Genetically engineered mouse models
- Gene therapy protocol development



Proteomics

- Human proteomics in health and disease
- Structural proteomics
- Biomarker and therapeutic target discovery

nature

CLIMATE STRESS

Amazon rainforest's ecosystem could reach a tipping point by 2050

Blunt instrument
Mass drug screening could aid precision treatment for cancer

Wind exposure
A global profile of populations affected by tropical cyclones

Language lesson
Neural probe reveals how brain encodes elements of speech

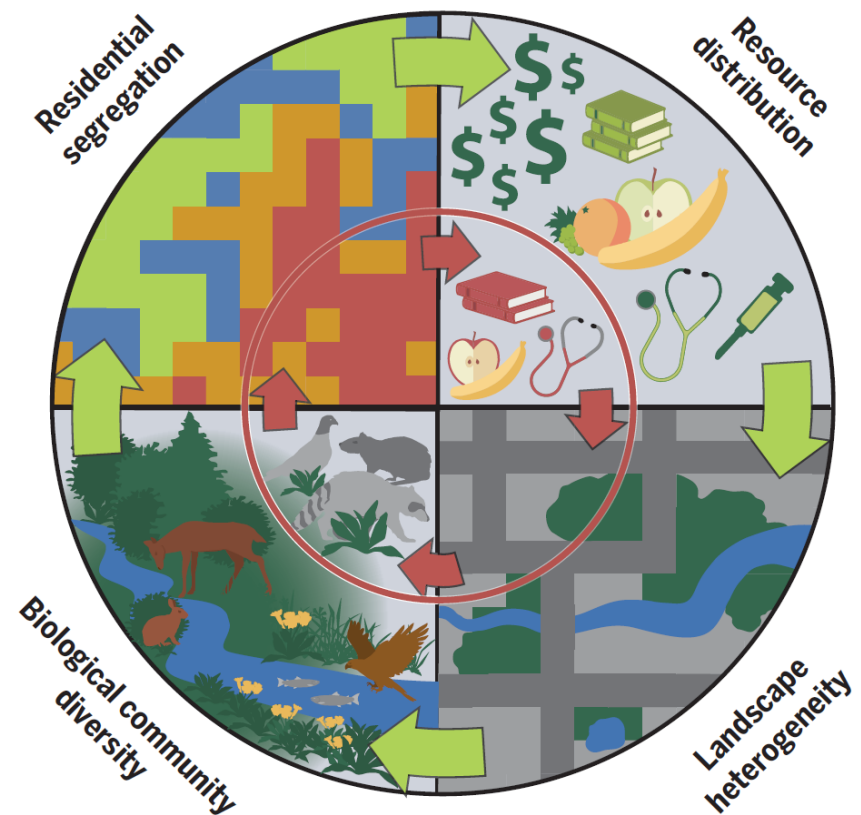
Vol. 628, No. 7998
February 2024

REVIEW SUMMARY

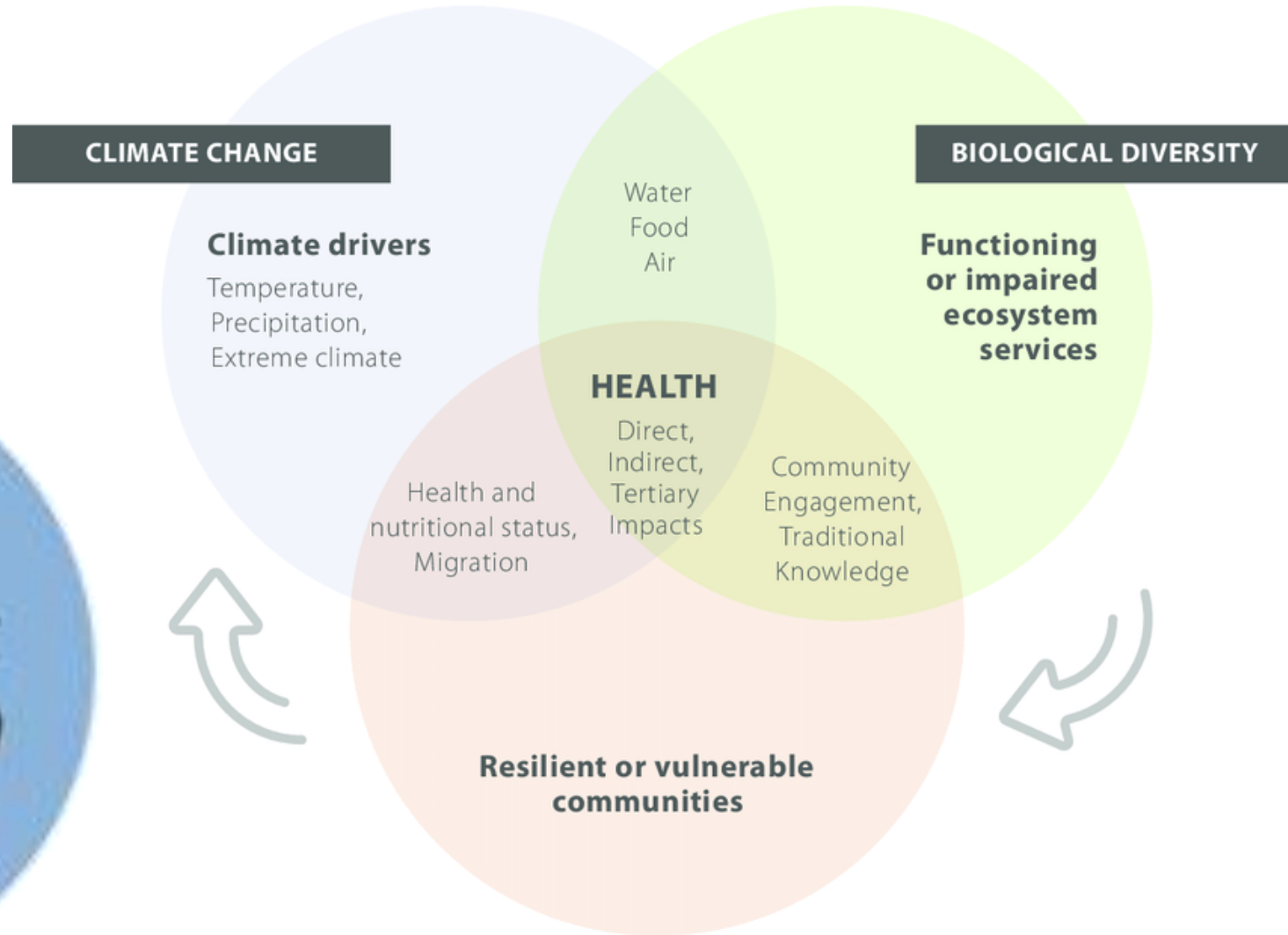
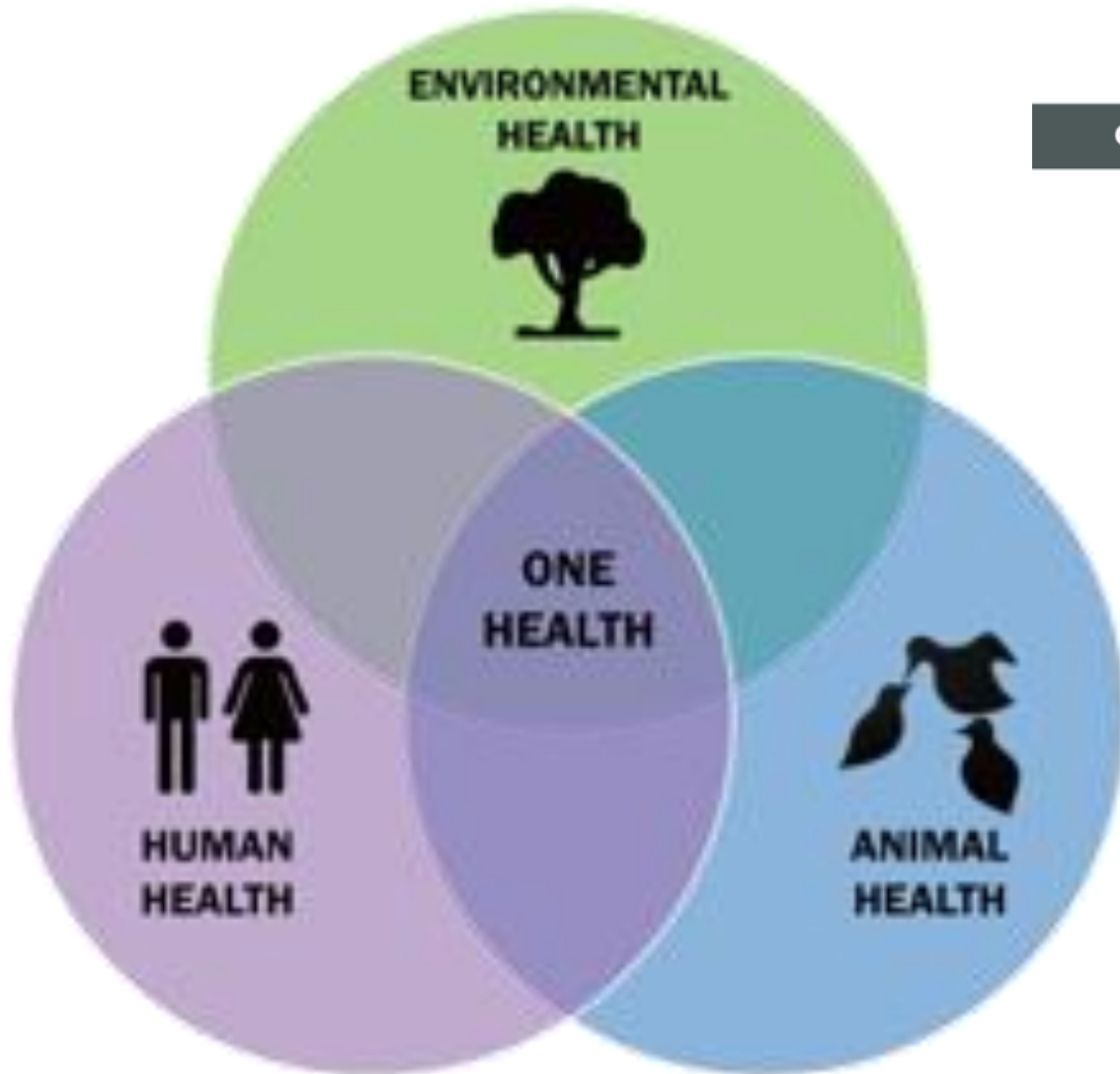
URBAN ECOLOGY

The ecological and evolutionary consequences of systemic racism in urban environments

Christopher J. Schell*, Karen Dyson, Tracy L. Fuentes, Simone Des Roches, Nyeema C. Harris, Danica Sterud Miller, Cleo A. Woelfle-Erskine, Max R. Lambert



One Health: Climate & Biodiversity



Start Where You Are.

