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Dipartimento di  
Biotecnologie Molecolari  
e Scienze per la Salute



## Department of Molecular Biotechnology and Health Sciences



# Book Research Lines

- Bachelor's Degree in Biotechnology
- Master's Degree in Molecular Biotechnology
- Master's Degree in Biotechnological and Chemical Sciences in Diagnostics



## INTRODUCTION



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The Book has been produced in **italian** and **english** with the main purpose of illustrating the main Lines of Research of the faculty members of the courses of study pertaining to the Department of Molecular Biotechnology and Health Sciences: Bachelor's Degree in Biotechnology, Master's Degree in Molecular Biotechnology and Master's Degree in Biotechnological and Chemical Sciences in Diagnostics.

The Book contains in the first part the Lines of Research of the faculty members of **the four sections** of the Department (**Biology, Chemistry, Hematology and Immunology**) and in the second part the Lines of Research of **faculty members of other Departments** of the University of Turin who teach in the three courses pertaining to the Department of Molecular Biotechnology and Health Sciences.

The index also allows **interactive browsing**: simply click on the Research Line to be referred to the relevant page.

To contact faculty members, please consult the **University directory** (<https://rubrica.unito.it/>) through which their contact information (email and office number) can be obtained.

The Book is not exhaustive, but it gives an overview of the main Lines of Research related to teaching activities.

All students are invited to the **Bioteclab day scheduled on October 20, 2023, from 2:00 pm to 6:00 pm** during which it will be possible to speak directly with representatives of the various Research groups.

Wishing you a good browsing, we look forward to seeing you there on **October 20!**

**Prof. Franco Novelli** Director of the Department of Molecular Biotechnology and Health Sciences

**Prof. Marina Marchisio Conte** Deputy Director for Teaching of the Department of Molecular Biotechnology and Health Sciences

**Prof. Paola Defilippi** President of the Bachelor's Degree in Biotechnology and Master's Degree in Molecular Biotechnology

**Prof. Enzo Terreno** Referring professor of the Master's Degree in Biotechnological and Chemical Sciences in Diagnostics



## BIOLOGY SECTION



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- Adaptor proteins in synaptic plasticity (Pag.9)*
- Computational genomics and gene networks - Interactions and gene networks (Pag.11)*
- Development of the neuroendocrine system (Pag.13)*
- Gene expression control in tumor biology and heart autoimmunity (Pag.15)*
- Hallmarks of aging: molecular basis of aging-associated syndromes (Pag.17)*
- Heme dynamics and mitochondrial metabolism in physiology and pathology (Pag.19)*
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- Intellectual Disability and the model in pluripotent stem cells (Pag.23)*
- MicroRNAs and their link with adhesion and metabolism in breast cancer and melanoma progression (Pag.25)*
- Physiopathology of Heme in the Nervous System (Pag.27)*
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- Protein-protein interactions and human cancer signalling (Pag.31)*
- Role of chaperone proteins in cancer progression and in cardiac diseases (Pag.33)*
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## CHEMISTRY SECTION



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- Design of PROTACs (Pag.46)*
- Mass spectrometry laboratory (Pag.50)*
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- Mechanisms of permeation of molecules through mucus barriers (Pag.58)*
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- Prediction of pathogenic mutations and design of therapeutic strategies (Pag.70)*
- Protein nanoparticles (Pag.72)*



## HEMATOLOGY SECTION

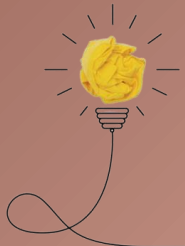
- ❑ *Translational research in B-Cell Lymphomas (Pag.75)*



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## IMMUNOLOGY SECTION



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- Computer Science (Pag.78)*
- Molecular and Translational Oncology - Molecular Biotechnoly Center 2 (MBC2) (Pag.80)*
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- Regenerative Medicine and extracellular vesicle lab (Pag.86)*
- Tumor immunology - Centro di Biotecnologie Molecolari "Guido Tarone", Piazza Nizza 44 (Pag.88)*





## RESEARCH GROUPS FROM OTHER DEPARTMENTS



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- Air Quality and Human Health (Pag.91)*
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- Determinants of rare neurodevelopmental disorders (Pag.100)*
- Development of GC-MS and LC-MS/MS analytical methods for clinical and forensic investigations (Pag.102)*
- Development of Imaging biomarkers (Pag.106)*
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- Identification of molecular biomarkers and novel therapeutic markers in cancers (Pag.110)*
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- Neuronal plasticity, neuronal circuits and sex-biased differences in emotional, cognitive and metabolic disorders (122)*
- Physiology of Reproduction (Pag.124)*
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- Plant genetics (Pag.128)*
- Plant Pathology and sustainable crop protection (Pag. 130)*
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- Quality of the sludge, produced by waste water treatment or organic fraction municipal solid waste tretment, and human health impact (Pag.135)*
- Theranostic in Nuclear Medicine: from diagnosis to therapy (Pag.137)*
- To see or not to see: Organic chemistry applied to biology (Pag.139)*



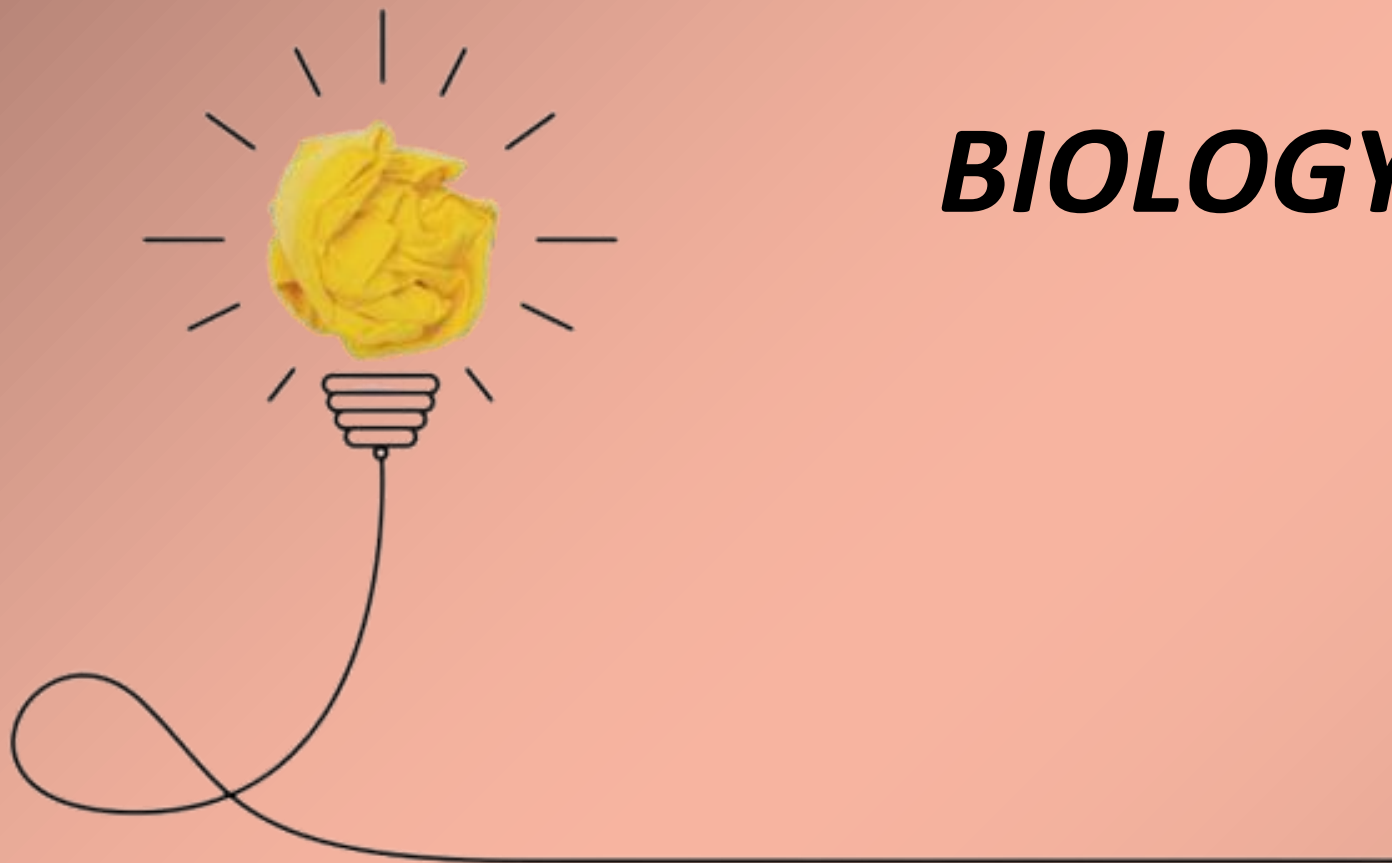
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# ***BIOLOGY SECTION***



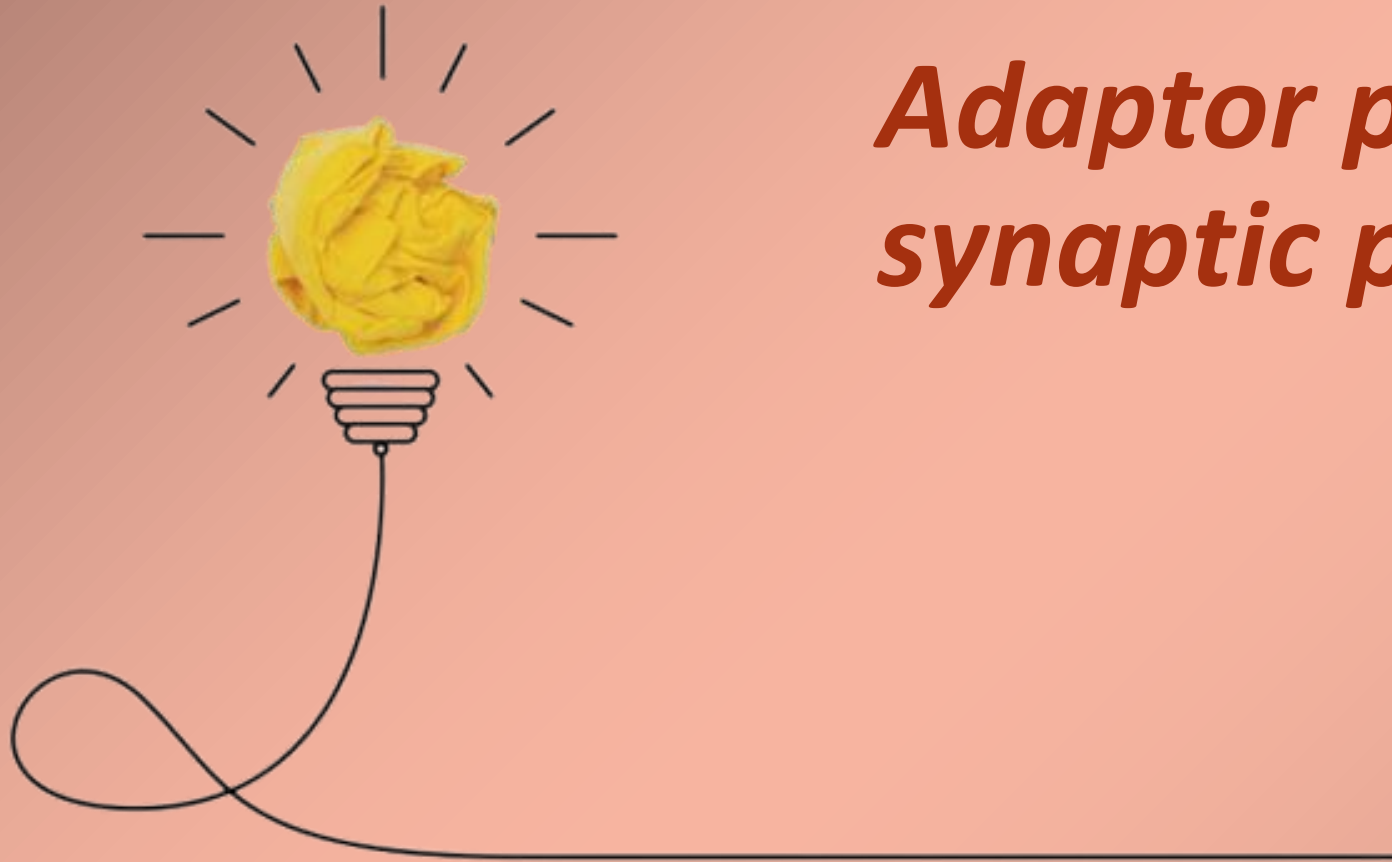




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# *Adaptor proteins in synaptic plasticity*



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**Teacher:** Prof. Paola Defilippi PO Applied Biology

**Collaborators:** Dr. Alessandro Morellato, Post Doc

## **Research lines**

Protein-protein interactions are essential for the construction of the dendritic spine, whose alterations are involved in the onset of multiple cognitive deficits. The p140Cap and SKT family of proteins are well expressed in neurons, with an enrichment in synaptic structures. Thanks to cellular and transgenic animal models, we study their role in the remodeling of the dendritic spine and their interactors. Furthermore, with differentiation experiments from human pluripotent cells we want to understand their involvement in the physiology and pathology of human neurons.

