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UFSC Biotech Network: a transdisciplinary platform for biotechnology innovation in Brazil

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Biotech Network (Rede Biotech in Portuguese) is a crossdisciplinary initiative launched at the Federal University of Santa Catarina (UFSC) to foster innovative biotechnological solutions aligned with Brazil's scientific, environmental, and societal challenges. Here, we highlight the structure, mission, and pioneering research efforts of the network, offering a model for integrated and sustainable biotechnology development in emerging economies.

Bringing together biotechnology researchers in Brazil

To catalyze innovation and strategic collaboration in biotechnology, the Biotech Network (Rede Biotech)[i] was officially launched in 2024 at the UFSC, one of Brazil's leading institutions in biotechnology research. For a brief overview of the organizational structure and thematic pillars of the Biotech Network, see Box 1. Rather than simply aggregating expertise, the network emerged from a growing need to address urgent national and global challenges, such as food security, human and environmental health, and sustainable economic development, through a unified and high-impact research ecosystem. Conceived as a platform that brings together researchers from multiple UFSC departments and research centers, Biotech Network fosters interdisciplinary solutions rooted in local demands and capacities. Beyond advancing scientific excellence, the network supports researchers and entrepreneurs in transforming biotechnological ideas into value-added solutions, aiming to generate lasting societal and economic benefits. Currently, it brings together 48 professors actively working across six strategic themes that reflect both regional priorities and national innovation agendas: ecological transition, energy transition, bioprocess engineering, bioproducts engineering, precision biotechnology, and One Health.

Ecological transition

Within the framework of ecological transition, researchers from the Biotech Network engage in studies that promote sustainable practices across multiple sectors. The sequencing, assembling, and annotation of whole genomes of non-model crop species is also an object of plant biotechnology efforts, toward developing reference genomes and discovering secondary metabolite pathways with potential agronomic, nutraceutical, and pharmacological uses [1]. In addition, in algal biotechnology, research focuses on optimizing cultivation techniques for microalgae and macroalgae, developing novel photobioreactors (such as thin-layer systems, algal turf scrubbers, bubble columns, and hybrid systems), and creating new processes and products based on algal biomass [2]. Effluent treatment technologies are being advanced through the design of novel bioreactors and processes that improve the efficiency of industrial and sanitary wastewater treatment [3]. Furthermore, researchers are applying innovative analytical

Box 1. Governance and structure of the UFSC Biotech Network

The Biotech Network was established in 2024 following an institutional invitation by Jacques Mick, the Pro-rector for Research and Innovation at UFSC (Figure I). The initiative brought together interdisciplinary researchers engaged in developing biotechnology-based processes, products, and services that address societal and industrial needs, while aligning with Brazil's national science, technology, and innovation policies. Its mission is to foster scientific and technological innovation through integrated expertise, with emphasis on the sustainable use of biodiversity, improvement of quality of life, and alignment with the United Nations Sustainable Development Goals (SDGs).

The network is governed by a general coordinator, supported by six thematic axes, each led by a coordinator and vice-coordinator. The general coordinator is responsible for convening and chairing network meetings, representing the network externally, and ensuring broad internal and external dissemination. Axis coordinators organize workshops to foster internal integration and promote strategic partnerships with research institutions, companies, and related stakeholders. Thematic priorities are defined collaboratively, and integration among axes is encouraged through regular cross-cutting meetings. Figure I summarizes the six thematic axes and illustrates some of their key research topics and application domains.

