

TURNING RESEARCH INTO  
**INNOVATIVE**  
AND SUSTAINABLE PRODUCTS

[www.bict.it](http://www.bict.it)

FOR **BIOINDUSTRY**





# BICT About us

## inspired by Nature, Technology lovers

We believe  
in the positive impact  
of co-Evolution of  
Technology and  
Nature, to create a  
better  
every day future.

Doing business in an  
excellent, high-performing,  
useful, ethical and  
sustainable way.

It is possible, and we feel it strongly  
part of our DNA, committing  
ourselves every day with passion in  
our work, in coherence with the  
values that guide us.

**BICT, CREATING FUTURE**

## How do we innovate?

We turn ideas into real innovation by offering research services for process development and innovative ingredients, wherever enzymes and fermentations can make a difference.

Research and development are conducted by professional researchers and performed in high processivity screening: this innovative approach leads to improved performance in protocol execution.

**Achieve your goal with BICT.**



INNOVATION



SUSTAINABILITY



NATURE



WELL-BEING



# lues

**We move the horizon every day  
a little bit further.**

Being innovative means knowing how to change what already exists in order to improve it, making a valuable contribution to health, the environment and sustainable development.

**It's time to choose the future we  
want**

We work to give the word sustainability a concrete meaning. What the future will look like, we decide today and it's totally a choice in our hands.

**Nature is the best Biotech  
company in the world**

Nature is our continuous source of inspiration. Observing how it evolves and deploys strategies to improve itself is for us a spark that enlightens our research.

**Well-being can only belong to  
everyone**

It is no longer time to consider well-being in watertight compartments: this model of life and business is showing all its limits. This is why our work applies to all living beings and the environment through the use of increasingly sustainable processes.

# Quality System

**We develop  
ingredients and  
industrial processes  
on a solid foundation  
of excellence.**

**We believe in quality management,  
respect for the environment  
and in the excellence of production.**



**ISO14001**



**ISO9001**



**Development  
in quality**



**Scale-up  
in quality**



**Quality  
manufacturing**

Our Quality System covers all services and all business functions. Our risk analysis technique and procedures embrace all production processes, from the start up of a project to the production and distribution of raw materials.



