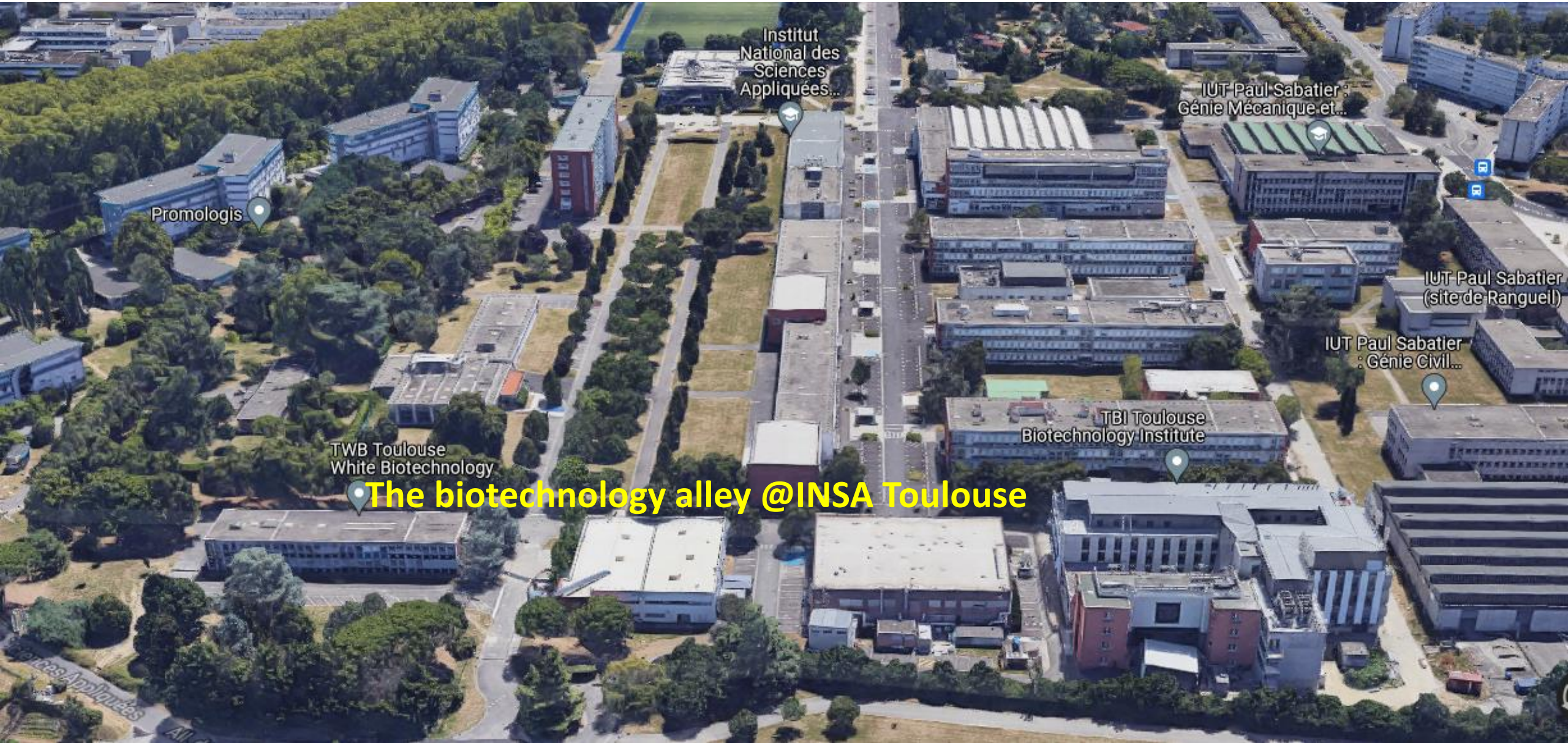
Continuum
Research, Development, Industrialization



Toulouse Industrial Biotechnology environment

Toulouse Biotechnology Institute
Bio & Chemical Engineering

BIOSCIENCES & BIOPRODUCTION

CRITT BIO-INDUSTRIES

GENIE DES PROCEDES TECHNOLOGIES ENVIRONNEMENTALES

- Enzyme engineering
- Strain design and construction
- Bioreactor design, modelling
- Catalyst and process development
- Down Stream Processing
- Life-Cycle analysis
- …