### **Projects:**

- 1) Role of the p140Cap protein in the control of tumor microenvironment
- 2) Role of the p140Cap protein in drug resistance
- 3) Role of the p140Cap protein in cell metabolism



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# *Computational genomics and gene networks - Interactions and gene networks*



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Teacher: Prof. Emilio Hirsch - SSD: BIO/13

## Research lines

### Role of PI3K in signalling pathway and human diseases

- Role of Class II PI3Ks in vesicular trafficking
- Impact of Class II PI3Ks in cell division and breast cancer progression
- Regulation of Class II PI3Ks during cytokinesis and senescence
- Employment of genetically-engineered animal models to study human diseases



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# *Development of the neuroendocrine system*

*Migration, differentiation and vulnerability of GnRH  
gonadotropic neurons, in different models.*



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**Teachers:** Prof. Giorgio Merlo; Prof. Patrizia Bovolin (University of Turin, Department of Systems Biology); Prof. Astrid Saraceni (University of Turin, Department of Systems Biology)

## Research lines

The hypothalamic gonadotropic neurons are fundamental for sexual maturation and fertility. We are studying their migration, their differentiation, their connectivity and their sensitivity to the harmful effects of exposure to environmental and food contaminants known as Endocrine Disruptors. We are using both the mouse and the zebrafish models.

1 place available for internship + master degree thesis

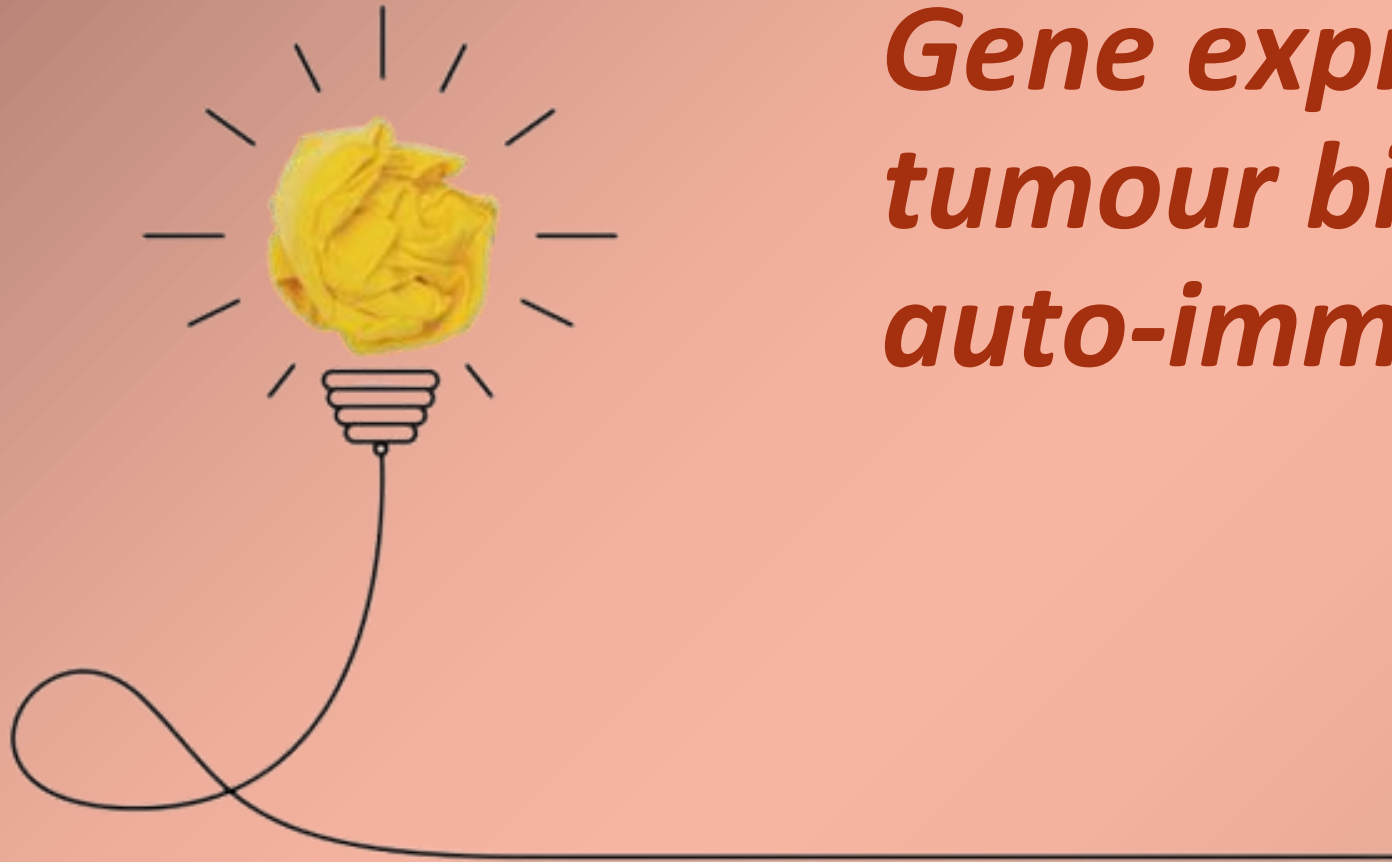




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# *Gene expression control in tumour biology and heart auto-immunity*



**Teacher:** Prof. Valeria Poli - SSD: BIO/11

## Research lines

Gene expression control in tumour biology and heart auto-immunity, with a focus on the inflammatory axis IL6-STAT3

- Mechanisms of cross-talk between tumor cells and Cancer Associated Fibroblasts (CAFs) in breast cancer.
- Identification and functional validation of regulatory networks and novel therapeutic targets in breast cancer.
- Non-canonical roles of STAT3 in the endoplasmic reticulum to regulate apoptosis resistance in breast cancer.
- Disentangling the relationships with tumor microenvironment in prostate cancer to better model and target tumor progression via the analysis of CAFs and tumor cells/organoids derived from high risk patient samples.
- Validation and improvement of cancer neoantigen vaccines efficacy.
- Role of STAT3 and complement in heart auto-immunity, exploring innovative therapeutic options for auto-immune myocarditis



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# *Hallmarks of Aging: molecular basis of ageing- associated syndromes*



**Teacher:** Prof. Andrea Graziani - SSD: BIO/11

## Research lines

### Cell signaling in cancer-induced immune escape and cachexia

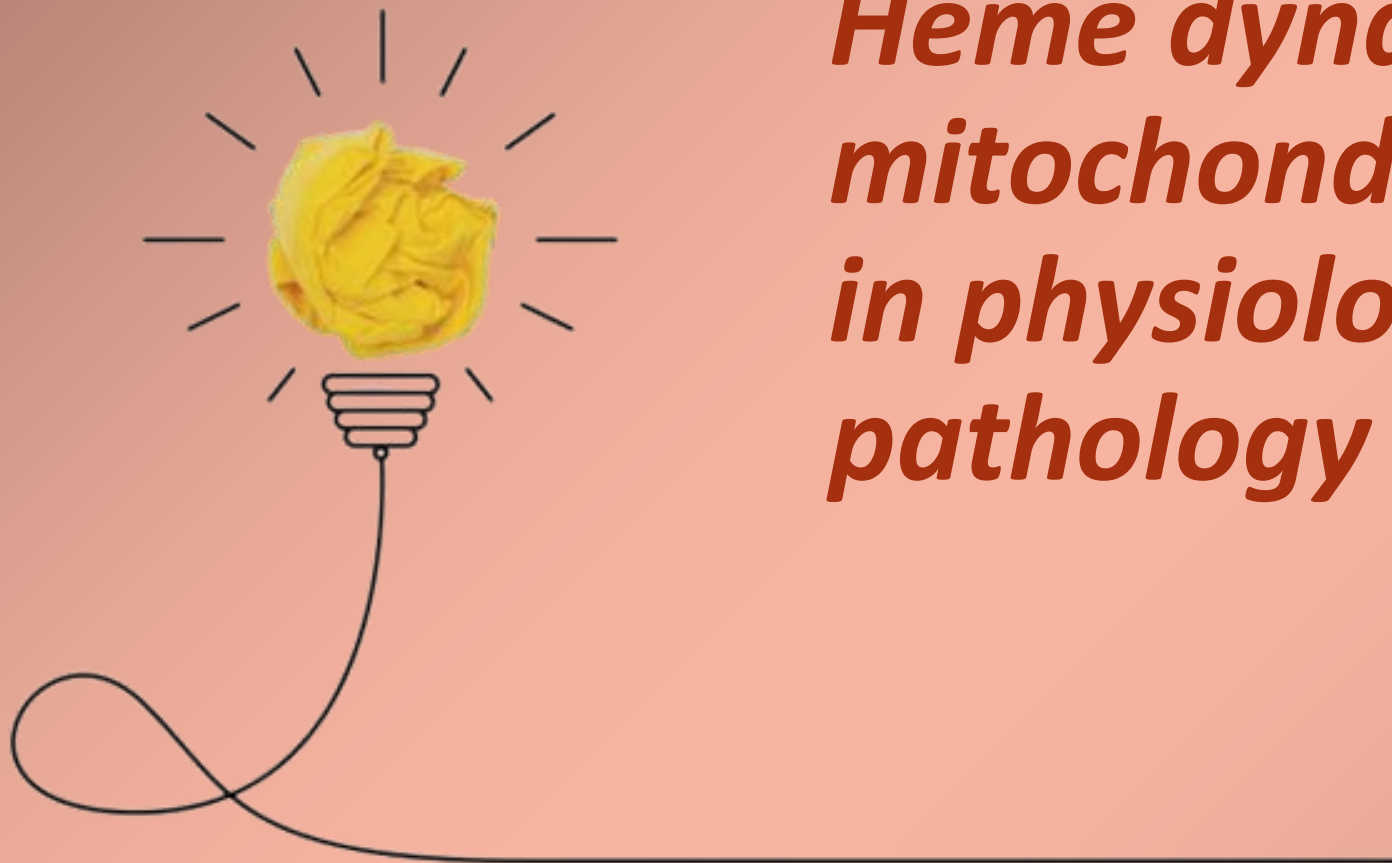
- Mechanisms of tumor-induced immune escape and immuno-aging:
  - Role of Diacylglycerol kinase alpha and SAP/SH2D1A in TCR and CAR-T ubiquitination and trafficking at the cell surface.
  - Role of Diacylglycerol kinase alpha in regulating microtubules dynamics and energetic metabolism in antigen-activated T cells
- Mechanisms of tumor-induced cachexia:
  - Role of tumor-induced factors in the deregulation of nerve-muscle interactions and the onset of resistance of skeletal muscle to beta-adrenergic signaling.
  - Role of tumor cells senescence in driving cachexia and mRNA splicing deregulation



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# *Heme dynamics and mitochondrial metabolism in physiology and pathology*



**Teachers:** Prof. Emanuela Tolosano

**Collaborators:** Dr. Veronica Fiorito (Senior Post-doc); Dr. Sara Petrillo (Senior Post-doc); Dr. Anna Lucia Allocco (PhD student); Dr. Francesco De Giorgio (PhD student)

## **Research lines**

Heme is the prosthetic group of key enzymes/proteins involved in several functions including oxygen transport and storage, cytochrome activity and mitochondrial metabolism. The major aim of our work is to understand how heme homeostasis (with a focus on heme synthesis and heme trafficking) affect cellular energetic metabolism in both physiologic and pathologic processes. Main research projects are:

- Heme dynamics in tumor initiation and progression
- Heme dynamics in muscle function
- Heme dynamics in hepatic response to dangerous stimuli





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# *Heart Engineering & Developmental Genomics et al (HEDGe lab)*



**Teacher:** Alessandro Bertero, PhD (PI) - SSD BIO/13

**Collaborators:** Dr. Elisa Balmas, PhD (postdoc); Dr. Federica Sozza, MSci (PhD student); Dr. Sveva Bottini, Msci (PhD student); Dr. Elisa Hahn, MSci (Visiting Scient.); Dr. Giulia Savorè, BSci (MSci Student); Dr. Martina Terenzi (BSci Student); Dr. Michelle Guichardaz (BSci Student)

## Research lines

### Chromatin Biology

- The TTN locus as a gene model to study the relationship between chromatin structure and function
- The functional role of inter-chromosomal chromatin interactions

### Heart Development & Disease

- Congenital heart disease due to impairment of chromatin organization dynamics in the developing myocardium
- Mechanisms behind the cardioprotective pathway downstream of Melusin

### Technology Development

- Phenotype-agnostic functional screens with barcoded shRNA and CRISPR perturbations deconvoluted by single cell genomics

### Cellular agriculture

- Self-sustaining and cheap to differentiate stem cells for cultivated seafood and meat



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# *Intellectual Disability and the model in pluripotent stem cells*

*Investigating Intellectual Disability in vitro, with  
models linked to altered control of cytoskeleton.*



**Teachers:** Prof. Giorgio R Merlo; Dott. Carla Liaci; Prof. Luciano Conti (Trent University, Molecular and Systems Cell Biology)

## Research lines

The control of cytoskeleton is KEY for cellular processes such as migration, axonogenesis, synaptogenesis and plasticity of neurons during development. Some forms of Intellectual Disability are due to mutations that alter this delicate control via GTPases. We have introduced two mutations in pluripotent stem cells, in order to study the early steps in development and clarify the cellular mechanism at the basis of these pathologies.