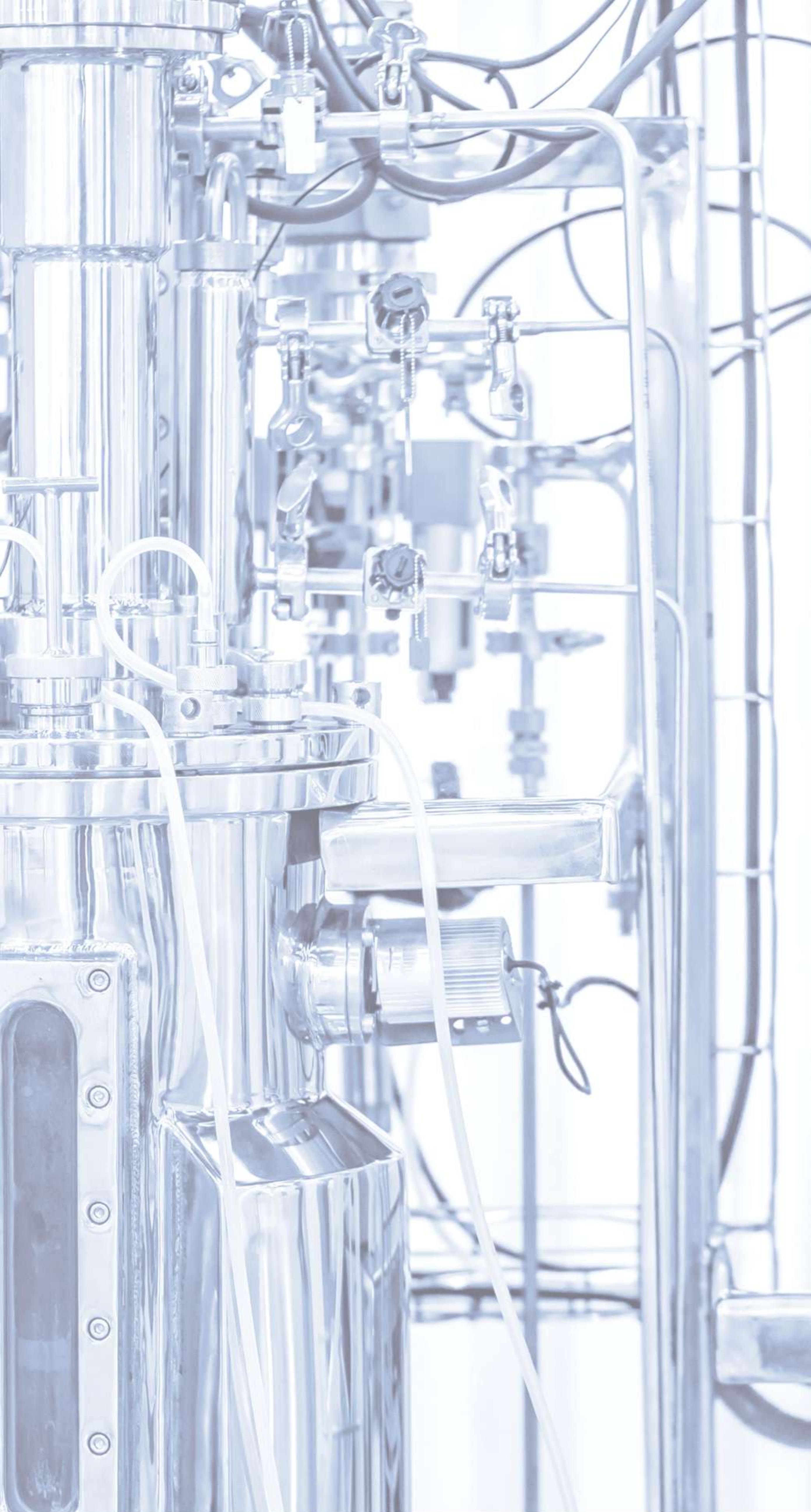


# **R&D Services**

**BICT, we move the  
horizon a little bit  
further every day.**

Thanks to biotechnological research, our products and industrial processes are true innovation, while respecting sustainability.





Development of innovative industrial processes

Heterologous expression

Mutagenesis and evolution of strain and enzymes

Strain development

Fermentation development

Bioconversion development

Development of purification process

Immobilisation of enzymes

Development of analytical methods

On quality, on time, on cost  
and out of the box!





# Development of innovative industrial processes

**enzymatic & chemo-enzymatic**

**We offer research services for the development of industrial products and processes**

**Biotechnology for innovation, competitiveness and sustainability**

Through the application of advanced biotechnology technologies, we offer a comprehensive service in the development of industrial bioprocesses and provide fully customised solutions, ensuring the highest standards of quality and support at all stages of development.

## From feasibility to industrialisation

The development team works on all phases, from feasibility - degree of risk, competitiveness, investment costs - to industrialisation. If you want to improve your production process or your product, you are in the right place: in BiCT you will find a multidisciplinary team with more than 20 years of experience in different fields and projects.

## A product that guarantees a return on investment

Working closely with development and using representative scale-up equipment, the team handling the delicate transition to industrial production identifies critical parameters for industrialisation and performs all technology transfer operations.



## Possible applications

- Transformation of a chemical process into a chemo-enzymatic process
- Design and optimisation of the biocatalysis process for the production of high value-added molecules
- Improving the production yield of strains in terms of biomass and molecules of interest
- Mutagenesis to improve the performance of strains and enzymes



# Heterologous expression

Based on the characteristics of the protein and your specific needs, we will carry out the development of the vector and recombinant strain, identifying the best expression system for your application.

## Heterologous expression in *E. Coli*

The bacterial expression system represents the most widely used and cheapest resource for obtaining heterologous proteins. BiCT is able to offer a fast and economical feasibility service for protein production, initially for research quantities for activity and selectivity screening and subsequently for scale-up and technology transfer steps.