Reduce time to market : derisk & accelerate process development

An ecosystem for innovation

AGRI SUD-OUEST INNOVATION

DERBI Île de compétitivité

Genotoul Genopole Toulouse

AQUA VALLEY

fermat Toulouse Midi-Pyrénées

TOULOUSE TECH TRANSFER

CRITT BIO-INDUSTRIES

Génie des Procédés Technologies Environnementales

Transfer of Validated Concepts to Industry

twb

Pre-Industrial Demonstrator

tbi Toulouse Biotechnology Institute Bio & Chemical Engineering

Basic and Applied Research

TRL: *Technology Readiness Level*

9
8
7
6
5
4
3
2
1

Key figures

Microbiology and Food Chain
Food, Bioproducts and Waste

Biological Engineering/ Chemical Engineering

Engineering Sciences/Biological Sciences

320	60	20 M€	10 M€	110	7	8000
People	PhD	Budget	Contracts	Publications	Patents	M^2

**March 2021*

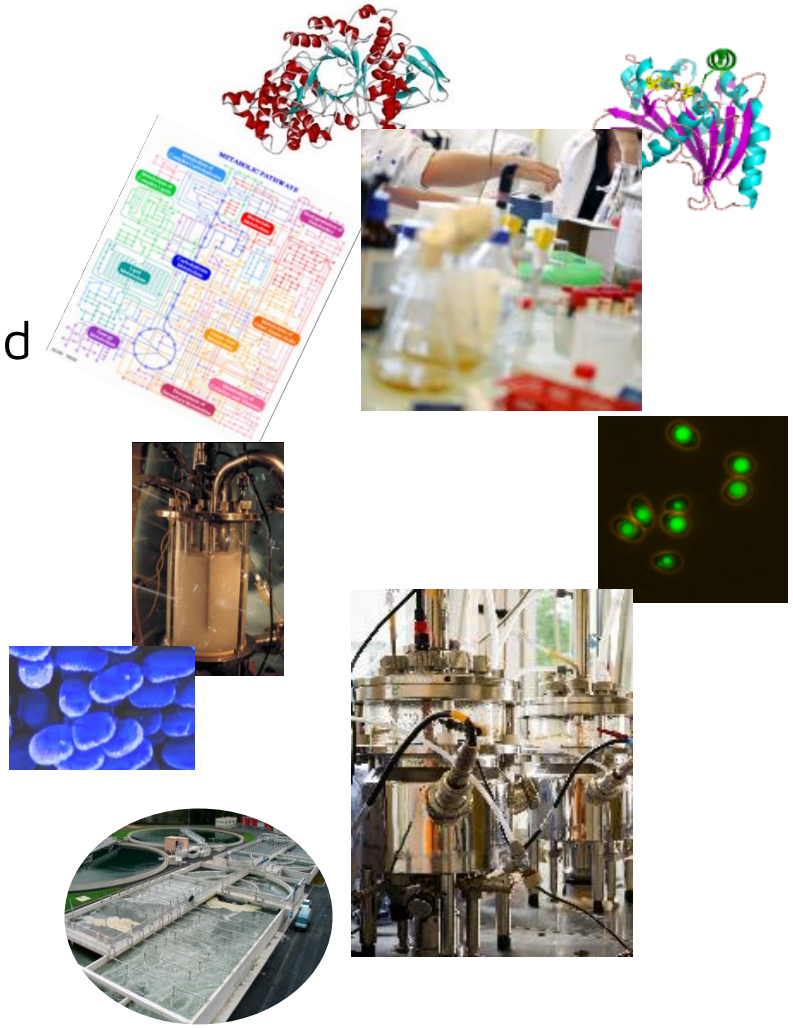
Certified ISO 9001, 2016

Carnot network

Labo1.5 approach

Scientific objectives and expertises

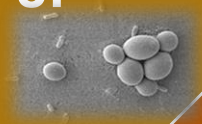
- To understand molecular phenomena underpinning biological systems, for predicting processes and systems dynamics
- To explore microbial metabolisms and biocatalysts, regulation and stability, redesigning organisms for useful purposes and new abilities
- To decipher physico-chemical and hydrodynamical phenomenon of complex environments
- Eco-design of innovative technologies, to tackle scale changes and rationally develop innovative processes for industrial and environmental biotechnology



4 scientific and 1 technological departments

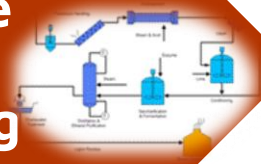
Enzyme molecular engineering and catalysis

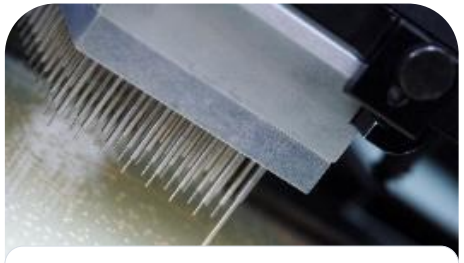
Physiology and Engineering of Microbial Metabolism