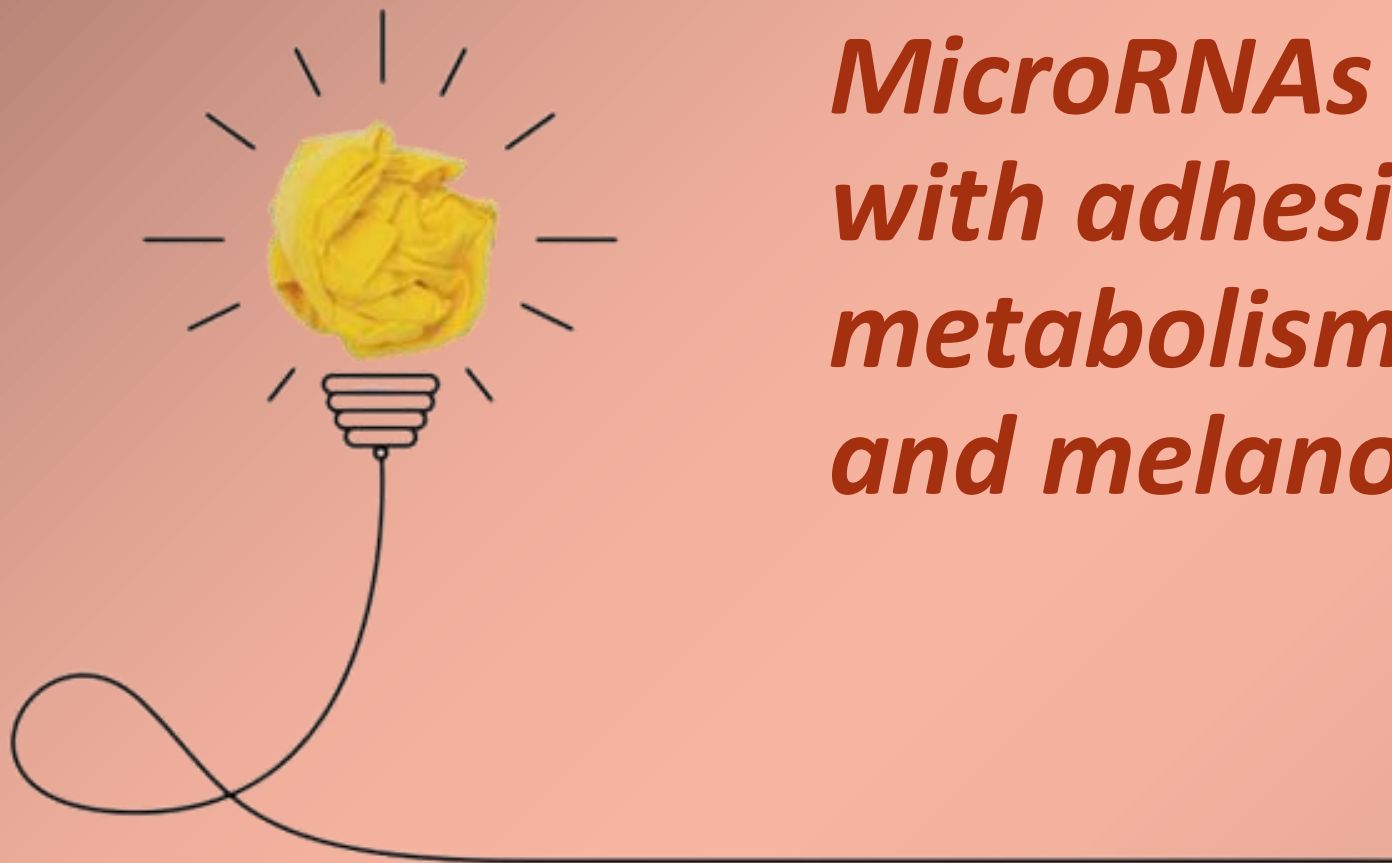
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# ***MicroRNAs and their link with adhesion and metabolism in breast cancer and melanoma progression***





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**Teacher:** Prof. Daniela Taverna

**Collaborators:** Dr. Francesca Orso; Dr. Lorena Quirico; Dr. Martina Coco

## **Research lines**

- Identification and characterization of microRNAs (miRNAs) involved in tumor breast cancer and melanoma progression and their involvement in adhesion and metabolism.
- miRNAs as therapeutic targets: preparation and evaluation of oligonucleotide-based tools that can be administered in vivo for pre-clinical studies such as stabilized anti/pre-miRNAs and aptamers conjugated with anti/pre-miRNAs.

<https://www.mbc.unito.it/en/research/research-areas/basic-and-applied-research/micrnas-and-adhesion-molecules-involved-tumor>





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# *Physiopathology of Heme in the Nervous System*

*New insights from the study of heme metabolism*



**Teacher:** Prof. Deborah Chiabrando (RTDB)

**Collaborators:** Dr. Francesca Bertino (PhD student); Dr. Elisa Quarta (PhD student)

## Research lines

Heme is a crucial molecule regulating different biological processes, ranging from oxygen sensing to the regulation of cell metabolism and signaling pathways. Our major research interests include:

- 1) Heme trafficking during the development of the nervous system
- 2) Identification of the molecular mechanisms underlying human neurodegenerative diseases due to mutations in the heme exporter FLVCR1
- 3) Dissecting the mechanisms of mitochondrial heme export/dynamics
- 4) Heme trafficking in brain pediatric tumors



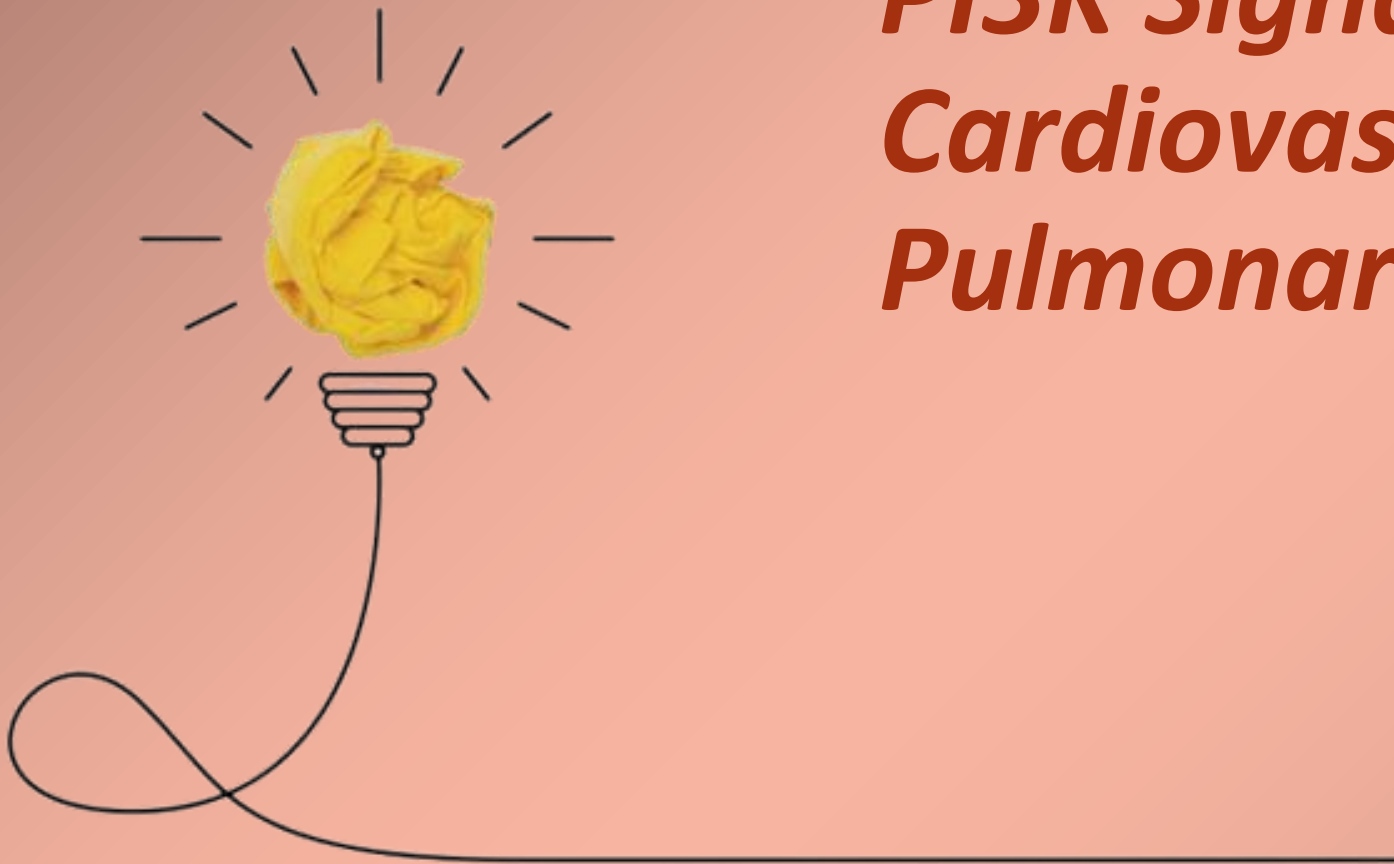
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# *PI3K Signaling in Cardiovascular and Pulmonary Disease*





Teacher: Prof. Alessandra Ghigo - SSD: BIO/13

## Research lines

- Cardio-Oncology:
  - Study of the molecular mechanisms underlying the cardiotoxicity of anti-cancer treatments (e.g., radiotherapy and chemotherapy).
  - Identification of pharmacological targets for the prevention and the treatment of anti-cancer therapy-related cardiotoxicity, with a major focus on PI3K.
- Obstructive and Restrictive Airway Diseases:
  - Study of the molecular mechanisms underlying obstructive (Cystic Fibrosis, Chronic Obstructive Pulmonary Disease, Bronchiectasis) and restrictive (Idiopathic Pulmonary Fibrosis) airway diseases.
  - Validation of new therapeutic targets for the treatment of obstructive and restrictive airway diseases, with a major focus on PI3K.



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# *Protein-protein interactions and human cancer signalling*



*The p140Cap protein's role in breast cancer  
and neuroblastoma*



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**Teacher:** Prof. Paola Defilippi PO Applied Biology

**Collaborators:** Dr. Vincenzo Salemme (Post Doc); Dr. Giorgia Centonze (PhD); Dr. Dora Natalini (PhD)

## **Research lines**

The group identified and characterized at genetic and functional level adaptor proteins that build molecular platforms downstream the signals generated by integrins and / or tyrosine-kinase receptors. Among these, the p130Cas and p140Cap scaffold proteins have been extensively studied in cellular and animal models, providing evidence of their role in controlling the molecular signaling leading to cytoskeletal organization, cell motility and invasion, key mechanisms for cellular cancer progression.

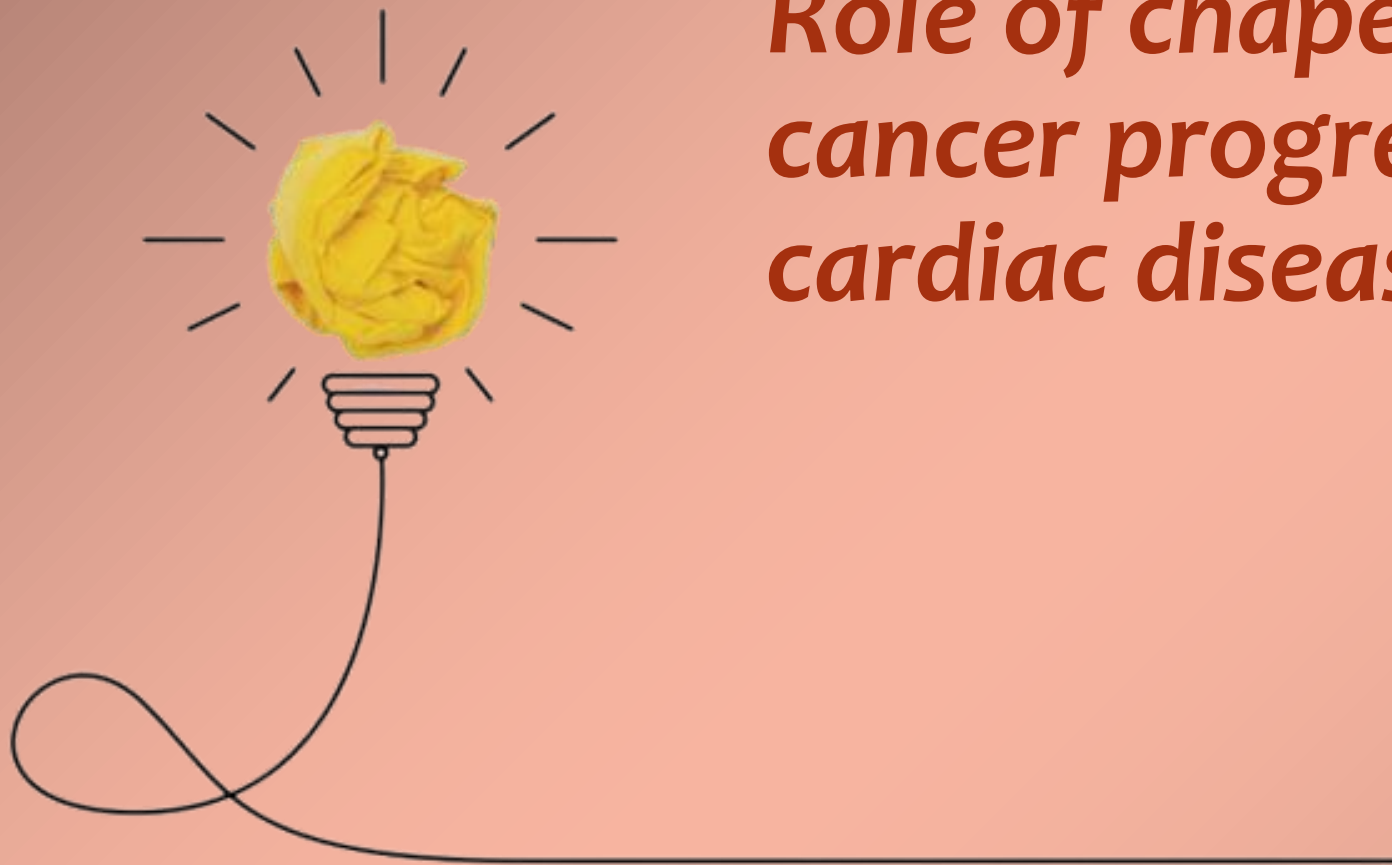




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# *Role of chaperone proteins in cancer progression and in cardiac diseases*