Given the industrial nature of our research, we also offer a service for strain improvement and optimization of fermentation and purification conditions to achieve production targets

## Heterologous expression in yeast and fungi (*Pichia*, *Aspergillus*, *Yarrowia*)

Yeasts constitute an industrially relevant heterologous expression system and are often the best solution to express some proteins. BiCT has the expertise and ability to perform process feasibility in different hosts: *Pichia pastoris*, *Aspergillus*, and *Yarrowia*.

Through the technologies used, it is also possible to develop strains capable of expressing the proteins of interest without the need for expensive and hardly scalable inducers such as methanol for *Pichia*.

Many years of experience and creativity build the expression strategy to meet your goals







# Mutagenesis

## The basis of evolution

BiCT deals with the genetic engineering and modification of microorganisms and enzymes, to improve their activities and properties, and thus develop a system optimised for specific customer needs. We perform both random and rational mutagenesis with the aid of bioinformatics tools that enable targeted and functional modifications.

Through customised and efficient screening strategies, it is also possible to screen a large number of mutants simultaneously and identify variants with improved properties.

### Can improve many aspects

- Increase biotransformation yields
- Eliminate a side activity that generates impurities
- Eliminate substrate inhibitions
- Eliminate product inhibition
- Improve performance under specific conditions

**Guaranteed return  
on investment**



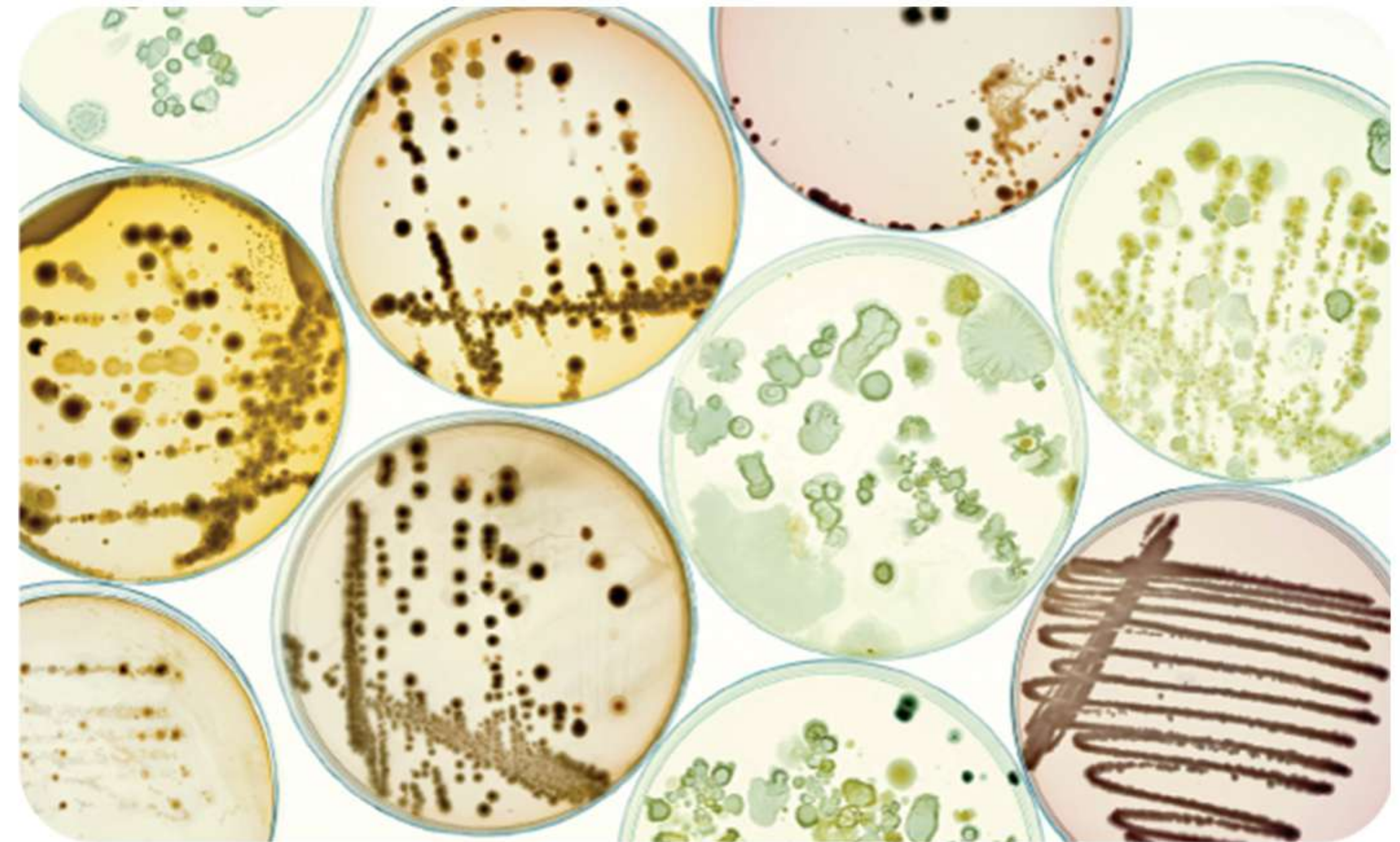
# Strain development

## Microorganisms are the future

**Microorganisms have always been used for different applications and nowadays they are a very important resource within many industrial sectors.**

BiCT has a wide expertise in microbiology and can improve microorganisms both in terms of biomass yield and in terms of related product, both endocellular and exocellular.

The activities performed can evolve both natural and recombinant strains and are carried out with the most modern technologies on different operational scales (microplates, Erlenmeyer flasks and fermenters).



BiCT has experience in the manipulation of various microorganisms: bacteria, from *E. coli* to the most complex actinomycetes, yeasts and filamentous fungi.

## Experience in the various operative phases

### Can improve many activities

- Isolation of microorganisms for complex matrices
- Phenotypic and genotypic characterization of strain
- Strain improvement (biomass and product productivity increase)
- Screening and optimization of growth conditions
- Development of scale-up and technology transfer
- Microbiological and chemical-physical analysis
- Definition of strain storage conditions



# Fermentation development

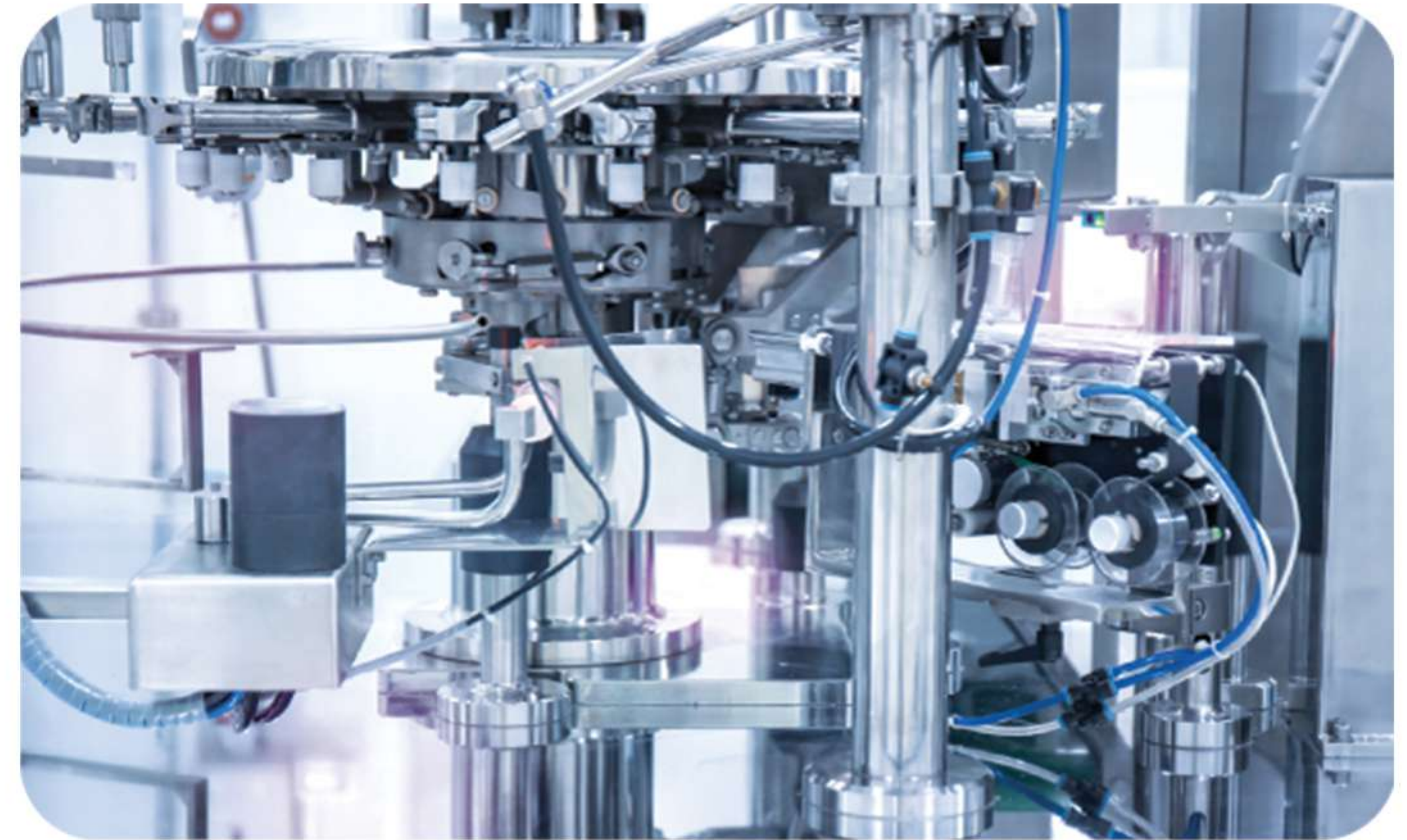
## Key technology for biotechnology process development