Use What You Have.

Do What You Can.

Arthur Ashe



BRAZILIAN NATURAL PRODUCT BANK



Dr Daniela Trivella & Team



What?

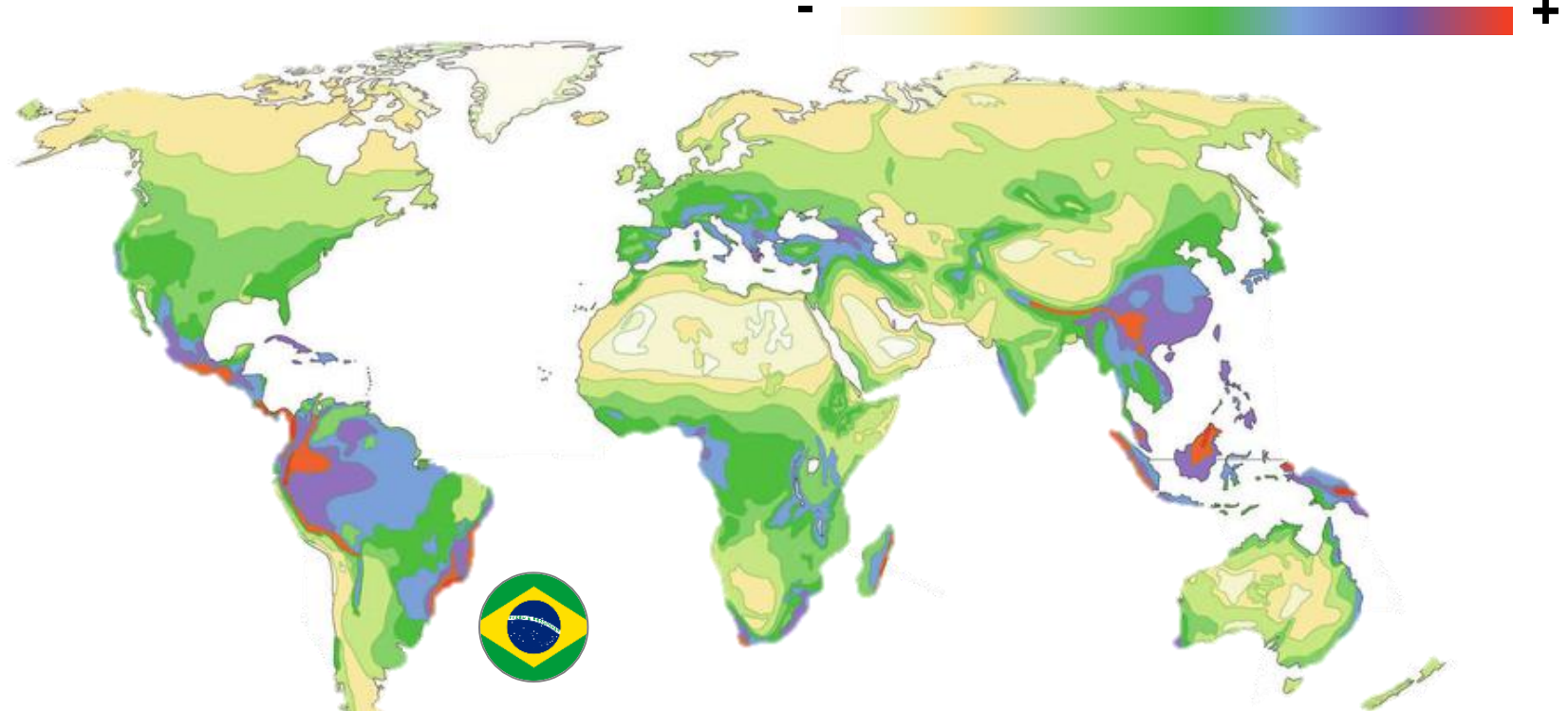


An initiative to compile and prospect molecules from the (Brazilian) biodiversity using the very best of our science and technology for innovation and sustainable preservation of the Brazilian biomes.

Why?

Brazil: a biodiversity hotspot (= diversity of molecules)

Biodiversity*



*vascular plants
Adapted from Barthlott 2019

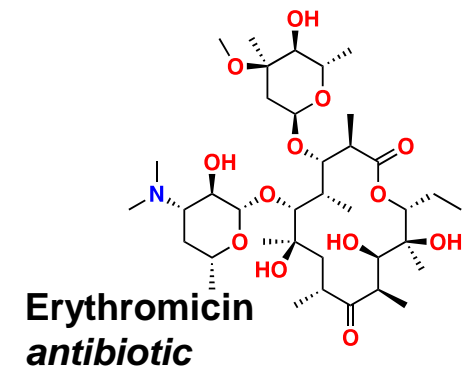
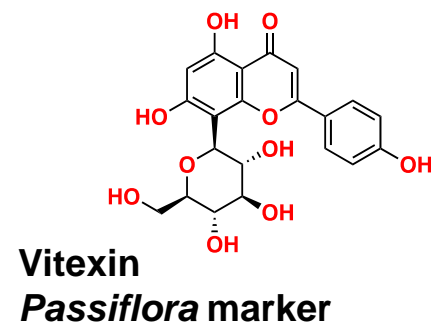
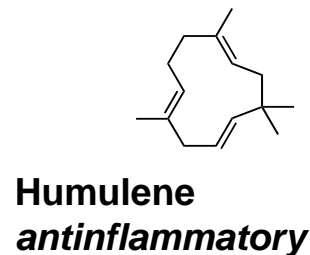
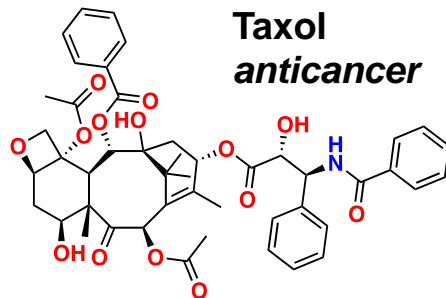
Approximate population within biomes in Brazil



Why?