Teacher: Prof. Mara Brancaccio - *SSD: BIO/13*

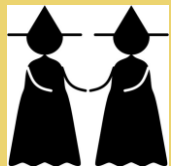
### The role of chaperone proteins in cancer progression and in cardiac diseases

#### **CANCER:**

- Chaperone role in cancer
- Extracellular chaperones and tumour microenvironment

#### **HEART AND MUSCLES:**

- Chaperone role in cardiac metabolism and signaling
- Chaperones as player in muscular atrophy



#### **GREEN:**

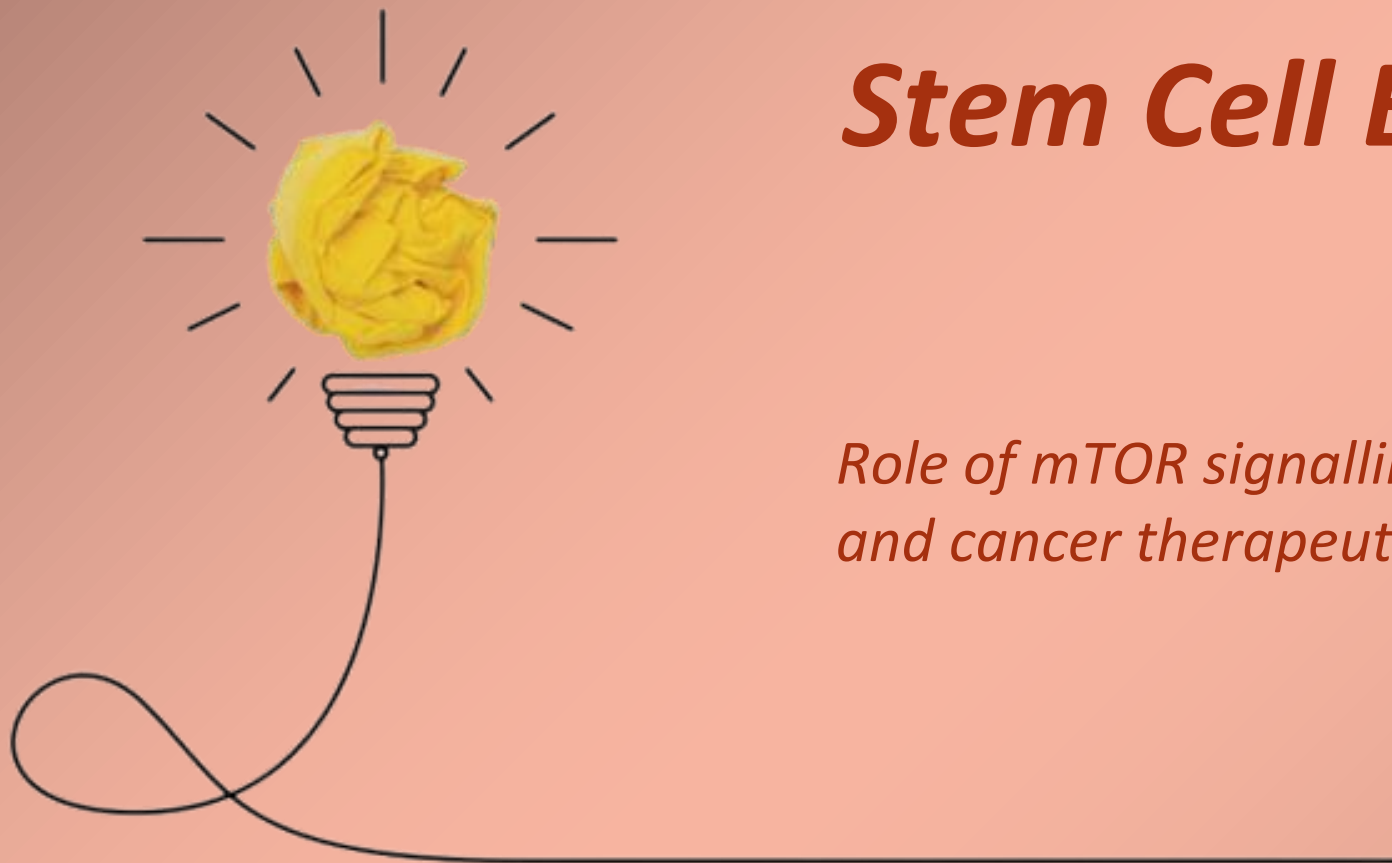
- Heat shock proteins as biomarkers of climate change in Alpine ecosystems



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# *Stem Cell Biology*

*Role of mTOR signalling pathway in epithelial stem cells  
and cancer therapeutic responses*



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Teacher: Prof. Enzo Calautti - SSD: BIO/13

## Research lines

- Role of mTOR signaling in epidermal stem cells
- Role of mTORC2 signaling in melanoma therapeutic resistance
- Role of mTORC2 signaling in breast cancer stem cells



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## *Targeting metabolic symbiosis in cancer*



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Teacher: Prof. Paolo Ettore Porporato

Collaborators: Dr. Alessio Menga

## Research lines

We will address the role of iron metabolism in fueling tumor growth and body wasting in lung cancer, with a particular focus on the alteration of mitochondrial metabolism and tumor aggressiveness

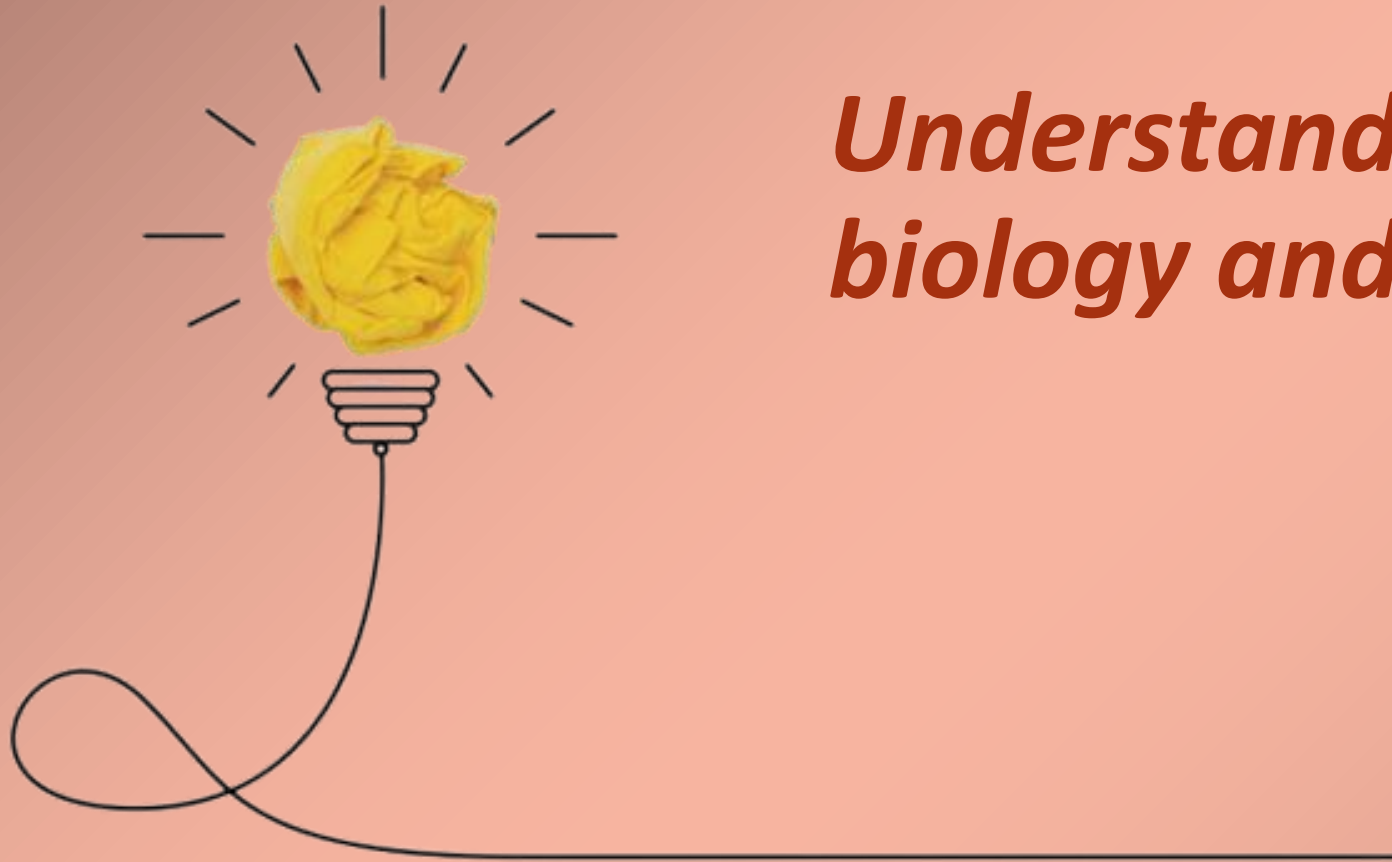




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# *Understanding Kras-driven biology and tumorigenesis*



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Teacher: Prof. Chiara Ambrogio

## Research lines

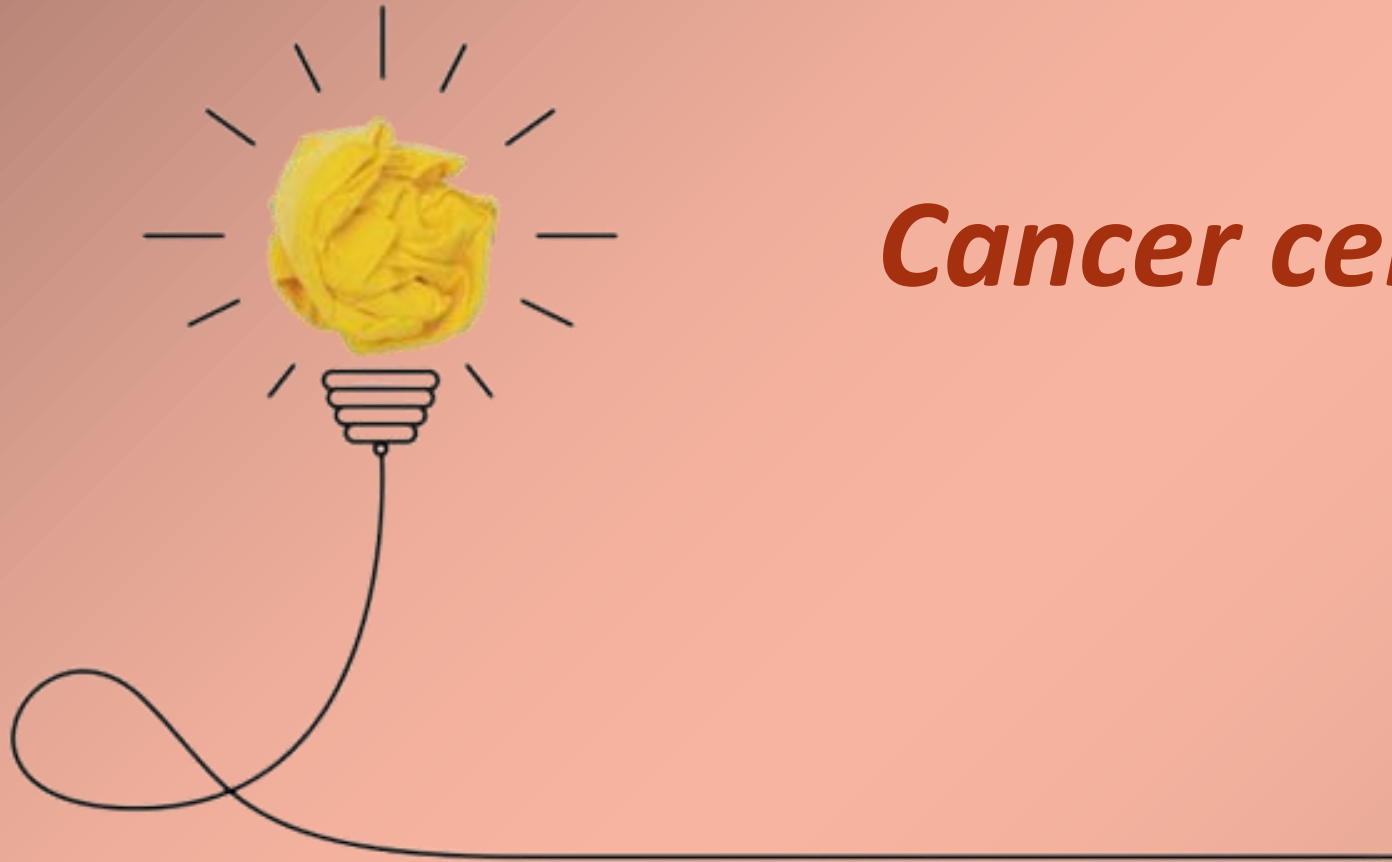
- Characterizing in vitro and in vivo the KRAS signalosome
- RAF kinases localization at the membrane: a key feature to sustain oncogenic mapk activity?
- Drug screening and mechanisms of resistance



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# *Cancer cell signaling*



**Teacher:** Prof. Miriam Martini, PhD (Responsabile Scientifico) - SSD BIO/13

**Collaborators:** Dr.ssa Maria Chiara De Santis, PhD (postdoc); Dr. Andrea Costamagna (postdoc); Damiano Abbo, Msci (PhD student), Noemi Ghiglione, Msci (PhD student); Anastasia Bushunova, MD (PhD student), Martina Sicuro, BSci (undergraduate).