### Fermentation experts

Fermentation is a key technology for the development of biotechnological processes.

BiCT has a strong expertise in fermentation and can develop and optimize multiple processes in different production areas.

The processes developed involve both Batch and Fed-batch technologies and can be applied to bacteria, yeast and fungi in a pathway starting from laboratory screening to scale-up in fermenters.



### Tailored industrial approach

BiCT will accompany you in the development of a fermentation process tailored to your specific needs addressing all key parameters, from the raw materials used for the culture medium to the plant requirements used in production.

Having an industrial approach, process development is conducted with a view to scale and considers all factors necessary for industrialization.

### Our fermentation development service

- Culture medium optimization
- Multifactorial surface response matrix screening
- Study of induction systems and cellular metabolisms
- Batch and Fed-Batch fermentation development
- High density fermentations with oxygen-enriched air
- Optimization of critical fermenter parameters
- Scale-up of the fermentation process
- Technology transfer
- Process validation and standardization
- Determination of process cost and production yield





# Purification process development

Industrial downstream,  
to obtain the specifications  
that satisfy you

## Product purification as a fundamental step of development

Downstream, a process in which the substance of interest is separated and purified from the reaction medium, is a fundamental and often crucial step in obtaining the desired product.

To achieve this, it is very often necessary to develop an ad hoc purification method, which allows to obtain a molecule with certain parameters and a defined purity profile.

BiCT can develop and optimize entire purification processes, or parts of it, using the most suitable technologies, from dead-end or tangential filtrations up to the most diverse chromatography: ion exchange, gel-filtration, hydrophobic interaction, mixed mode, affinity and reversed phase, with the most suitable stationary phases for each specific application.