These molecules are the main source of medicines, functional foods and cosmetics, bio-inputs for agriculture, generating:

- high-value-added products
- bioeconomy and sustainable development
- path to improve human development index across biomes



How?

A **trackable and accessible Natural Product Bank**, comprising plant- and microorganism-derived chemical samples from all 6 Brazilian biomes (+ Blue Amazon).

Brazilian technology enabling the prospection of **new molecules** and the development of **high-value products from biodiversity**.



Detangling Natural Products Composition

analytical
chemistry

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Open Access

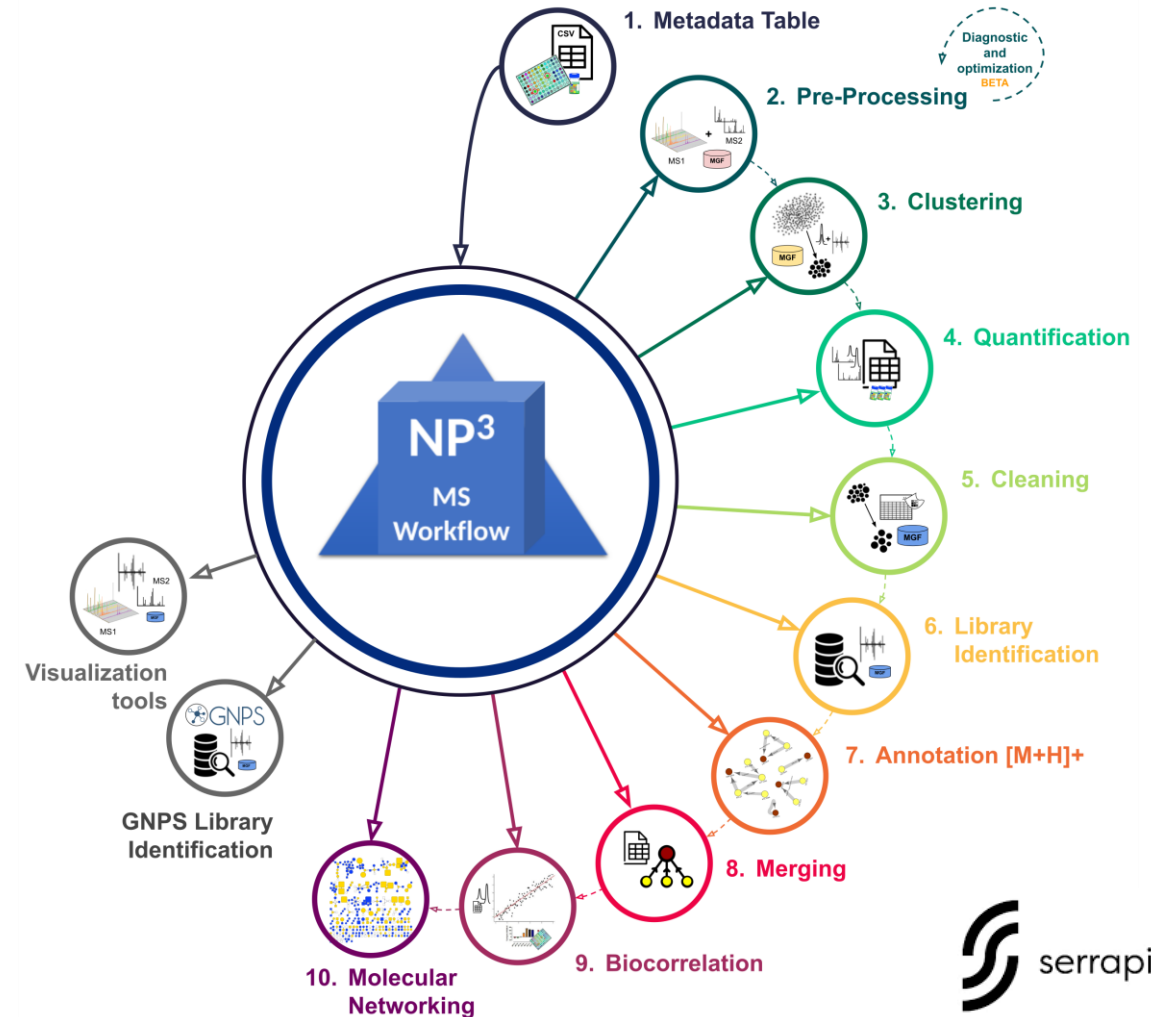
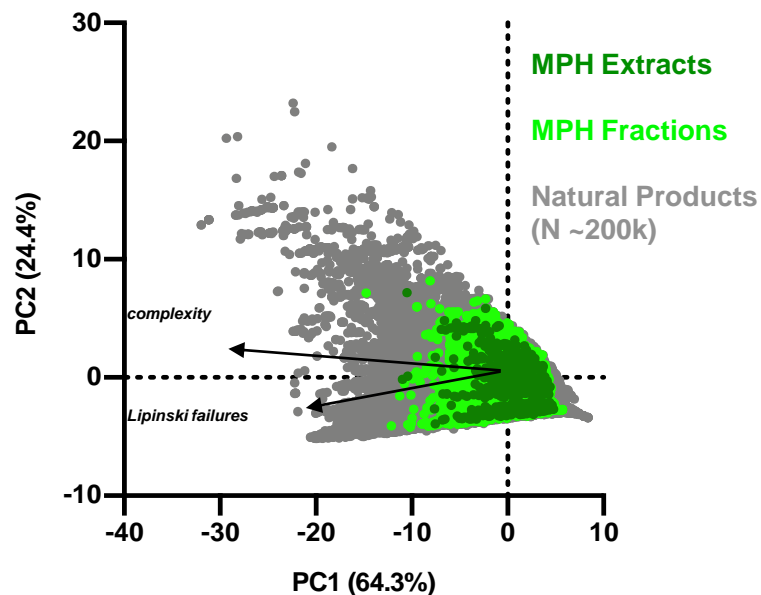
Article