## Research lines

### Pancreatic cancer biology

- Characterization of glutamine sensing mechanisms and therapeutic perspectives
- Study of molecular mechanisms regulating mTOR signaling pathways
- Identification of cell of origin of pancreatic ductal adenocarcinoma (PDAC)



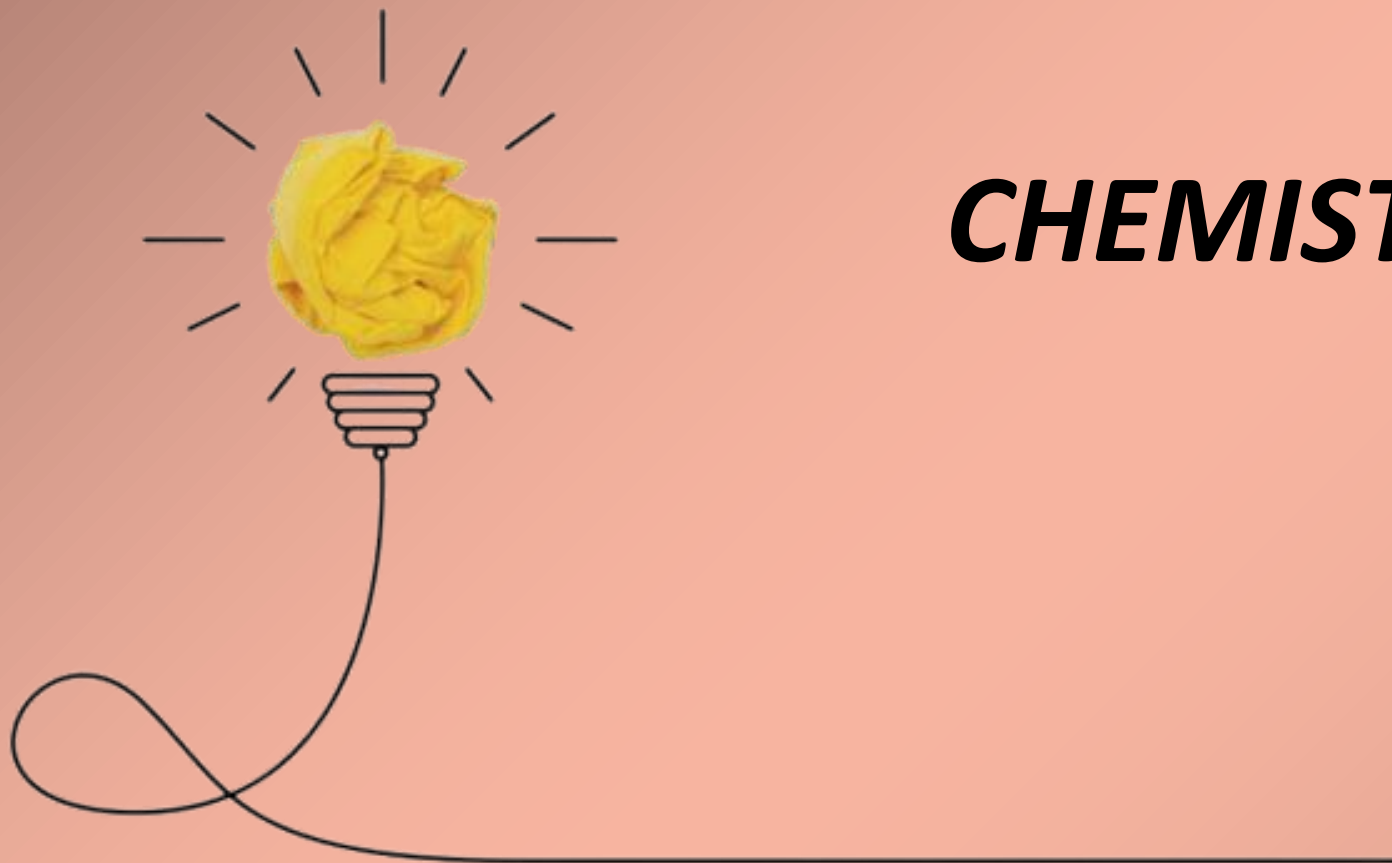
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# ***CHEMISTRY SECTION***





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# *Design of PROTACs*

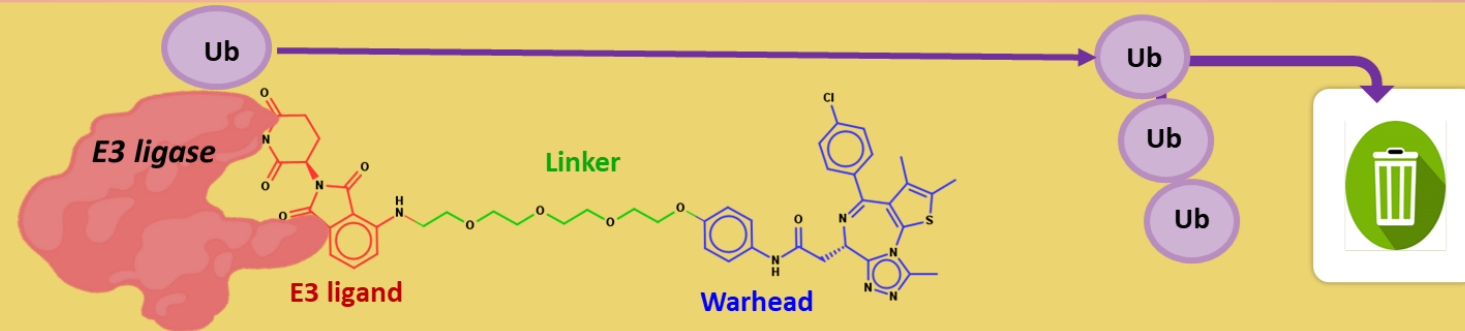




**Teachers:** Prof. Giulia Caron; Prof. Giuseppe Ermondi

**Collaborators:** Dr. Matteo Rossi Sebastiano; Dr. Diego Garcia Jimenez; Dr. Giulia Apprato

## Research lines



## Design of PROTACs

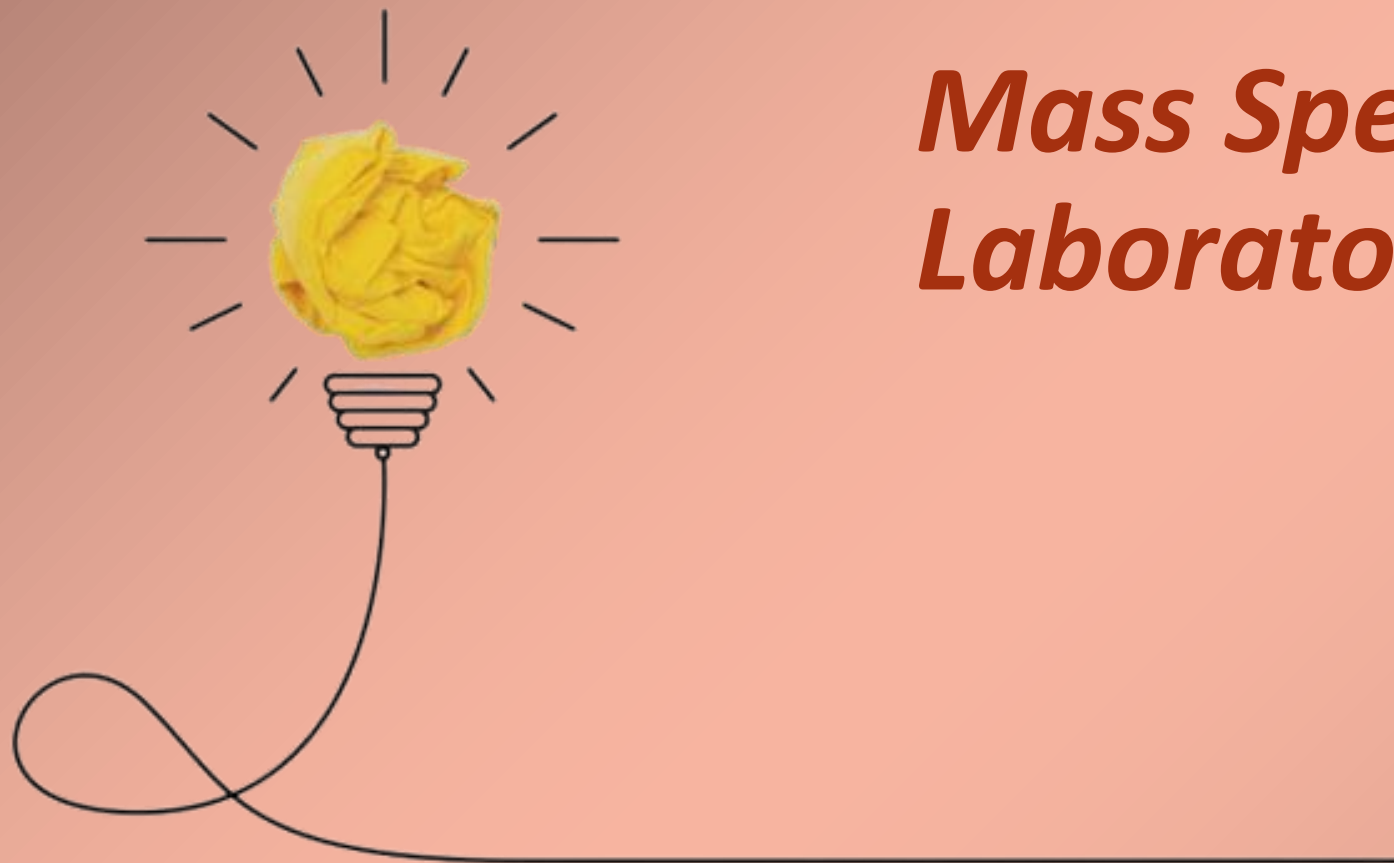
- Development and application of experimental and computational strategies for optimizing PROTACs in terms of "drug-like" properties
- De novo design of PROTACs directed against validated oncology targets



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# *Mass Spectrometry Laboratory*



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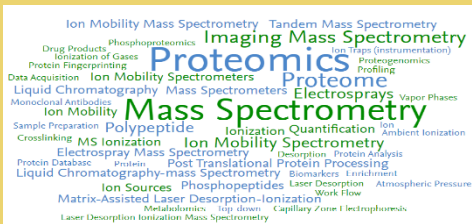
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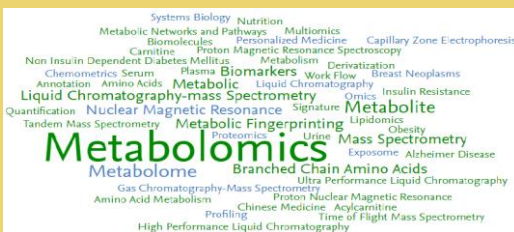


**Teachers:** Prof. Claudio Medana; Prof. Federica Dal Bello

## Research lines



**Peptides quantification:** Endogenous peptide identification and quantification in biological matrices; **Allergens:** Protein allergens analysis in Novel food; **Protein/peptides Biomarker research** by SPE/digestion/SDS page/top down/bottom up approaches and nanoHPLC-HRMS



**Bioactive compounds analysis:** identification and quantification of small molecules in vegetable matrices; **Biomarker discovery:** research of new metabolites in biological pathways by SPE/LLE and HPLC-MS/MS (trip quad) with Chemometrics approaches