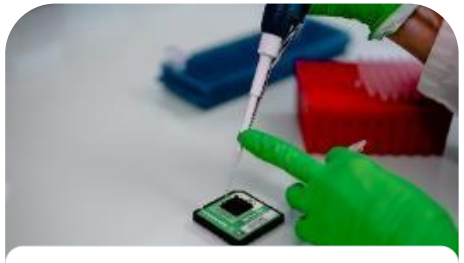
Microbial engineering

Sustainable chemical engineering





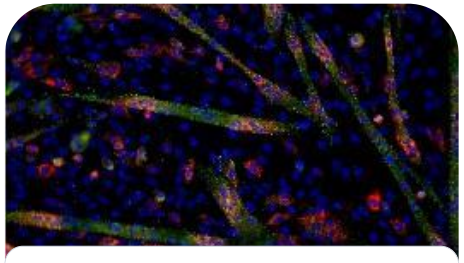
PICT: Engineering and Screening for Original Enzymes



GeT Biochips - Genomics and Transcriptomics

MetaToul- Metabolic Network

IBiSA INFRASTRUCTURES BIOLOGIE SANTÉ ET AGRONOMIE



Quantitative and Functional Ecology

FAMETech – Fermentation

Chemistry and biomolecules analysis

Physico-chemical analysis

Mathematics unit

Mission

Help industry in facing climate change and population growth along its social and environmental responsibility

Enabling the development of innovative and sustainable routes

- Industrial biotechnology
- Research and innovation acceleration approach
- Focus on the needs of our members

A partnering-enabling ecosystem

TWB public-private consortium

Product and process developers – Large, SMEs, start-ups

Technology developers / providers

Public Research

Investors / Tech transfer

Institutions

- **Consortium agreement**: a framework ruling TWB activities
- **Simplification of IP** and contractual terms

Fostering Innovation to Preindustrial Stage

Leverage a unique public / private ecosystem

53

Integrate workflow to design, develop, test and optimize catalyst and process


Strain engineering


Biotransformation & culture


Process development

De-risk & Accelerate
Bioprocess / biocatalyst development

Detect and mature **innovation breakthrough** into technology bricks

€10M+

Support product development

200+ projects

Foster **start-ups inception**
Provide means to speed-up

9 hosted start-ups

Scale-up, DSP and batch production

> Optimize and scale the process up to pre-industrial stage ready for transfer to industry

BIOPROCESS UPSCALING

Process development, validation, scale up, pre-sizing for
- Liquid and solid **fermentation** (bacteria, yeast, fungi, micro-algae)
- **Enzymatic process** (immobilization, heterogeneous and homogenous, batch and continuous)

Liquid Fermentors from 10 L. to 300 L, Solid state fermentor 50 L.

DOWNSTREAM PROCESSING & PURIFICATION

Combination of purification **unit operations** from proof of concept to industrial pre-sizing

Grinding, Solid-liquid separation, Purification (Adsorption, MFT/UF/NF/RO, Desalting (ED, IE), Chromatograpy) from 1 L to 500 L

Batch production: cells (kg), proteins 0.1-1 kg)
Process book (mass balance,…)

Scale-up and batch/continuous production

Génie des Procédés Technologies Environnementales

- Microbial system = mixed bacterial population in non sterile environment
- Complex substrate (gas, liquid and solid waste)

Combined PHYSICAL_CHEMICAL_BIOPROCESSES

Process development, validation, scale up, pre-sizing for
- Liquid and solid **fermentation** (bacteria)
- **Gaz** fermentation from H2 and CO2 to acid organic, methane, …

SOLIDIA Platform = gaz fermentor 300 L, packed reactor (300 L), trickling bed for solid state fermentation 10 m3, Laboratory reactors from 2 L.to 15 L.

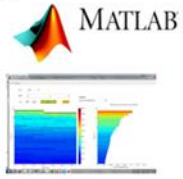
Voie Solide Discontinue :
10 m^3 liq / 10 m^3 solide

PROCESS MODELING

- Precipitation, Stripping, Adsorption operations coupled (or not) with bio-reactions
- Anaerobic, anoxic or aerobic bioreactors
- Life Cycle Assessment for the sustainable development of process and monitoring

Software : Aquasim, Matlab, Openfoam, ecoivent, umberto

- **Outils de calculs**



CRT centre de ressources technologiques