NP³ MS Workflow: An Open-Source Software System to Empower Natural Product-Based Drug Discovery Using Untargeted Metabolomics

Cristina F. Bazzano, Rafael de Felicio, Luiz Fernando Giolo Alves, Jonas Henrique Costa, Raquel Ortega, Bruna Domingues Vieira, Raquel Peres Morais-Urano, Luciana Costa Furtado, Everton L. F. Ferreira, Juliana R. Gubiani, Roberto G. S. Berlinck, Leticia V. Costa-Lotufo, Guilherme P. Telles,* and Daniela B. B. Trivella*

Cite This: <https://doi.org/10.1021/acs.analchem.3c05829>

Read Online



serrapilheira

MPH collection: 35% novel compounds



CNPq

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E INOVAÇÃO



CNPEM Drug Discovery Platform



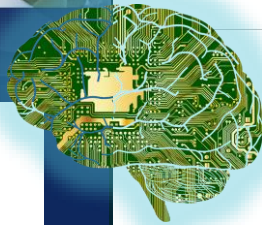
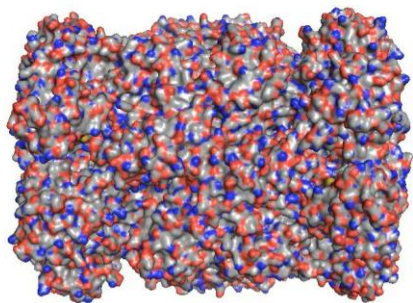
from target to HIT

hit2lead

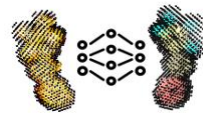
validation

drug-candidate
(API)

