BioStructLab

UNIVERSITÀ
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RESEARCHER

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1 research fellow
1 PhD student

DEPARTMENT

Biotechnology, Chemistry and Pharmacy

LAB

Gene manipulation Lab
Macromolecule (proteins, RNA and DNA) production Lab
Structural Biology Lab

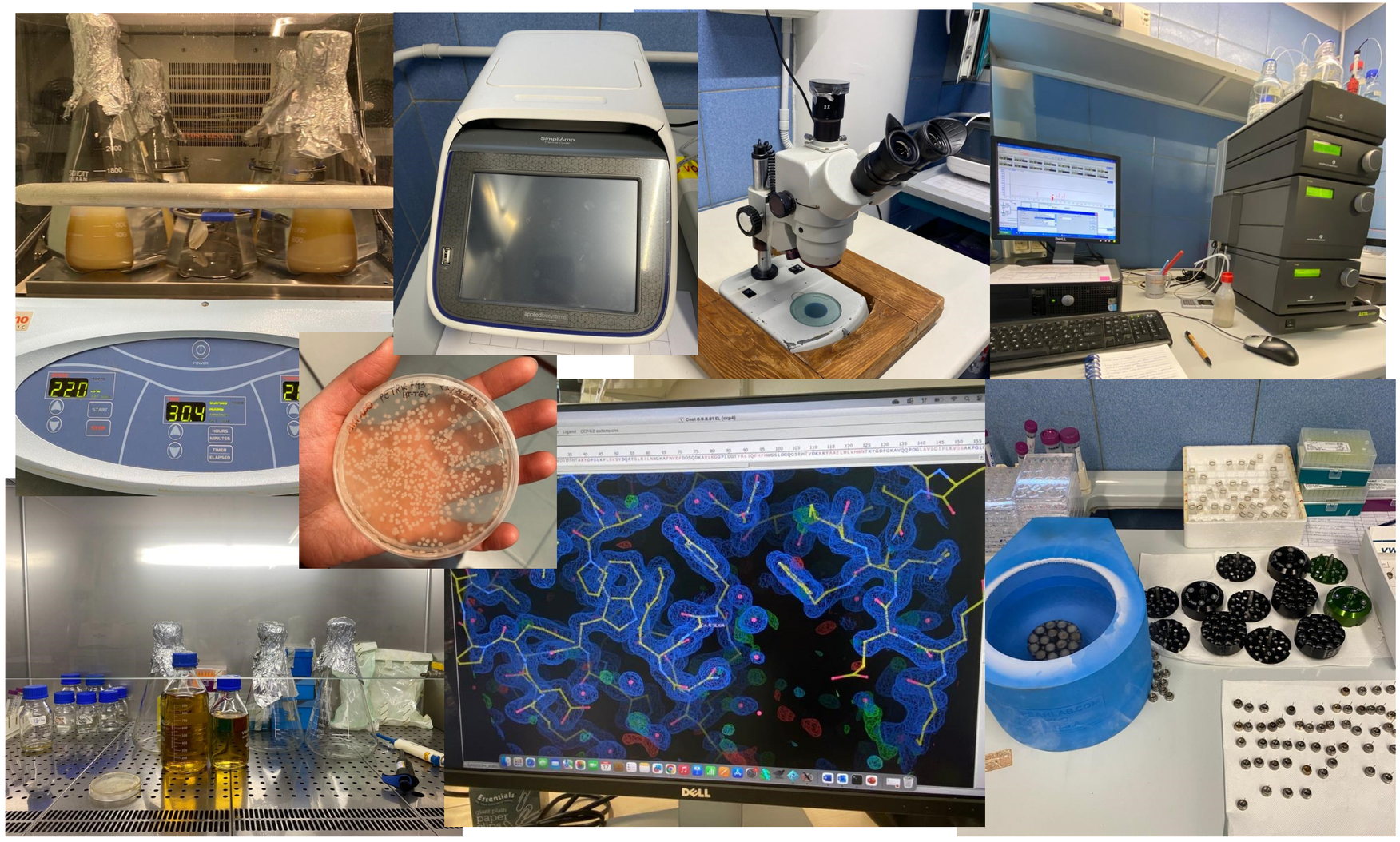
Polo Scientifico San Miniato – Siena
Rooms 30-116/128/228