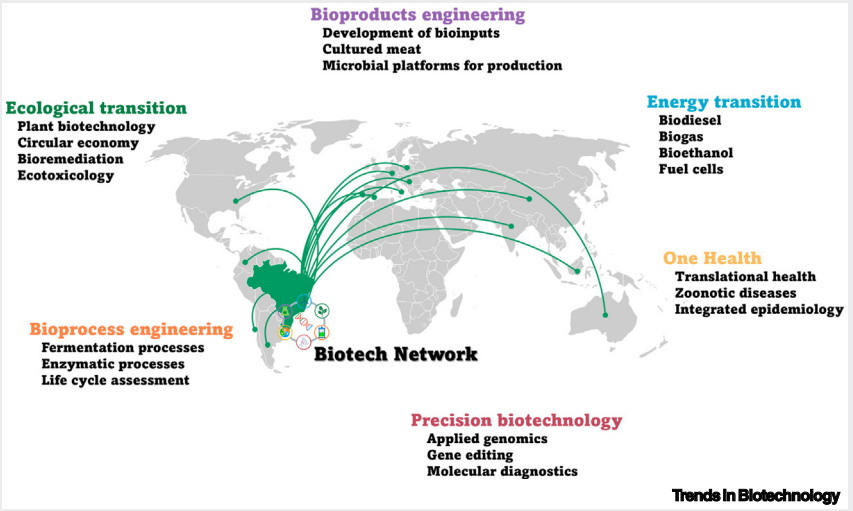

Figure I. Thematic structure of the Federal University of Santa Catarina (UFSC) Biotech Network (Rede Biotech).

techniques, such as LC-MS/MS, to detect and quantify emerging pollutants in water sources of high ecological and economic relevance [4]. These efforts in ecotoxicology and environmental monitoring are essential for understanding contaminant dynamics and for developing targeted remediation strategies to protect vulnerable ecosystems.

Energy transition

As we transition to sustainable energy systems, our research in biotechnological innovations is advancing renewable fuel production and environmental recovery strategies. In our commitment to align biotechnological innovation with urgent societal needs, members of the Biotech Network are collaborating with the Brazilian Federal Police in a project known as 'Cannabiofuel'[ii]. This initiative explores the conversion of confiscated cannabis biomass into biofuels via pyrolysis. By transforming what would otherwise be incinerated at high environmental and logistical costs into bio-oil, biogas, biochar, and pyrolytic vinegar, the project highlights how biotechnology can provide unexpected, sustainable alternatives to complex public security challenges. In addition to advancing traditional approaches for converting agricultural and industrial waste into clean energy, our efforts reflect the broader mission of our network: to develop interdisciplinary, high-impact solutions at the intersection of science, policy, and society. This vision guides our commitment to addressing complex challenges through collaborative, context-driven biotechnological innovation.

Bioprocess engineering

Within the bioproduct engineering theme of the network, much of our work has emerged from the need to connect academic research with the real demands of industrial-scale bioprocesses. Several teams have focused on optimizing fermentative and enzymatic production systems, often using microbial consortia to stabilize results and correct deviations during scale-up [5]. One specific challenge involves the formation of biofilms, which can either disrupt or enhance production depending on the process. In response, our teams have developed targeted microbiological controls tailored to each application. In all of these initiatives, we routinely apply techno-economic analyses and life cycle assessments, not only as academic tools, but also as essential frameworks for decision-making. These strategies, combined with our expertise in the effects of bioproducts on different manufacturing dynamics, have helped us shape more efficient and sustainable processes, aligned with the principles of the bioeconomy and the realities of Brazilian industry. Ultimately, the goal is to transform lab-scale innovation into viable solutions to complex national challenges.

Bioproducts engineering

In our bioproducts engineering subgroup, research is significantly influenced by the diverse applications that our members are pursuing across UFSC. Some laboratories are exploring natural microbial pathways to synthesize bioaromas, biosurfactants, pigments, and other bioactive molecules,

many of which derive from the rich biodiversity of Brazil. Others are customizing enzymatic processes to address the sustainability demands of the textile industry, where harsh chemical inputs remain prevalent. We have also fostered interdisciplinary collaborations to enhance separation and purification technologies and chromatography to improve product quality and process efficiency. One particularly exciting effort has arisen from a partnership between food scientists and chemists focused on developing scaffolds for cultivated meat. By integrating principles from natural product chemistry, this team is enhancing bovine cell adhesion and tissue structuring, paving the way for alternative protein production that is both scalable and suitable for Brazilian dietary and economic contexts[iii].