# Enzyme Immobilization

**We adopt the most suitable carriers and strategies for your application**

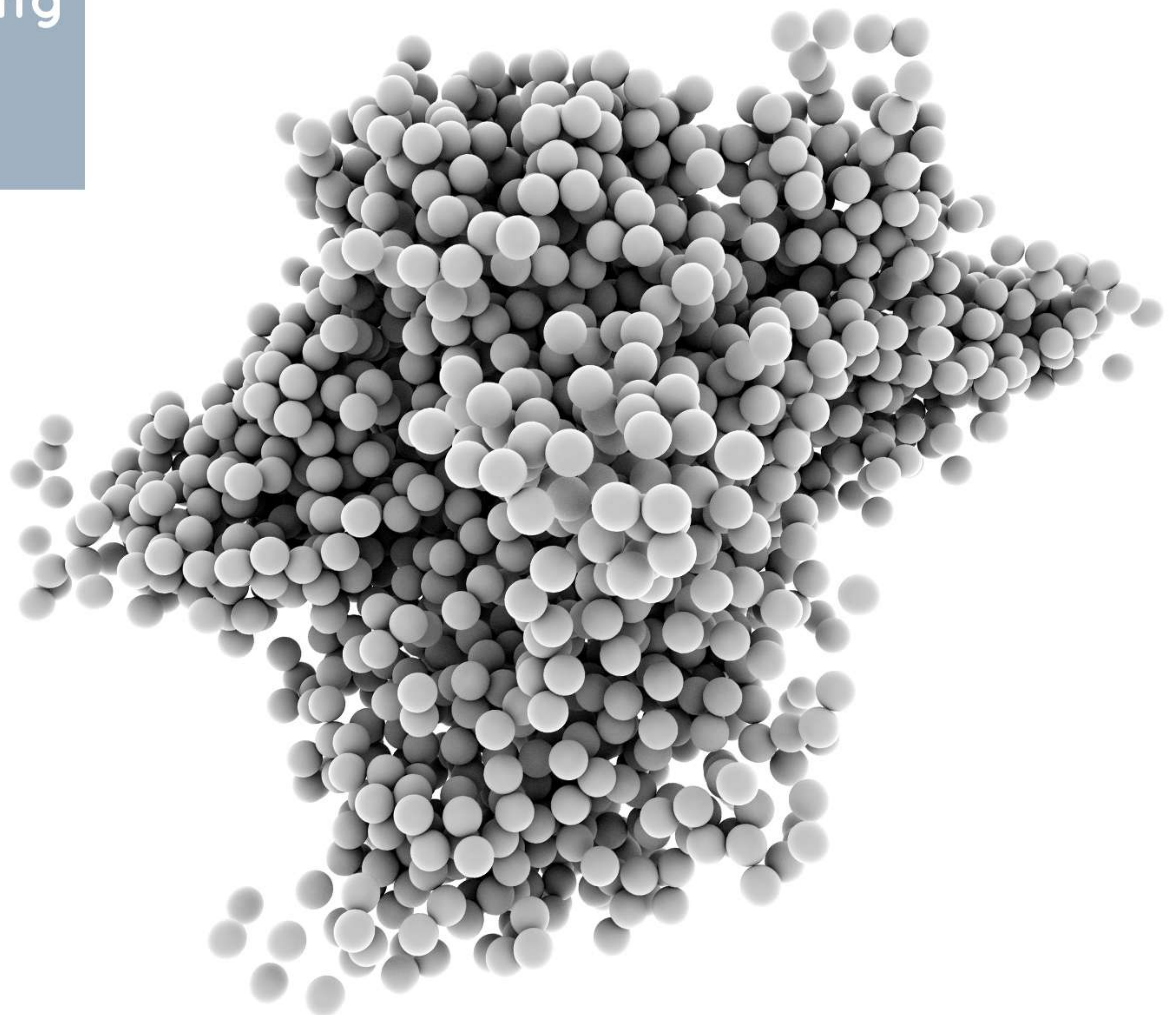
**What are the benefits to using immobilized enzymes industrially?**

- It lowers the supply costs of biocatalysts, due to the possible reuse of the enzyme.
- In some fields, such as food, it allows not to have the residual enzyme inside the product.
- It allows the use of the enzyme also in the presence of solvents, as it is in solid non-aqueous phase.
- It improves the stability of the catalyst.
- It confers particular reaction characteristics or modify the kinetic parameters of the biocatalyst.

To obtain these advantages, Bict offers a service of industrial biocatalysis development, using commercial or proprietary enzymes, depending on the convenience, also thanks to targeted screening by automated scale-down.

**Immobilizing an enzyme can improve the performance of your process**

BiCT offers you its expertise in the field of enzyme immobilization, adopting the most suitable carriers and strategies for the required application (adsorption, covalent bonding, or modifications in the functionalities). It is possible to apply the technology both to newly designed enzymes and to commercial enzymes.