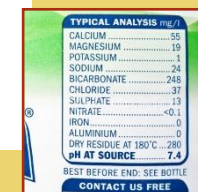


Teachers: Prof. Claudio Medana; Prof. Federica Dal Bello

## Research lines



**Volatile organic compounds:** Drinking water pollutants (Sample prep/Purg- & Trap extraction); Quantitative analysis by **GC-MS** (EPA8260); **Heavy metals:** Drinking water pollutants (quantitative analysis by **ICP-MS**); **Inorganic ions:** Drinking water micro components; Quantitative analysis by **IC-conductivity**;  
**Toxins:** Freshwater toxins by **LC-MS/MS** (triple quad)



TYPICAL ANALYSIS (mg/L)	
CALCIUM	55
MAGNESIUM	19
POTASSIUM	1
SODIUM	24
BICARBONATE	248
CHLORIDE	37
SULPHATE	13
NITRATE	<0.1
IRON	0
ALUMINIUM	0
DRY RESIDUE AT 180°C	280
<b>pH AT SOURCE</b>	<b>7.4</b>

BEST BEFORE END: SEE BOTTLE  
CONTACT US FREE





Thesis tutor:

**Prof. Claudio Medana**  
**Prof. Federica Dal Bello**  
**Dr. Riccardo Aigotti**

PhD Students

**Alberto Asteggiano**  
**Enrica Mecarelli**  
**Sandra Vietti Michelina**  
**Sandra Zeaiter**

Undergraduate students

**Alessandra Bui**  
**Anabel Marani**  
**Marta Librizzi**  
**Valentina Schiavo**

and  
**YO**  
**U**



## *In Our Lab*

- **GC-MS** (gas chromatography - ion trap mass spectrometry, EI, CI sources)
- **HPLC-IT MS** (liquid chromatography – MS, ion trap analyzer, ESI, APCI sources)
- **UPLC-TQ MS** (liquid chromatography – MS, triple quadrupole analyzer, ESI, APCI sources)
- **HPLC-OT MS** (nano liquid chromatography – HRMS, orbitrap analyzer, nESI, h-ESI sources)
- Sample preparation (Purge&trap/SPE/SPME)
- Elemental analysis (**ICP-MS**)
- Inorganic ion analysis (**IC**, ion chromatography)





## Collaborations

### *Main collaborations@UniTO*

Prof. Paola Calza, Dept. of  
Chemistry

Prof. Ivan Norscia, Dept of Life  
Sciences and Systems Biology

Prof. Manuela Aragno, Dept of  
Biological and Clinical Sciences

Various researchers, Dept  
Molecular Biotechnology

### *Other collaborations*

Istituto di Ricerche

Farmacologiche Mario Negri

IRCCS, Milano, Italy

Azienda Ospedaliero-Universitaria  
sede «Le Molinette»

IZS Piemonte, Liguria, Valle  
d'Aosta

Ospedale Maggiore di Novara,  
Nefrologia

### *International collaborations*

Paolo Giacobini PhD, INSERM, Lille

Prof. Elisabetta Boeri Erba, IBS,  
Grenoble

Prof. M.J. Lopez Munoz, RJC  
University, Madrid, E

Prof. B. Kuch, University Stuttgart,  
D

Prof. K.W. Schramm, Helmholtz  
Inst., Munich, D

### *International academic agreements*

Prof. Silvia Balbo, School of Public  
Health, University of Minnesota,  
USA





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# *Mathematics in the field of Biotechnology*

*DELTA Research Group*

*Digital Education for Learning and Teaching Advances*



**Digital  
Education for  
Learning and  
Teaching  
Advances  
RESEARCH GROUP**





**Teacher:** Prof. Marina Marchisio

**Collaborators:** Dott.ssa Alice Barana; Dott.ssa Giulia Boetti; Dott.ssa Francesca Casasso; Prof. Alberto Conte; Dott.ssa Cecilia Fissore; Dott. Francesco Floris; Dott.ssa Valeria Fradiante; Dott.ssa Marta Pulvirenti; Ing. Sergio Rabellino; Dott. Fabio Roman; Dott. Matteo Sacchet; Dott.ssa Daniela Salusso

## **Research lines**

- Integrated Digital Learning Environments and Learning Analytics in Open Educational Practices
- Adaptive, inclusive and data driven digital methodologies for learning and teaching scientific disciplines
- Computational Mathematical Models for Biotechnologies
- Biostatistical Methods applied in Biotechnology and Medicine

Number of students who can be accepted: 2



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# *Mechanisms of permeation of molecules through mucus barriers*

- *Synthesis and applications of bio-inspired hydrogels*
- *Mucus and pathogens*
- *Permeability*



**Teacher:** Prof. Sonja Visentin

**Collaborators:** Dr. Cosmin Stefan Butnarusu; Dr. Olga Valentina Garbero

## **Research lines**

The focus of our laboratory is on basic mechanisms by which mucus barriers exclude, or allow passage of different drugs and pathogens (bacteria, viruses). It hopes to provide the foundation for a theoretical framework that captures general principles governing selectivity in mucus, and bacterial biofilms. In collaboration with the Politecnico of Milano the Lab's works on synthetic gels that mimic the basic selective properties of biological gels like mucus.

Collaborations: Politecnico Milano, Università di Pavia, Bac3Gel (Lisbon), KTH (Stockholm)





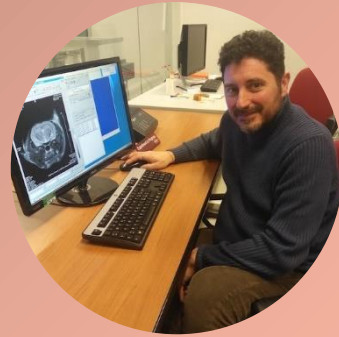
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## *Molecular Imaging group Development of innovative diagnostic tools*

- *Imaging & therapy*
- *Imaging Contrast Agents*
- *Imaging metabolism*
- *Image analysis*





**Teacher:** Prof. Enzo Terreno

**Coworkers:** Dr. Francesca Garello; Dr. Martina Capozza; Dr. Gianluca Destro

## **Research lines**

- Development of an MRI-guided theranostic protocol to boost, by acoustic stimulation, the anticancer drug release from liposomes in preclinical tumor models.
- Synthesis of targeted near infra-red (NIR) fluorescent probes for image-guided surgery and photodynamic therapy to improve cancer treatment.
- Synthesis, development and validation of nuclear probes for PET/CT and SPECT/CT for tumor diagnosis and theranostics.
- Preparation of innovative nanosystems for  $^{19}\text{F}$  Magnetic Resonance Imaging (MRI).
- Development of new chemical reactions for radiolabelling with carbon, fluorine and iodine



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**Teacher:** Prof. Simonetta Geninatti Crich

**Coworkers:** Dr. Simona Baroni; Dr. Diego Alberti; Dr. Valeria Bitonto; Dr. Sabrina Elkhanoufi; Dr. Sahar Rakhshan;  
Dr. Sebastiano Micocci

## Research lines

- Design and validation of novel therapeutic agents based on Boron Neutron Capture Therapy for treating Alzheimer Disease and Pleural Mesothelioma.
- Development of new radical-based probes to monitor enzymatic activity associated with inflammation and tumorigenesis
- Innovative MRI-based diagnostic techniques for determining tumor margins and aggressiveness in conservative surgery in breast and prostate cancer.



Teacher: Prof. Eliana Gianolio

Coworkers: Dr. Enza Di Gregorio; Dr. Lorenzo Palagi; Dr. Serena Rizzuti, Dr. Ferdeze Hasallari

## Research lines

### **Paramagnetic Imaging Contrast agents:**

The study of paramagnetic metal (**Gd, Fe, Mn**) complexes starts from the synthesis of differently functionalized metal-based probes and continues to their relaxometric characterization for the in depth elucidation of the relationships between structure and dynamics of paramagnetic metal complexes and the determinants of their proton relaxation enhancement. Moreover, all the new probes are tested for their specific function in vitro (at the cellular level) and/or in vivo (in specific animal models) as **Magnetic Resonance Imaging Contrast Agents**.

### Specific research lines include the study of:

**Small-molecular weight metal complexes:** Unspecific hydrophilic chemicals to visualize tumor perfusion or abnormalities in organ function or as responsive agents to tissue microenvironment parameters. A specific focus on the in vivo Gd-retention issue is also pointed out.

**Blood-pool agents:** metal-complexes functionalized with hydrophobic moieties which enable the binding to human serum albumin in order to increase relaxivity and the retention time in blood vessels. These complexes find application also in quantitative assessments of tumor angiogenesis by exploiting DCE-MRI (Dynamic Contrast Enhanced-MRI) approaches.

**Macromolecular agents:** metal-complexes are incorporated in high molecular weight systems either as part of supramolecular assemblies (liposomes, micelles, different nanoparticles) and as multimers of metal-complexes (dimers, tetramers, dendrimers).



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Teacher: Prof. Daniela Delli Castelli

### Research lines

- Development of nano-based imaging probes for early diagnosis and treatment of tumor in preclinical cancer murine models
- Innovative CEST probes based on  $^{31}\text{P}$  detection
- Development of ligand/anti-ligand *in vitro* assays



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Teacher: Prof. Francesca Reineri

Coworkers: Dr. Ginevra Di Matteo

## Research lines

### **Imaging metabolism:**

all the diseases are associated with altered metabolic processes (e.g. the Warburg effect in cancer). We develop new imaging tools that allow to detect metabolism in vivo.

Hyperpolarized contrast agents for MRI:

MRI is a powerful diagnostic tool, but it suffers from low sensitivity. Hyperpolarization allows to increase the MR signals of some metabolites, so that we can observe metabolic processes in vivo, using magnetic resonance.





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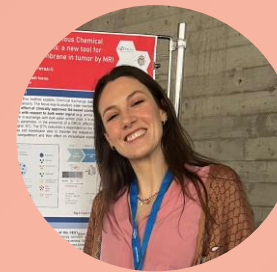


Teacher: Dr. Walter Dastrù

### Research lines

- Dynamic Contrast Enhanced Magnetic Resonance Imaging
- Development of software for the analysis of MR images





**Teacher:** Prof. Giuseppe Ferrauto - Dr. Enza Di Gregorio S.S.D. Chim/03 - Chimica generale e inorganica

**Coworkers:** Dr. Alessandro Amaolo, Dr. Chiara Papi, Dr. Chiara Romiti, Dr. Angelo Scarciglia.

**Lab Address:** MBC «Guido Tarone» Via Nizza, 52 - 10126 Torino

## Research lines

- Design and development of innovative and “smart” nanosystems for:
  - *in vivo* diagnosis (imaging) and targeted therapy
  - *in vitro* assays for quantification of bioanalytes
  - detection and decontamination from chemical and biological weapons of mass destruction (CBNRe).
- *In vivo* imaging of oncological, neurological (multiple sclerosis) and infectious diseases in preclinical murine models by Magnetic Resonance Imaging (MRI), Optical Imaging (OI) and Photoacoustic Imaging (PAI):
  - analysis of tumor microenvironment (pH, vascularization, hypoxia...)
  - quantification of water exchange across cells' membranes
  - design of innovative metal-based imaging contrast agents
- Design of new strategies for reducing environmental impact of Gd-based MRI contrast agents.



**Teacher:** Prof. Angelo Bifone

**Collaborator:** Dr. Eleonora Cavallari

### Research lines

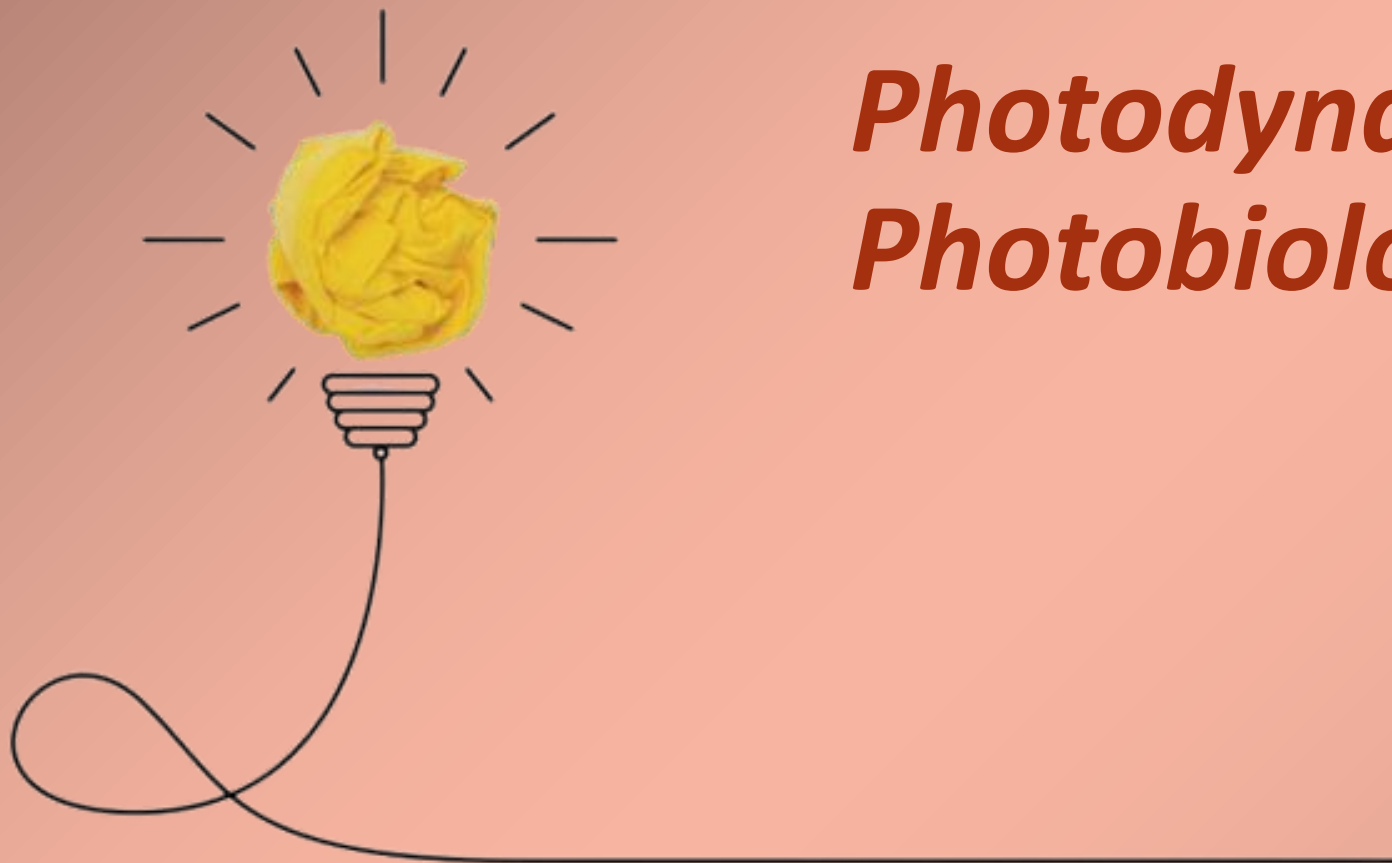
- Neuroimaging: morphological, functional, and tractographic imaging applied to neurodevelopmental models and central nervous system pathologies
- Metabolic and Molecular Imaging: development of methods and probes for studying hemodynamic and metabolic responses in the brain
- Optical Methods for Magnetic Resonance: development of new probes for imaging based on color centers in nanodiamonds for applications in spectroscopy and magnetic resonance imaging