Precision biotechnology

In the field of precision biotechnology, our researchers are integrating molecular biology and computational tools to tackle some of Brazil's most pressing health and agricultural challenges. Within the network, several teams are using 'omics approaches and bioinformatics to identify biomarkers for infectious diseases and cancer, with the goal of enhancing early diagnosis and improving patient outcomes. Vaccine development is another key focus, particularly recombinant strategies that provide increased safety and adaptability in response to emerging pathogens [6]. On a different front, some labs are refining protocols for *in vitro* cultivation and micropropagation, not only to preserve native plant biodiversity, but also to scale up the production of valuable secondary metabolites. These bioactive compounds are being investigated for their potential applications in agroindustry and pharmaceuticals, reinforcing the mission of the Biotech Network to transform molecular insight into real-world applications.

One Health

Operating within the One Health framework, our teams have been exploring how biotechnology can bridge gaps between human, animal, and environmental health. At the pharmaceutical level, several groups are focused on developing therapies for diseases often neglected in global agendas, such as Chagas and leishmaniasis, as well as neurodegenerative conditions, including Alzheimer's disease [7]. Recently, we began investigating the therapeutic potential of cannabinoids, particularly in the context of neuroprotection and regenerative medicine [8]. These studies have not only opened new research directions, but also sparked collaborations across different departments. In regenerative therapies, our researchers are validating novel scaffolds and biomaterials through cellular platforms, with the aim of enhancing tissue compatibility and therapeutic performance. These experiences reflect our broader vision: to advance healthcare solutions through interdisciplinary approaches grounded in local challenges and scientific collaboration.

Concluding remarks, perspectives, and opportunities

Advancing sustainable biotechnologies requires more than institutional efforts; it demands coordinated action among interdisciplinary teams and strategic support from public agencies. From our experience, progress depends not only on adequate funding, but also on regulatory frameworks that facilitate large-scale implementation. Even in its early stages of operation, the Biotech Network successfully collaborated with a broader transdisciplinary team, including researchers beyond UFSC, to secure public funding from the Brazilian National Council for Scientific and Technological Development (CNPq). The approved project, with a budget of approximately US$2.5 million, will support the establishment of the National Institute for Biofactories (INCT – Biofábricas), coordinated by Débora de Oliveira, current general coordinator of the Biotech Network. This Institute will serve as a key pillar for scaling up most of the processes and products initially tested at the laboratory level. With the right policies and international collaboration, biotechnological innovation can transcend the laboratory and integrate into real-world systems, replacing outdated and unsustainable practices.

Following the publication of this article, the researchers in our network aim to compile data from future publications authored by network members to build a comprehensive interdisciplinary data set. By leveraging machine learning tools, our goal is to generate strategic insights that drive impactful advances in Brazilian biotechnology. We believe that integrating a robust research consortium with emerging analytical approaches can help minimize thematic overlap and more effectively direct our efforts, ensuring that biotechnological innovations transition from academic papers to tangible contributions to the national economy. These efforts are especially relevant in the context of emerging countries, where financial resources for research and innovation are limited. By identifying scalable technologies and innovation-ready areas, biotechnology may become more attractive not only for public funding, but also for private investments. Therefore, understanding the risks, innovation potential, and scalability of technologies is crucial to fostering long-lasting and successful private-sector partnerships [9].

Finaly, researchers from the Biotech Network are eager to welcome scientists from around the world, expand existing collaborations, and establish new partnerships. These initiatives aim to foster knowledge exchange, facilitate researcher mobility, and promote the dissemination of biotechnology across all sectors of society.

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Declaration of interests

No interests are declared.

Resources

[i]https://redebiotech.ufsc.br/

[ii]https://noticias.ufsc.br/2025/04/pesquisa-da-ufsc-realizada-em-parceria-com-a-policia-federal-e-ufpa-busca-transformar-maconha-apreendida-em-biocombustivel/

[iii]www.alt-meat.net/jbs-ufsc-sign-cultivated-meat-agreement-brazil

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