# Corso di Dottorato in Tecnologie Convergenti per i Sistemi Biomolecolari (TeCSBi)
# XXXV ciclo, a.a. 2019/2020

## Borse finanziate dal Dipartimento

### n.1 scholarship related to research projects

*Generation of functionalised biomaterial for biomedical applications.*

Project Supervisor: Dr. Laura Russo

Possible support for Phd students w/o a University fellowship: no

Objectives: Aim of the project is to functionalise biomaterials in order to generate tools for biomedical application. Different biocompatible materials of biological or synthetic origin, such as collagen, elastin, chitosan, polyglutamicacid, hyaluronic acid, will be functionalized in order to generate both nanoparticles for theragnostic purposed and 3D scaffolds mimicking the cell microenvironment of different tissues. The functionalizations will allow proper crosslinking, in order to provide the required 3D structure of the nanoparticles and scaffolds, and will permit to covalently link detectable agents, targeting agents, and bioresponsive and bioactive molecules. In the case of nanoparticles, for example, multiple functionalization will be performed in order to attach a couple of different detectable agents and a targeting agent. In the case of synthetic tissues, the functionalization will tone the 3D printability and the stiffness of the artificial tissue, and will allow the insertion of peptides or glycans inducing specific cell fate. Furthermore, the artificial tissues mimicking human pathological conditions of specific organs, will be used to study the efficacy of drugs.

Methodologies: chemical reactions for biomaterial functionalization, characterization of the functionalised products, generation of nanoparticles and their characterization, exploitation of the nanoparticles for diagnostic purposed. Generation of bio-inks for 3D printing and bioprinting, characterization and study of the printability, 3D cell models (organoids). Analysis of the cell fates regulation in different 3D synthetic tissues.
The work is highly collaborative, involving foreign partners for the diagnostic nanoparticles, and Italian partners for the artificial tissues study.

**n. 3 borse finanziate su fondi "Dipartimenti di eccellenza" vincolate al progetto di ricerca**

**n.1 Project Title:** "*The role of legumes in Mediterranean diet to prevent and treat cancer*"

**Prof. Massimo Labra**

**Abstract**

The present PhD project proposal focuses on legumes used as food ingredients in the Mediterranean diet that are source of phytochemical compounds able to contrast several human health issues, including chronic multifactorial diseases such as cancer. The project aims to investigate the bioactive compounds occurring in legumes of genus Vigna because recent literature suggested their strong effect on the mortality of colon cancer cell lines. Through the exploitation of several extraction and separative procedures of legume seeds phytocomplexes, different fractions will be investigated under the chemical and bioactivity points of view. We will use specific cell lines of colon cancer to better elucidate the capability of single molecules and legume phytocomplexes to interact with cancer cells. Moreover, we will investigate the effect of the most promising legume extracted fraction on colon cancer organoids to evaluate their effect on the tumour microenvironment.

The ultimate goal of the project is to understand which legume species and/or cultivars are the most active against colon cancer development. This information could encourage the cultivation and consumption of certain legumes in the Mediterranean to exploit their nutraceutical value.

**n.1 Project Title:** *"Yeast as a model of AT pathogenesis"*

**Prof.ssa Longhese**

Ataxia telangiectasia is a rare human genetic disease, characterised by a progressive loss of cerebellar neuron function, sensitivity to ionizing radiation and high rate of malignancies. This syndrome is caused by mutations in ATM gene, which encodes a highly conserved protein kinase that mediates the cellular response to DNA double-strand breaks. The proposed research will use a model organism to identify and characterize pathways that compensate for ATM dysfunction.

**n.1 Project Title:** "PROGETTO "CHRONOS"

DIPARTIMENTI DI ECCELLENZA

**Project Supervisors: Prof. Rita Grandori and Dott. Ivan Orlandi**

**Dendritic cell aggresome-like induced structures, DALIS, in aging, inflammation and neurodegeneration.**

Neurodegenerative diseases (NDs) are devastating pathologies with a common underlying pathogenic mechanism, involving incorrect protein folding processes, followed by protein

aggregation. In neurodegenerative states such as Parkinson's disease, neurons are subjected to inflammatory factors and oxidative stress. Through an integrated and multidisciplinary approach, that will ensure expertise in multiple model systems (from dendritic cells, to yeast, to neurons) as well as multiple technical approaches (from proteomics to genetics to cell biology), this project proposes the parallel and comparative study of healthy and pathological processes of intracellular protein aggregation in immune cells, in yeast (a well-established aging diseases model) and in human neuronal cell lines, modelling neurodegeneration.

## Borsa finanziata da Enti esterni

**n. 1 borsa finanziata da Regione Lombardia vincolata al progetto di ricerca**

*Valorizzazione di reflui di processi industriali in una logica di economia circolare*

Il progetto prenderà in considerazione matrici organiche di scarti provenienti da lavorazioni industriali o dal comparto agroalimentare/forestale con la finalità di valorizzare matrici secondarie e supportare lo sviluppo di filiere circolari. L'obiettivo tecnologico è di realizzare ed ottimizzare processi di estrazione chimica, eventualmente coadiuvati da trattamenti enzimatici e microbica, per la liberazione di prodotti di interesse (quali ad esempio nutraceutici, antiossidanti, ecc) e/o di substrati che verranno successivamente utilizzati per trasformazioni microbiologiche che risulteranno in ulteriori molecole di interesse.