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# *Photodynamic Therapy & Photobiology*



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**Teacher:** Prof. Sonja Visentin

**Collaborators:** Dr. Cosmin Stefan Butnarusu; Dr. Olga Valentina Garbero

## Research lines

1) Photodynamic Therapy (PDT) is an innovative and non-invasive therapeutic procedure for the treatment of superficial skin cancer and infectious diseases. The PDT is based on the photocatalytic generation of singlet oxygen by a laser irradiation of a dye, specifically delivered to the cancerogenic target cells.

In our lab we perform: NIR dyes photophysical characterization by UV-Vis, steady-state, time-resolved fluorescence and fluorescence anisotropy spectroscopies. The kinetics and thermodynamics dye-protein binding parameters are in detailed investigated by stopped-flow fluorometer.

2) We use dyes to perform cancer biomarker detection in physiological samples (e.g serum, urines) for liquid biopsy  
Collaborations: MOF Lab UniTO, DBIOS UniTO, Saragoza University



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# *Prediction of pathogenic mutations and design of therapeutic strategies*





**Teachers:** Prof. Giulia Caron; Prof. Giuseppe Ermondi

**Collaborator:** Dr. Matteo Rossi Sebastiano

## Research lines

### Rare diseases



- Use of computational methods to rationalise the pathogenicity of mutated proteins through the use of bioinformatics and molecular modelling software
- Virtual drug design strategies to identify molecules capable of restoring lost functionality

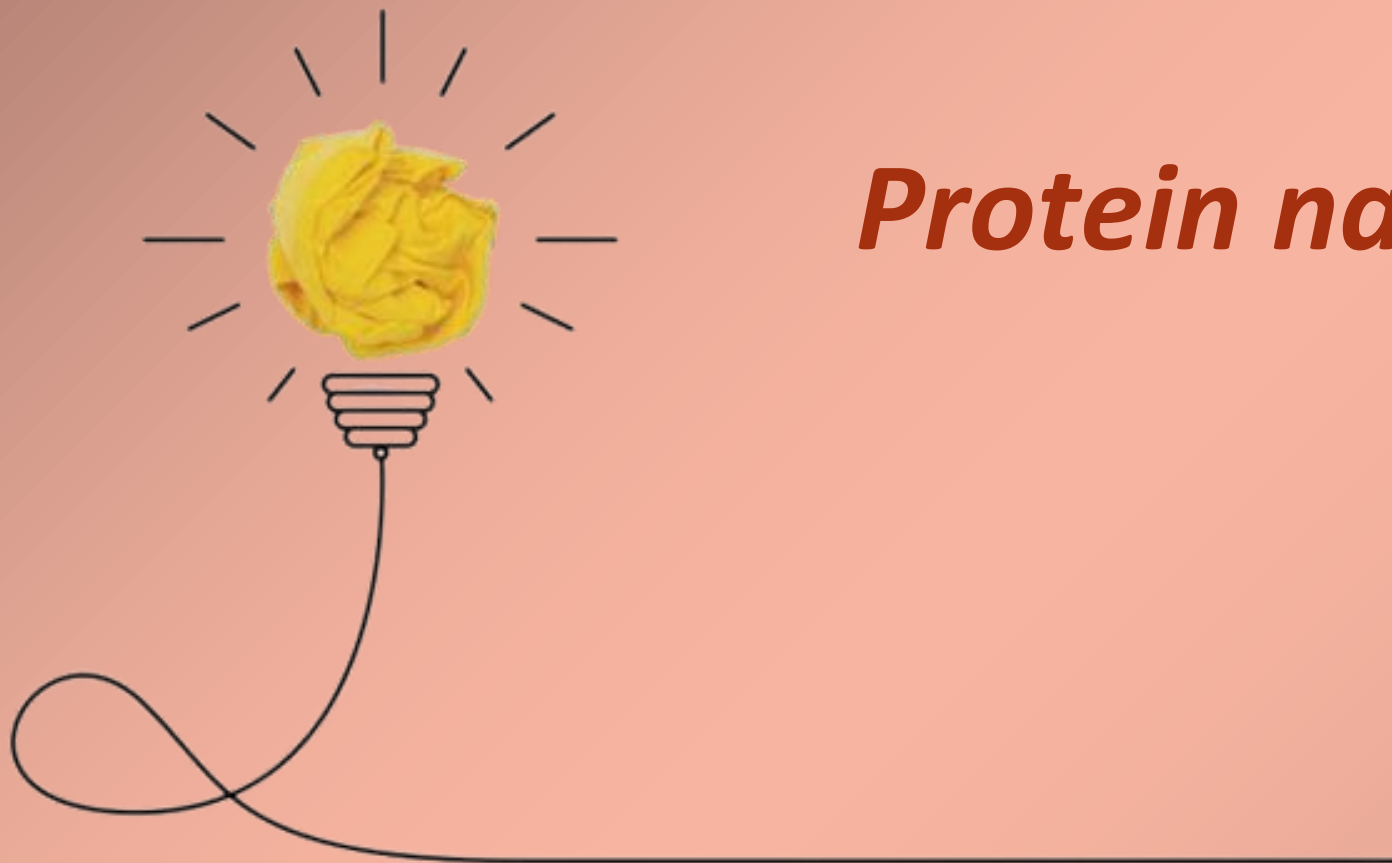




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# *Protein nanoparticles*



**Teacher:** Prof. Sonja Visenti

**Collaborator:** Dr. Cosmin Stefan Butnarusu

## Research lines

NanoMugs are multifunctional nanoparticles, intrinsically glycosylated, mucoadhesive and able to incorporate drugs.

The one pot synthesis method allows to obtain completely functional nanoparticles within approximately 12 hours (lab scale). In one single product NanoMugs enclose a triple effect:

- Persistence in the site of infection because mucoadhesive.
- Bacterial and viral engagement by glycan-mediated binding.
- Targeted drug delivery and release; molecules with different molecular weight, charge and chemistry can be efficiently loaded during the synthesis. Drugs can be released over time because not covalently bonded to NanoMugs.
- Collaborations: Politecnico Milano, Università di Pavia, KTH (Stockholm).



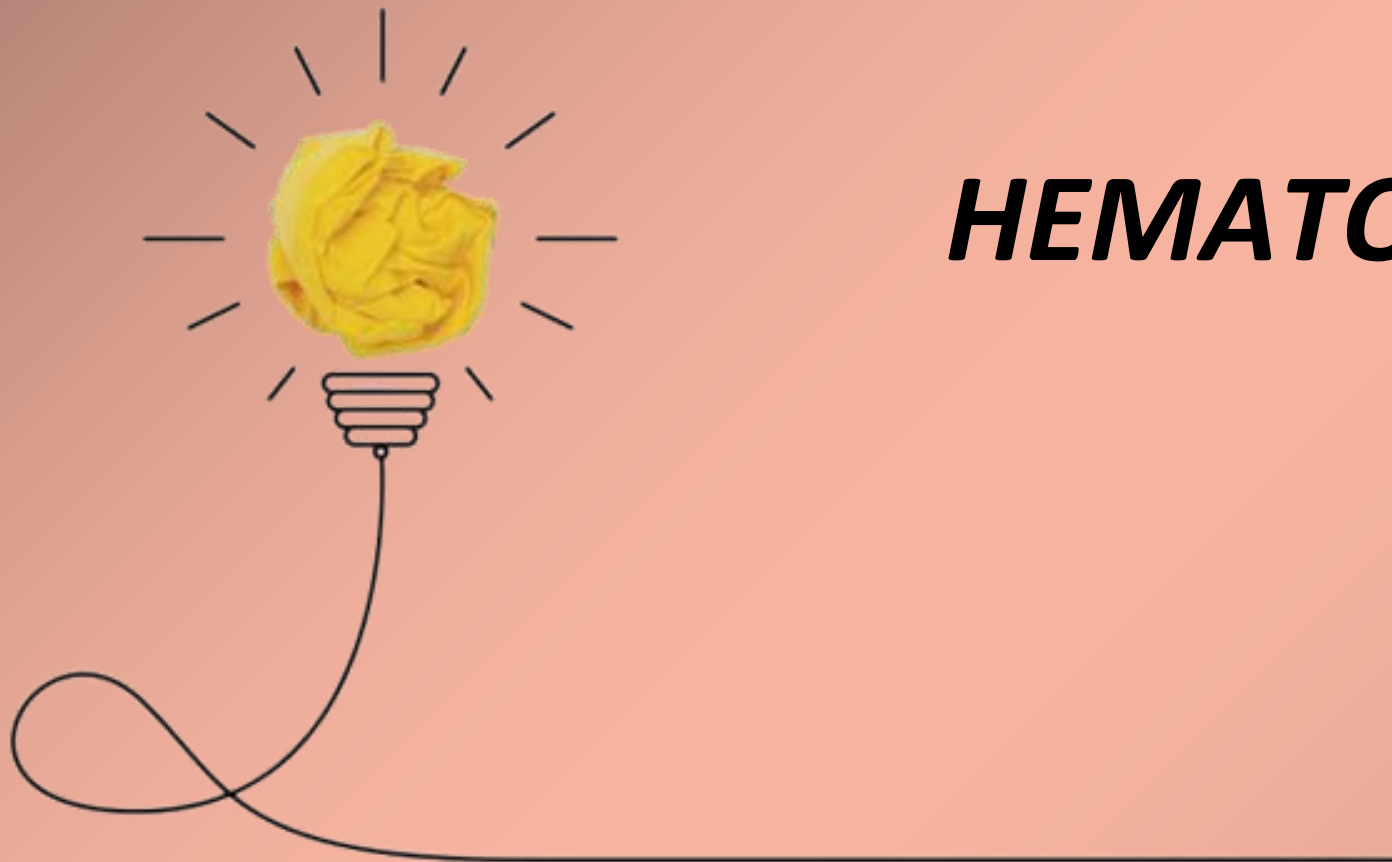
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# ***HEMATOLOGY SECTION***