# Analytical Methods Development

**Analytics is a crucial step in validating your process and enhancing the value of your product**

**To always know where we are going and where we want to arrive**

BiCT's analytical team has gained considerable experience in meeting any analytical need of the chemical and pharmaceutical industry, at all stages, from method development to standardization of protocols in the production phase.

## Available equipment

HPLC (standard and semi-preparative) and UPLC equipped with the following detectors

- UV detector / VIS diode array
- Refractive index
- Fluorimeter

Gas chromatograph equipped with

- Mass spectrometer detector
- Headspace analysis
- Autosampler

## Separation chemistry

- Inverted phases (C18, C8, C4 etc)
- Normal phases (Silica, Alumina, etc)
- Bound phases (diol amino acids, CN, PFP, Phenyl, Hexylphenyl, etc.)
- Polymeric stationary phases
- Ion exchange (SAX, SCX, CERA, WCX)
- Gel Filtration
- Chiral phases

## Analytical Services

Bict analytical services include:

- method development and validation
- stability studies
- qualitative and quantitative analysis



# Our success Stories

## KyroBio

### Project Goal

BiCT has successfully implemented a high throughput screening system by defining the optimal conditions for the immobilisation of enzymes, evaluating parameters such as the type of enzyme, the carrier used, the composition of the buffer solution and the enzyme/support ratio.

Optimisation of immobilisation enabled a percentage of activity expressed after immobilisation of over 80% to be achieved.

### Project Description

The partners in the KyroBio project have selected and optimised enzymes for the preparation of chiral compounds and their use in bioreactors, including in continuous (Flow Chemistry) and with the use of electrodialysis.

Thanks to the excellence of the partners involved, the project ranged from bioinformatics to biocatalysis. Bict in the project has developed the immobilisation of stereospecific enzymes for the production of chiral compounds.

### Partner



## BioOX

### Project Goal

BiCT successfully achieved the expression of enzymes in the fungi host system.

The oxidases were also immobilised on carriers with specific functional groups.

### Project Description

In the BIOOX project, various ODEs (Oxygen-Dependent Enzymes) were developed, in particular for hydroxylation with different CYPs (P450 monooxygenases) and oxidation with Alcohol Oxidases. Biocatalysis tests were also conducted in flow reactors (Coflore).

Bict was involved in the expression of the enzymes of interest in fungi as host cells and in immobilization tests of the oxidases developed in the project.

### Partner





# Tascmar

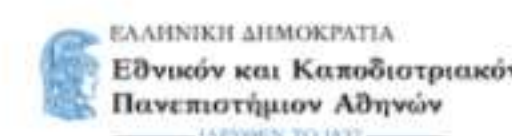
## Project Goal

The project made it possible to find and characterise enzymes for bio-remediation and pharmaceutical applications from microbial collections: different producing strains were selected, the latter being active on reference POPs (Persistent Organic Pollutants).

## Project Description

The TASCMAR project started with the breeding of mesophotic marine invertebrates and the preparation of collections of symbiotic micro-organisms of these organisms. The microorganisms have been used for the research of active biomolecules for the pharmaceutical, nutraceutical, cosmetic and bio-remediation sectors, with the design of bioreactors for their culture. Bict has characterised enzymes for bio-remediation and pharmaceutical applications.

### Partner



# INCITE

## Project Goal

BiCT was responsible for the mutagenesis, production and purification of the enzyme at the heart of the project.

It optimised the enzymatic step for the stereoselective production of the intermediate of interest from a racemic mixture, with particular attention to reaction time, enzyme/substrate ratio and transformation yield. He has also developed a strategy for recovering the acid of interest from the reaction mixture for the racemization step.

Finally, he took part in the basic engineering of the process demonstration plant, defining and installing a demonstration subunit for the production of the biocatalyst.

## Project Description

The INCITE project will contribute to the introduction of biotechnologies in the production of agropharmaceuticals, by designing demonstration plants for 2 chemo-enzymatic processes.