SIRIUS



NP³
BLOB LABEL



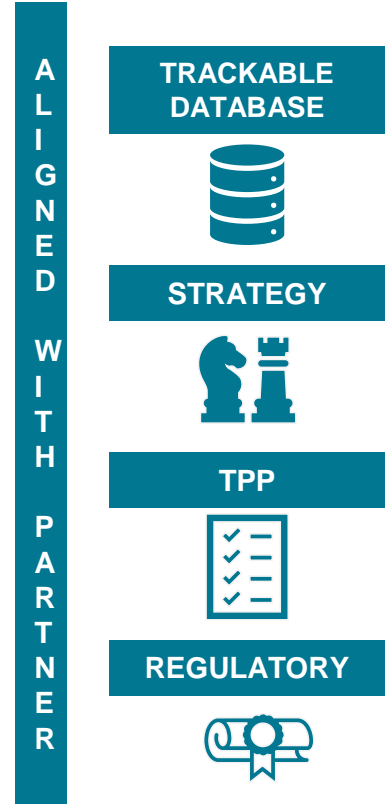
CNPEM

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E INOVAÇÃO

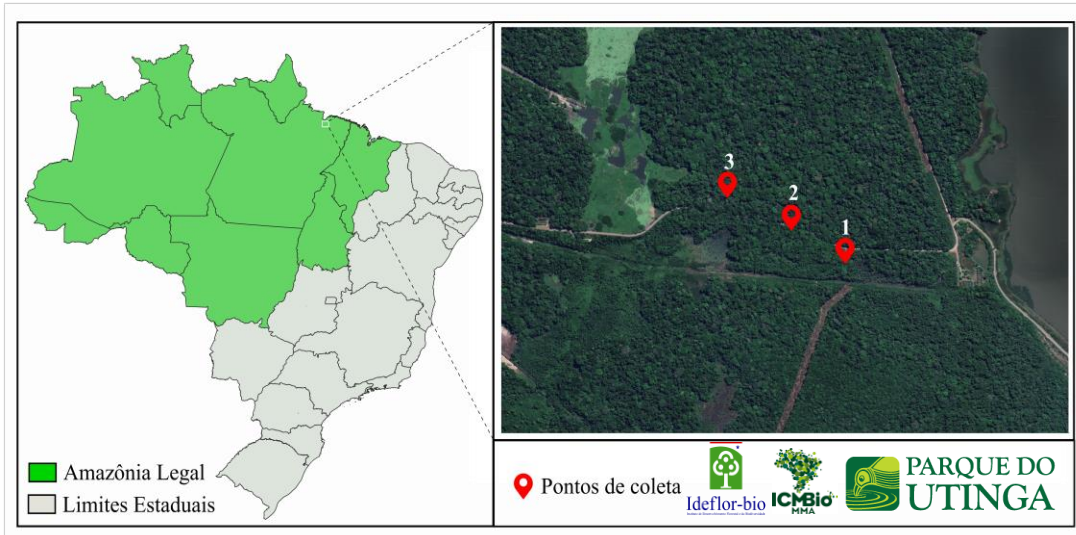


Partnerships with Brazilian Companies

DISCOVERY PHASE→	0	I	II	III	IV
PROJECT per THERAPEUTIC AREA					
ONCOLOGY					
CNP 001	█	█	█	█	
CNP 009	█	█			
INFECCIOUS DISEASES					
<i>Viral</i>					
CNP 003	█	█	█		
<i>Multiresistant bacteria</i>					
CNP 002	█	█	█		
<i>Parasites</i>					
Chagas	█	█			
CARDIOVASCULAR & METABOLIC DISEASES					
CNP 008	█	█	█	█	
PAIN & INFLAMMATION					
CNP 004/005	█	█			
CNP 006	█	█			
CNP 007	█	█	█	█	



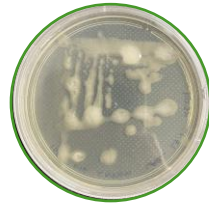
Microorganisms from Amazon (UFPA)



