



**INNOVATIONS
FROM NATURE**



Areas of expertise

DISRUPTIVE BIOECONOMY

acib creates the basis for disruptive developments in the bioeconomy and focuses its strategic orientation on two main areas of research: the CO₂/H₂-based bioeconomy and the provision of essential medicines through bioproduction in plant cells.

SUSTAINABLE PRODUCTION

By developing innovative strategies in bioproduction, we aim to increase the sustainability of products. In this area, we research the possibilities of microbial cell factories and advanced biocatalysis, and look at various aspects of environmentally friendly bioproduction technology and „green chemistry“.

RENEWABLE RESOURCES

In the field of renewable raw materials, we focus primarily on food and feed production as well as materials that open up new opportunities in the areas of circular economy and resource efficiency.

HEALTH BIOTECHNOLOGY

The focus in this area is on the development of innovative production processes, the molecular characterisation of novel biopharmaceutical products and the identification of new active pharmaceutical ingredients (APIs). Another research topic of the department is the development of early diagnosis systems that enable the use of prophylactic medical measures.

Vision for the future of biotechnology

As COMET Centre of Excellence owned by the University of Natural Resources and Life Sciences, Vienna, Graz University of Technology, the University of Graz, and the research organisation JOANNEUM RESEARCH, the Austrian Centre of Industrial Biotechnology (acib) has an exceptionally broad spectrum of knowledge at its disposal. With state-

of-the-art equipment, excellent know-how and more than 25 years of experience, acib is the perfect partner when it comes to developing forward-looking solutions that impress across the board with maximum efficiency, minimised costs and an optimal environmental balance.

WE LIVE OUR VISION

With the wide-ranging expertise of over 150 qualified employees, who combine their individual expertise from all areas of biotechnology, we develop industrial applications that replace traditional industrial technologies with new, economically advantageous and environmentally friendly methods. Through global exchange with scientific partners, we bridge the gap between science and industry and meet the international standards of biotech, pharmaceutical and chemical companies with innovative production processes.

NON-PROFIT COMPETENCE CENTRE

acib was founded as a competence centre within the framework of the COMET programme and is funded by the BMIMI, BMWET, SFG, the Standortagentur Tirol, the Lower Austrian provincial government and the Vienna Business Agency. As a non-profit organisation according to the EU definition, acib is financed by public and private research funds.

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Research fields

BIOCATALYSIS AND ENZYME TECHNOLOGY

acib develops innovative biocatalytic processes and technologies to make the production of valuable compounds more sustainable and efficient. The focus is on establishing new enzyme reactions in the areas of amidation/esterification, redox reactions (e.g. biocatalytic C=C cleavage, C-H, alcohol/amine and aldehyde oxidations) and C-C bond formation. New enzymatic (cascade) reactions, enzyme optimisation and process development enable the industrial application of these reactions. By combining several enzymes in a reactor, complex, multi-step processes can be reduced to a single step. The aim is to establish biocatalytic processes as environmentally friendly alternatives to chemical synthesis and to revolutionise the production of speciality chemicals, active pharmaceutical ingredients and functional biomolecules. An important aspect is the use of tailor-made enzymes for specific reactions in order to achieve higher selectivity, stability and efficiency. For example, acib is working on the enzymatic production of beta-lactam antibiotics and enzymes for industrial, medical and environmental applications.

INNOVATIVE PRODUCTS FROM RENEWABLE RAW MATERIALS/ BIOREFINERIES

Through the consistent use of sustainable resources, acib pursues a holistic strategy for the development of bio-based products and materials. The focus is on the material use of CO₂ and biogenic and industrial waste streams for the production of high-quality products such as food, cosmetics, animal feed and chemicals, as well as products used in agriculture.

- Production of functional biomolecules (proteins, prebiotics/probiotics, cosmetic active ingredients)
- Development of state-of-the-art biopolymers (e.g. PHA, cyanoflan) with tailor-made properties

- (Bio)catalytic utilisation of difficult-to-degrade plastics
- Design of innovative biorefinery concepts as a basis for a circular bioeconomy

A key objective is to reduce the carbon footprint through carbon fixation, upcycling of side streams and the substitution of fossil raw materials with agricultural or industrial waste.

PLANT BIOTECHNOLOGY

In this area, our research and development activities aim to make the production of relevant crops more future-proof and to establish innovative, sustainable production options for food, feed, cosmetics and, in particular, medicines. The focus is particularly on products that, due to their complexity (e.g. structure), cannot be produced or can only be produced with difficulty in existing biotechnological systems (e.g. microorganisms or mammalian cells).

Specifically, new methods for the production of so-called small molecules as well as protein-based active ingredients and nutrients in active form have been established. Among other things, this solves the problem of climate change-related threats to supply chains. At the same time, plants are strengthened in their germination and growth potential through targeted modification of the surrounding microbiome and individual substance groups.







APPLIED BIODIVERSITY

Check out our bionanoparticle infrastructure

In this area of research, we are working to translate scientific findings from our microbiome research into practical measures for the protection, sustainable use and restoration of agricultural and natural ecosystems.