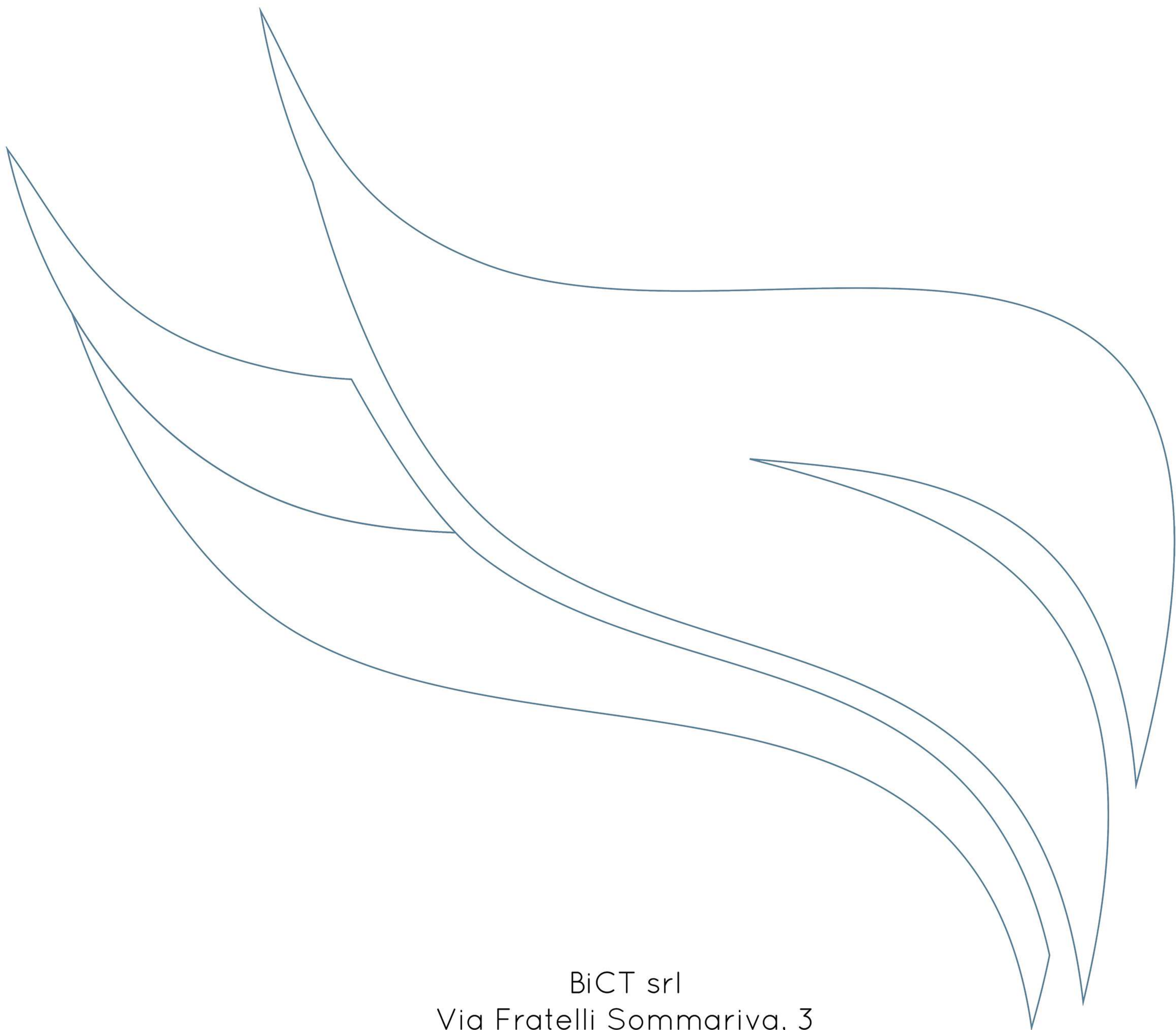
The first process concerns the production of an intermediate by means of an Esterase, with recycling of the esters and reuse.

The second case concerns the solvent-free synthesis of oleochemical esters using Lipase. Bict deals with the step with esterase of the first process and the subunit for enzyme production.

### Partner







BiCT srl  
Via Fratelli Sommariva, 3  
26818 Villanova del Sillaro (LO) - Italy  
T. +39 0371 774510  
**info@bict.it - www.bict.it**