Brevibacillus sp. FIR094

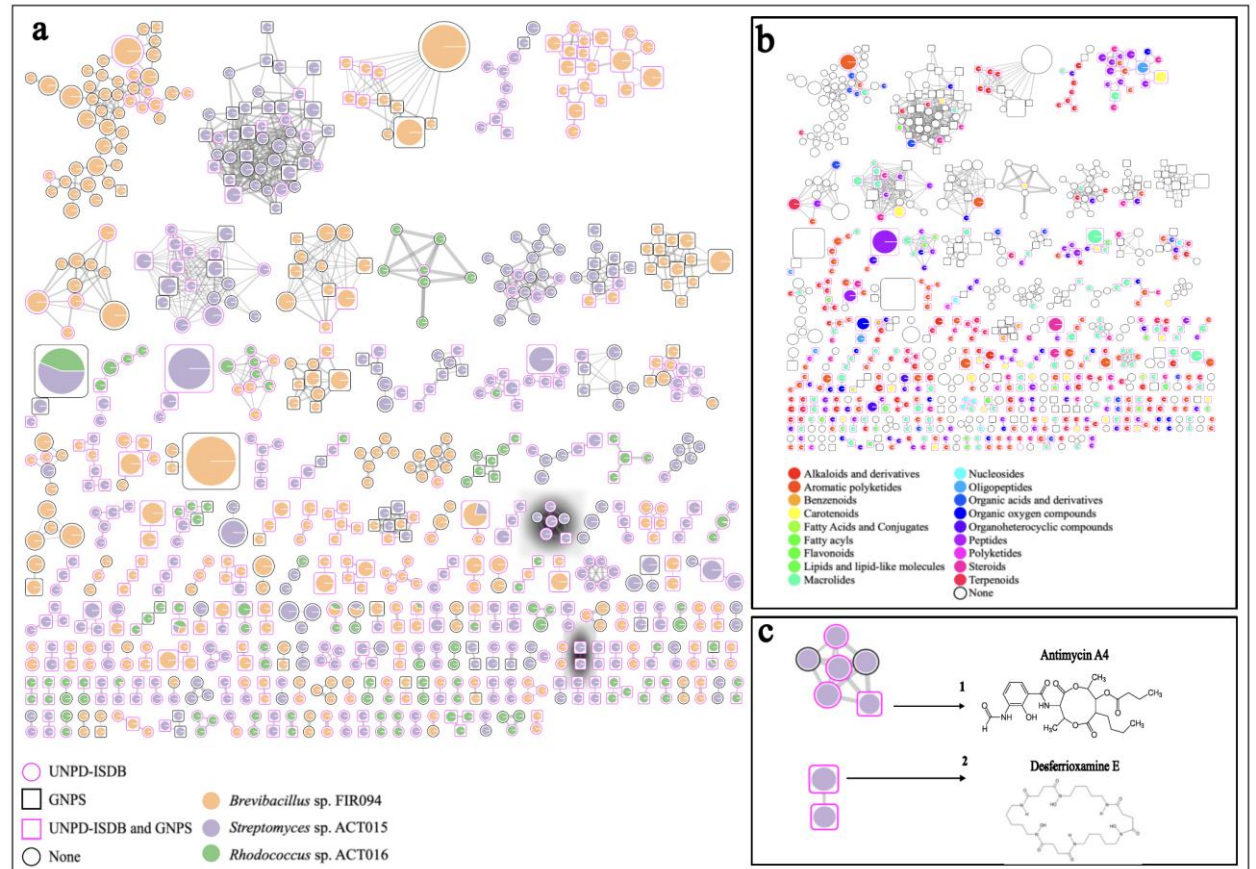


Streptomyces sp. ACT015



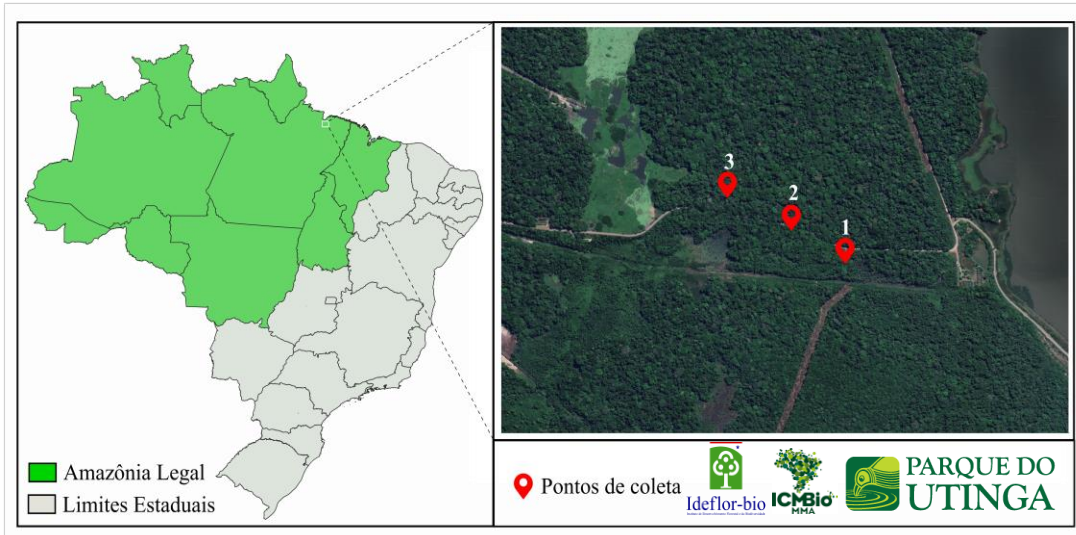
Rhodococcus sp. ACT016

Metabolome: many (yet) unknown compounds

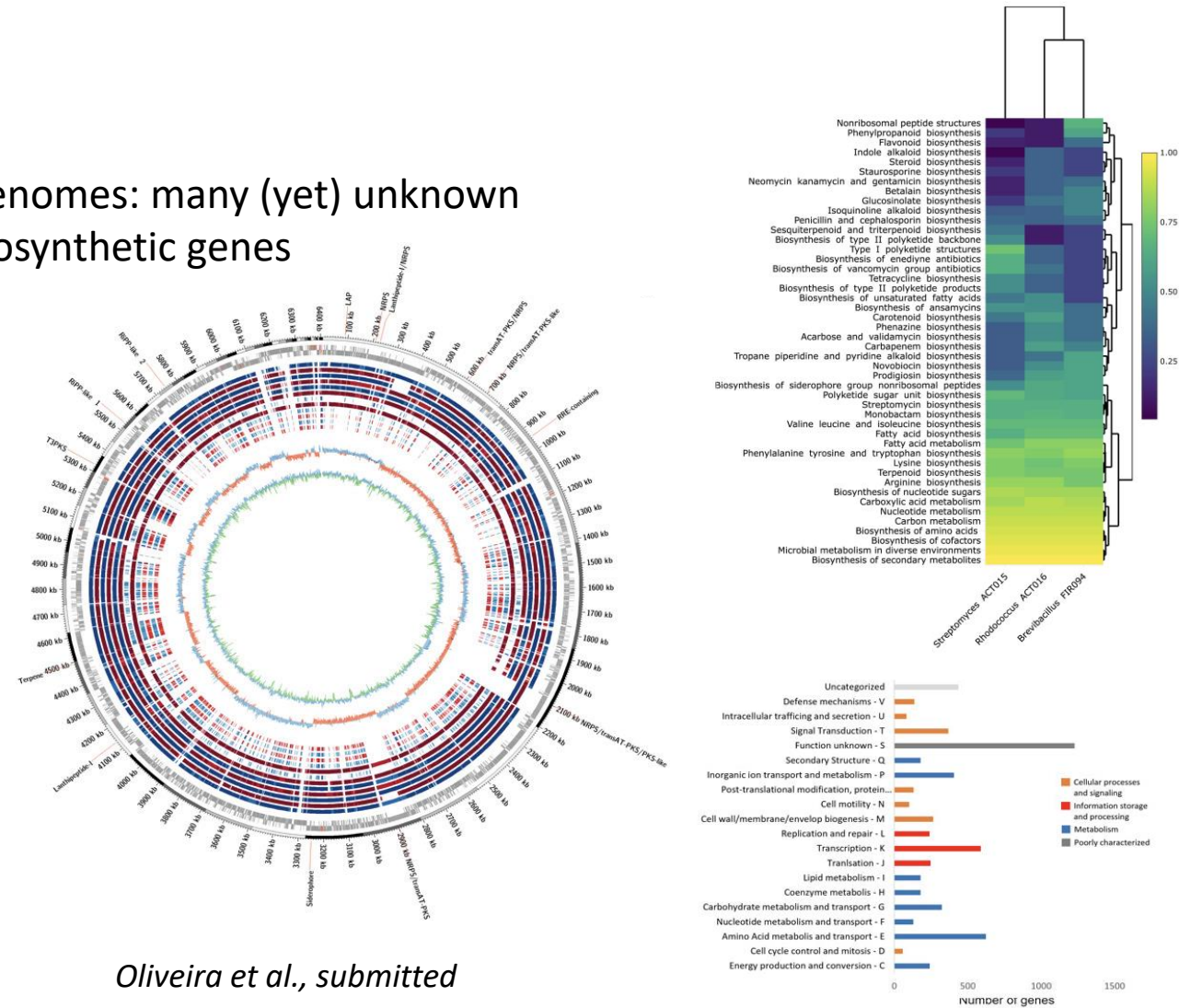


Oliveira et al., submitted

Microrganisms from Amazon (UFPA)