Research activity

The research activities of the BioStructLab are focus on gene manipulation by recombinant DNA technique, production of biological macromolecules (proteins, RNA and DNA), and structural characterization by structural biology techniques. The BioStructLab is fully equipped to carry out these activities, which have led to the publication of a relavant number of scientific publications in internationally relevant journals and structural data, publicly accessible through the Protein Data Bank (PDB). The main lines of research developed by the BioStructLab are focused on the structural and functional study of macromolecular targets involved in neurodegenerative diseases, cancer, bacterial, viral and parasitic diseases and drug-resistance mechanisms, and of transporter proteins and photoinducible systems. The BioStructLab also focuses on the characterization of protein-protein and protein-DNA/RNA interactions and the characterization of macromolecule-ligand complexes, combining spectrophotometric and spectroscopic techniques (including UV-vis spectrophotometry, fluorimetry, circular dichroism, mass spectrometry) and structural biology techniques.

The established know-how of the BioStructLab research group is the result of years of experience in the field of structural biology. BioStructLab therefore has specific expertise in the areas of gene manipulation, production and purification of macromolecular targets, spectroscopic and spectrophotometric characterization, and structural biology. These skills have enabled the BioStructLab to significantly contribute to and support research projects dedicated to new drug development by providing detailed information on the structure of targets, their complexes with inhibitors and ligands, and protein-protein and protein-DNA/RNA complexes.

Images



Technologies and services

The BioStructLab has the necessary instrumentation for the production and characterization of biological macromolecules and research activities in the field of structural biology. The BioStructLab has developed protocols for the production and structural characterization of more than 50 macromolecular targets. Instrumentation currently in use at the BioStructLab includes:

- Thermal cyclers, used for DNA amplification by Polymerase Chain Reaction (PCR).
- Static and orbital cell culture incubators for protein production by recombinant DNA technique.
- FPLC chromatographic systems, used for purification of biological macromolecules by different techniques and chromatographic columns.
- UV-visible spectrophotometers, fluorimeter and circular dichroism, used for spectrophotometric and spectroscopic characterization of biological macromolecules and kinetic characterization of enzymes.

Based on available expertise and instrumentation, BioStructLab can offer:

- Gene manipulation services such as gene cloning in plasmid vectors and site directed mutagenesis.
- Production of recombinant proteins for structural and functional studies.
- Characterization of biological macromolecules and their interactions (protein-protein interactions and protein-DNA/RNA interactions) and characterization of protein-ligand interactions by spectrophotometric and spectroscopic techniques.
- Crystallization services and structural study of biological macromolecules and protein-protein and protein-DNA/RNA complexes.
- Crystallographic screening services of ligands and inhibitors toward macromolecular targets (characterization of the crystallographic structure of macromolecule-ligand/inhibitor complexes).

Applications and collaborations

The main research activities carried out by BioStructLab in collaboration with companies have involved the production and structural characterization of pathologically relevant biological macromolecules for the development of drugs for the treatment of various human diseases. A project previously carried out in collaboration with the pharmaceutical company Siena Biotech Spa focused on the development of novel inhibitors of the human metallo-enzyme glutaminyl cyclase for the development of drugs for the treatment of neurodegenerative diseases such as Alzheimer's disease and Huntington's disease. As part of this project, the BioStructLab was involved in the production and characterization of the target enzyme and structural characterization of the enzyme-inhibitor complexes. The information provided by the BioStructLab allowed relevant structural details on the binding mode of inhibitors to be obtained, leading to the rapid development of high-affinity molecules. The BioStructLab has also participated in several research projects in collaboration with pharmaceutical companies such as Venatorx Pharmaceuticals (USA) and Antabio SAS (France), focused on the development of drugs to combat bacterial drug resistance to antibiotics. In particular, the BioStructLab carried out structural biology studies aimed at characterizing the binding mode of the inhibitors developed by the companies with the target enzymes, beta-lactamases. The BioStructLab has contributed to the development of two drugs currently in clinical use, Avibactam and Taniborbactam. The BioStructLab is currently collaborating on a project for the development of innovative antibacterials in collaboration with GSK Vaccines S.r.l., in which it carries out production and structural characterization of target proteins.

For more information

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