- Promotion of microbial diversity in the soil
- Biological protection against pests and support for high-yield ecosystems through targeted colonisation with beneficial microorganisms
- Sustainable healthcare by supporting a healthy gut microbiome while preserving microbial diversity and the associated genetic potential (next-generation probiotics)
- Sustainable use of resources by evaluating biomass from microbial production for environmental compatibility and strategies to reduce silage spoilage
- Biological decontamination, detection, monitoring, and prevention of disease outbreaks

SUSTAINABLE MICROBIAL BIOTECHNOLOGY

In this area, we research and develop microorganisms such as bacteria, yeasts and filamentous fungi for the sustainable production of bioproducts. Our goal is to increase the sustainability of microbial strains and bioprocesses through novel strategies. One focus is on the microbial conversion of previously unused, climate-friendly substrates such as lignocellulose sugars, glycerine and methanol into high-quality biomolecules that can be used for pharmaceutical and food purposes, in organic acids and as biofuels.

In particular, the aim is to improve the use of cellular resources and save time. We achieve this, for example, through targeted strain improvement and cell engineering, through the development of coupled production processes in which several products are produced simultaneously in a single microbial host, or through the use of predictive models for bioprocesses.

In addition, the use of environmentally harmful substances and antibiotics is to be drastically reduced or avoided altogether. Specific goals include the development of antibiotic-free, co-producing *Komagataella phaffii* strains for the production of high-quality recombinant proteins, the microbial production of 1,3-propanediol and

3-hydroxypropionic acid from alternative raw material sources using *Lentilactobacillus diolivorans*, and the more efficient use of alternative substrates in methylotrophic yeasts.

BIOPROCESS TECHNOLOGY, BIOPHARMACEUTICALS AND DIAGNOSTICS

Our goal in this area of research is to make novel biopharmaceutical agents such as peptides and bionanoparticles (BNPs) accessible through innovative manufacturing processes. At the same time, established biopharmaceuticals such as antibiotics, monoclonal antibodies (mAbs) and vaccines are to be made usable for additional indications through new approaches, and their production in Europe is to be secured.

In the field of diagnostics, the focus is on improving methods for the early detection of diseases. In addition, growing knowledge about the interactions between the microbiome and human health is being used to develop a new generation of prebiotics, probiotics and synbiotics for humans.



Successes & Spin-offs

SHORTEST BIOCATALYTIC ROUTE TO NATURAL VANILLIN FROM EUGENOL OR CLOVE OIL

Eugenol/clove oil is a natural resource that was used to produce vanillin more than a hundred years ago. However, this method was not sustainable and did not result in a product that could be classified as natural. Alternatively, microorganisms were found that convert eugenol into vanillin via a five-step sequence that requires energy-intensive steps using ATP.

In our study, we demonstrated in a proof of concept that eugenol/clove oil can be converted into vanillin in just two biocatalytic steps that require molecular oxygen as the sole oxidising agent. The success is based on the combination of suitable enzymes from different microorganisms in an artificially generated cascade. Since only molecular oxygen and biocatalysts are required in this cascade and the reaction is carried out in a buffer solution at ambient conditions, the product can be considered natural. Among other things, the study also highlights the strength of artificially developed cascades, which even surpass natural metabolic processes.

IMPROVING SKIN CARE WITH ALGAE-BASED ACTIVE INGREDIENTS

Our skin deserves natural, healthy and high-quality products. To address this, acib researchers developed an eco-friendly skincare from microalgae.

Conventional cosmetics often contain between 15 and 50 ingredients, many being synthetic petrochemicals that are harmful to both human health and the environment. They can cause allergies, acne and skin irritation. Prolonged use can even lead to cancer. Growing health awareness drives demand for sustainable alternatives. Cyanoflan, – a natural biopolymer derived from a special type of algae (a

cyanobacterium), offers a solution. It naturally produces a complex extracellular sugar called cyanoflan on a continuous basis. This bio-based polymer acts as a thickener and provides soothing bioactive effects. Cyanoflan's simple cultivation only requires salt water with inorganic nutrients, light and air. This technology has already been patented in the USA and is pending patent approval in the EU.

The remaining algae biomass, rich in proteins, vitamins and minerals, can be used as a food or feed supplement, or extract a natural, bright blue pigment called phycocyanin, which is used as a food colouring or nutraceutical due to its antioxidant properties. This supports a circular bioeconomy. Originating in Portugal and now advanced in Austria, the project is evolving into the start-up CyanoCare, aiming to deliver sustainable, algae-based products for a healthier planet.