Genomes: many (yet) unknown biosynthetic genes



Oliveira et al., submitted

Brevibacillus sp. FIR094

Streptomyces sp. ACT015

Rhodococcus sp. ACT016



Case Study: Licuri



CADEIAS PRODUTIVAS DA
BIOECONOMIA
LICURI — MCTI



Licuri 


Coopes
LICURI do SERTÃO
BAHIA - BRASIL

Licuri (UFPE/COOPES/FINEP)





CADEIAS PRODUTIVAS DA
BIOECONOMIA
LICURI — MCTI



Licuri (UFPE/COOPES/FINEP)

Licuri 


Coopes
LICURI DO SERTÃO
BAHIA - BRASIL



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION

2 patents filed UFPE – COOPES



CADEIAS PRODUTIVAS DA
BIOECONOMIA
LICURI — MCTI



Licuri 

COOPES
LICURI DO SERTÃO
BAHIA - BRASIL

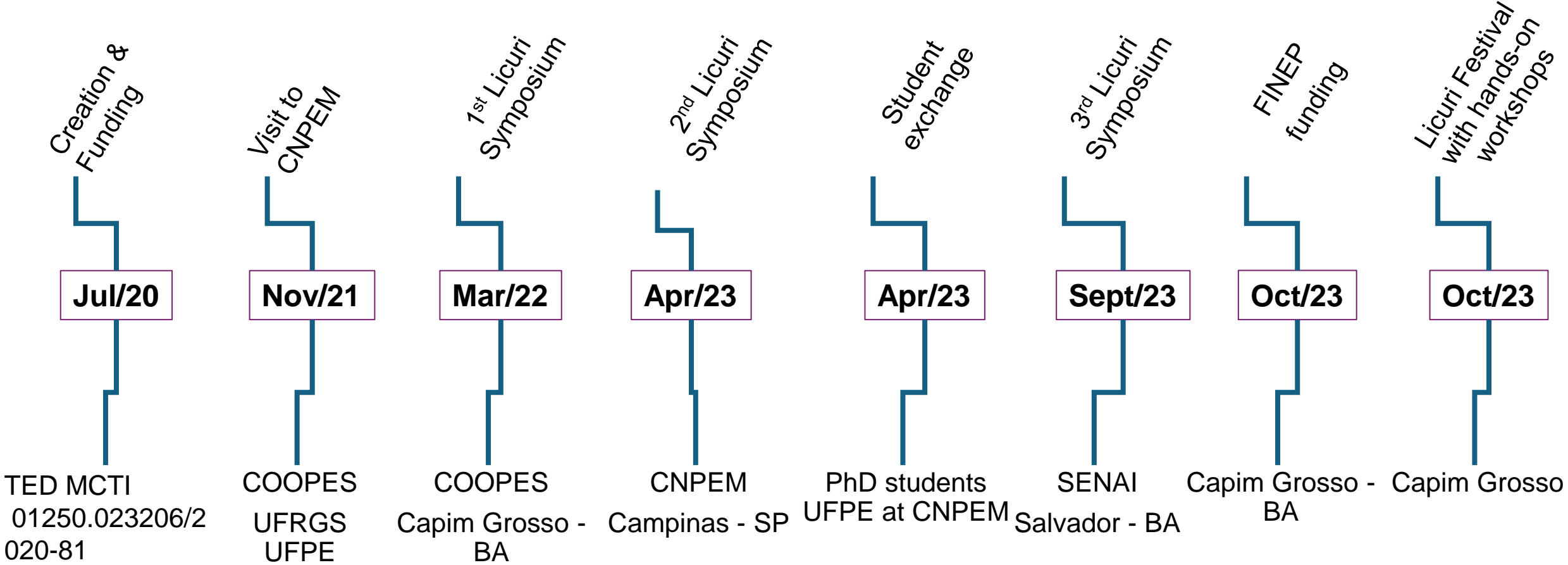
Licuri (UFPE/COOPES/FINEP)



<p>1 NO POVERTY</p> 	<p>2 ZERO HUNGER</p> 	<p>3 GOOD HEALTH AND WELL-BEING</p> 	<p>5 GENDER EQUALITY</p> 	<p>8 DECENT WORK AND ECONOMIC GROWTH</p> 
<p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p> 	<p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p> 		<p>13 CLIMATE ACTION</p> 	<p>15 LIFE ON LAND</p> 
<p>10 REDUCED INEQUALITIES</p> 			<p>11 SUSTAINABLE CITIES AND COMMUNITIES</p> 	<p>17 PARTNERSHIPS FOR THE GOALS</p> 

2 patents filed UFPE – COOPES

Licuri Productive Chain Programme - timeline



Chemical & Biological Analysis

Chemical constituents and distribution across the botanical family

Antibiotic, anticancer & wound healing activities

2 patents filed
UFPE – COOPES

Beyond Brazil

Bioprospection in Latin America

A partnership across Amazonian countries with IDB support

Bolivia



Colombia



Ecuador



Coordination & Sponsorship

The Future

Inclusive Drug Discovery in the Amazon

Instituto de Desenvolvimento
Sustentável Mamirauá



CNPEM
Centro Nacional de Pesquisa
em Energia e Materiais

OPAS



BIREME

Centro Latino-Americano e do Caribe
de Informação em Ciências da Saúde

1. Engagement with IPLCs
2. Legal Framework for Ethical Collaboration & Fair Benefit Sharing
3. Digital Preservation of TK
4. AI algorithms and integration with Molecular Networking
5. Molecular Biodiversity Map.



Take-Home Message

Identifying biodiversity's high-value molecules while co-creating with Indigenous & Local Communities presents a framework for SCP-based benefit sharing.



Obrigada



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