NATURAL AND HEALTHY MEAT FLAVOUR FOR MEAT ALTERNATIVES

Yflavour, a spin-off from acib, develops alternative protein products with authentic, natural and vegan flavours to make plant-based meat both, delicious and healthy. A global demand grows for sustainable, CO₂-neutral food replacing meat with alternative plant-based protein sources is key. Yet, consumer acceptance is slow due to disappointing taste. Yflavour solves this by offering natural flavours that significantly improve sensor quality. Through fine-tuning our bioprocesses, we produce authentic meat flavours with stable profiles, demonstrating in sensory tests to enhance all key meat attributes in a commercial plant-based burger. Our goal is to turn plant-based meat from an alternative to the popular standard for meat lovers. In the manufacture of our products, we combine innovative methods and processes

to create a sustainable overall package. The environmentally friendly process design avoids the use of organic solvents by employing mild conditions. We utilise by-products from industrial food production as raw materials for more cost-effective and sustainable fermentation. To achieve higher yields in less processing time, we use a special laboratory development approach to produce our yeast strains, which are classified as non-genetically modified. The fine-tuning of fermentation in combination with our innovative feeding strategy is a unique and sustainable process that allows us to fully exploit the potential of fermented flavours. This enables us to produce a variety of unique flavours that are healthy and tailored to the needs of our customers. Founded in 2025 after proof of concept with acib in 2023, Yflavour is scaling production with support from aws, acib GmbH, TU Graz, BOKU, FH Campus Wien, Sofinnova Partners and Bisy GmbH.



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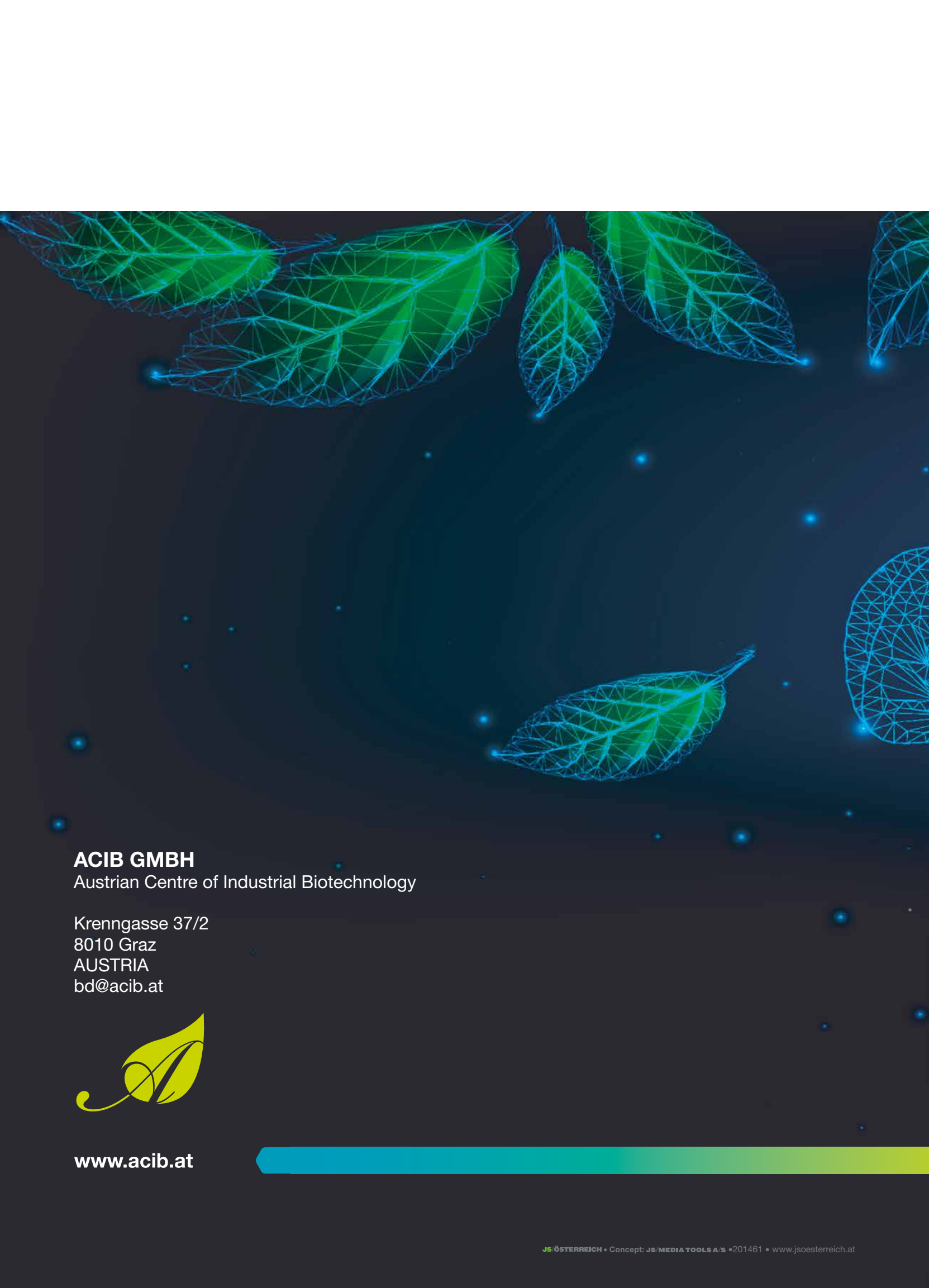
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