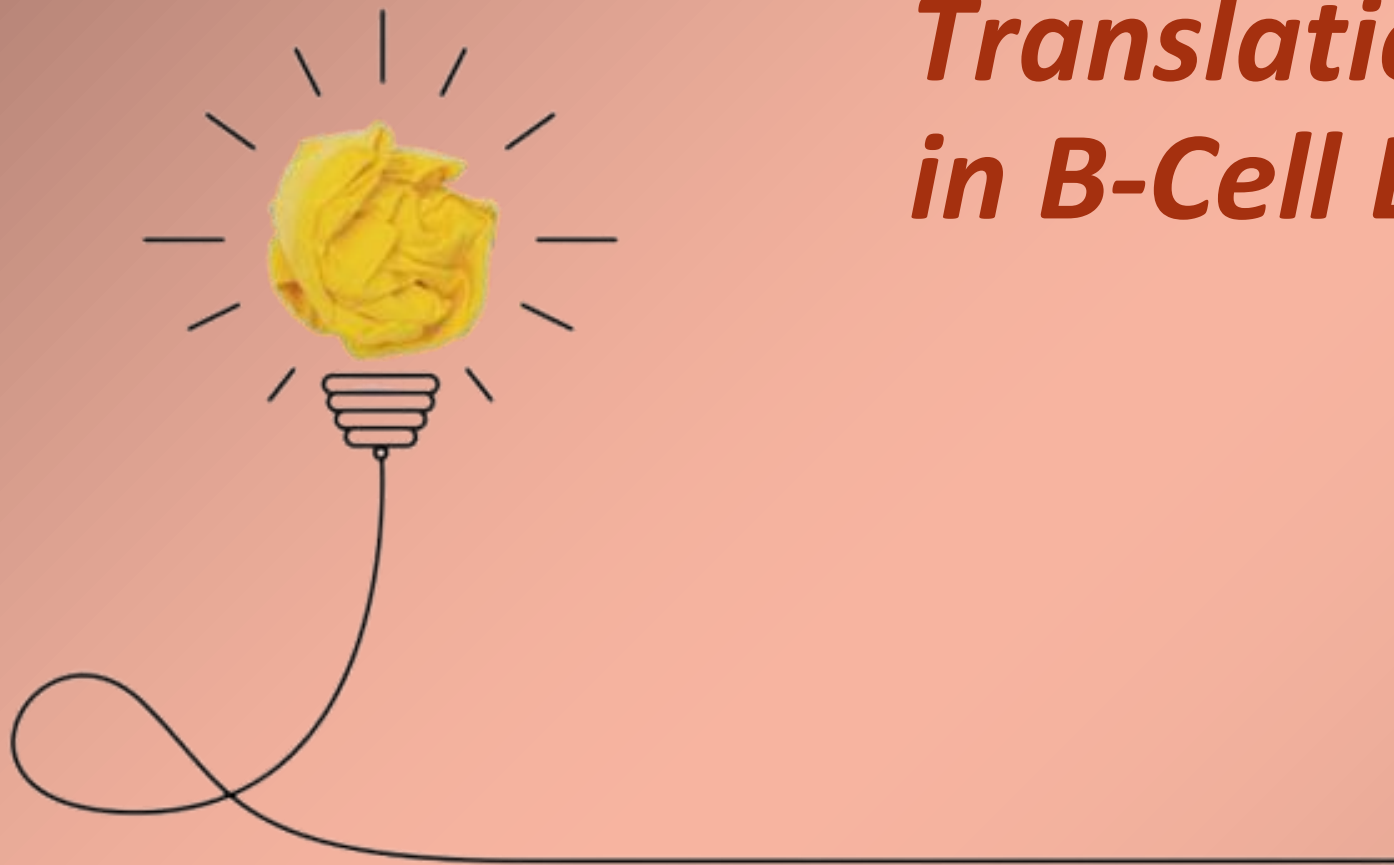
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# *Translational research in B-Cell Lymphomas*





**Teachers:** Dr. Simone Ferrero; Dr. Daniela Drandi; Dr. Elisa Genuardi

## Research lines

- Molecular biomarkers investigation in the context of mantle cell lymphoma, follicular lymphoma and Waldenström macroglobulinemia.
- Identification of baseline prognostic and predictive biomarkers.
- Minimal residual disease (MRD) monitoring.
- Non-invasive diagnostic tools (i.e. “liquid biopsy”)
- Main technologies employed are: quantitative-Real Time PCR, Droplet Digital PCR and Next Generation Sequencing to target both genomic rearrangements (*e.g. immunoglobulin VDJ, Bcl1/IGH, Bcl2/IGH*) and mutations (*e.g. MYD88, TP53, EZH2 and others*).

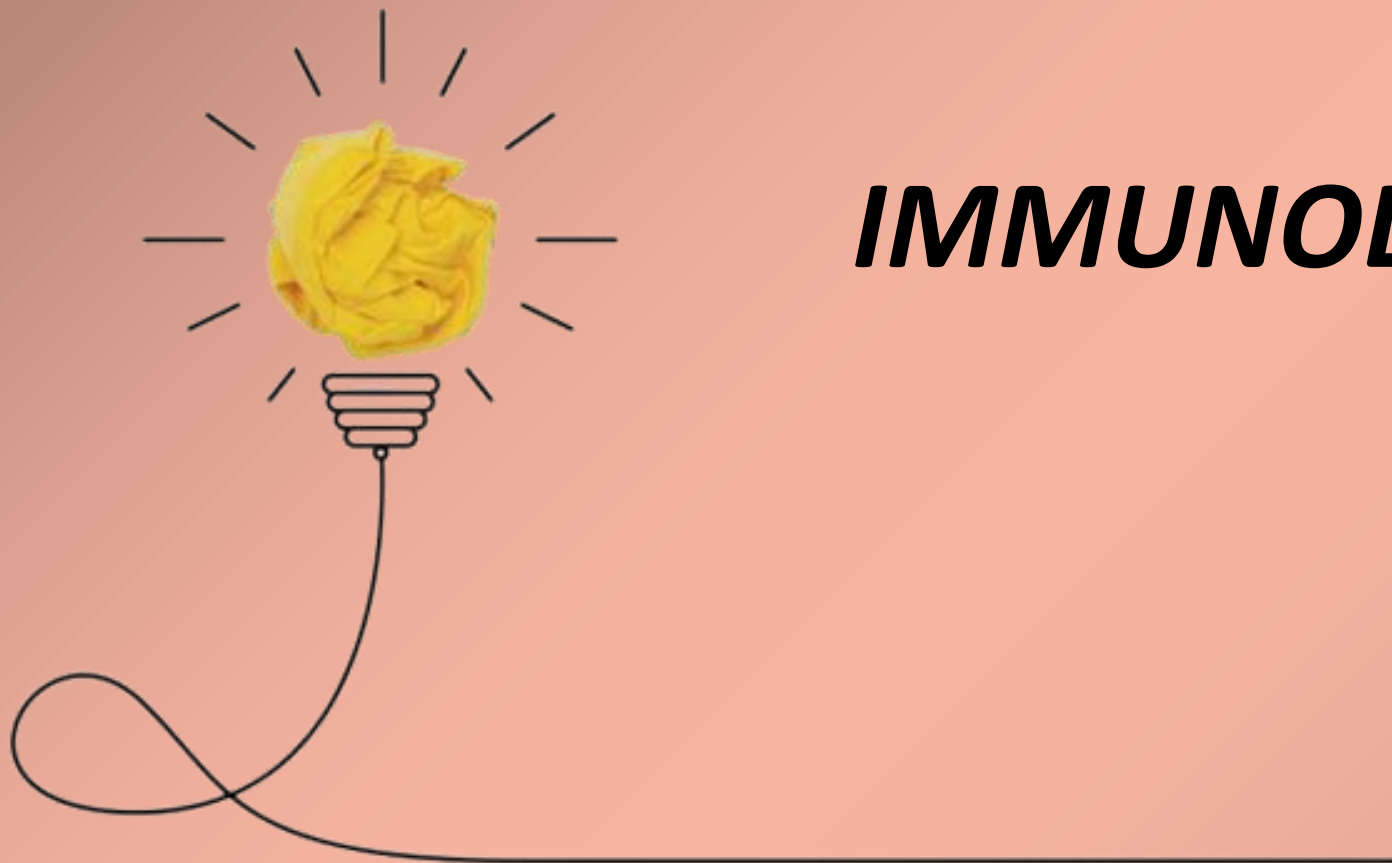
Number of students who can be accepted: variable 1-2 year. Possibility of compilative, experimental and clinical research thesis



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# ***IMMUNOLOGY SECTION***

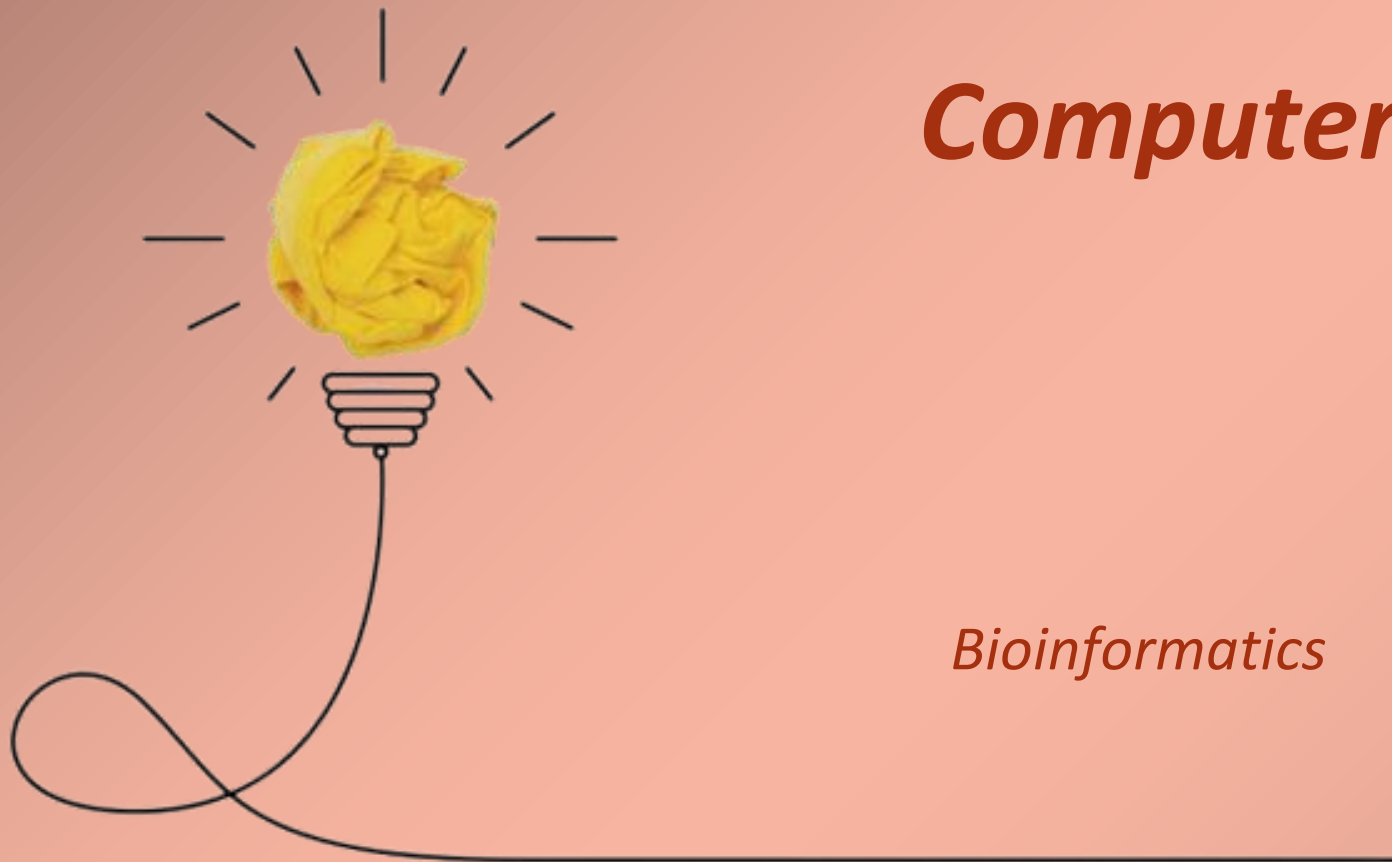




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# *Computer Science*

*Bioinformatics*



**Teacher:** Prof. Raffaele Adolfo Calogero - SSD: BIO/11

## **Research lines**

- Development and validation of bioinformatics tools for omics data analysis
- requirements:
  - Basic programming in R or Python.



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## ***Molecular and Translational Oncology Molecular Biotechnoly Center 2 (MBC2)***

*The lab mainly focuses on tumors driven by oncogenic alterations of the Anaplastic Lymphoma Kinase (ALK) gene, such as translocations and activation mutations in Anaplastic Large Cell Lymphoma (ALCL), Non-Small Cell Lung Cancers (NSCLC) and other type of solid tumors including neuroblastoma.*



**Teachers:** Prof. Roberto Chiarle; Prof. Claudia Voena

**Collaborators:** Drs. Giulia Mura, Maria Vittoria Di Marco, Mariapia Russo and Marta Rubin.

## Research lines

- Mechanisms of transformation in ALK-driven tumors to define new therapeutic vulnerabilities and to find innovative treatments
- Discovering and validating novel mechanisms of resistance to targeted therapy in ALK-driven tumors
- Role of microenvironment in response to ALK inhibition in ALK-driven tumors
- Dissecting the role of RHO GTPases in lymphomagenesis
- Pathological role of AID in lymphomas and leukemias

Number of students who can be accommodated: 1-2/year



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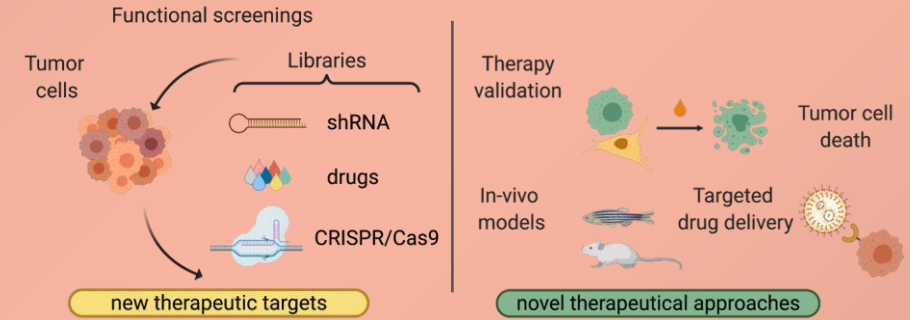
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# *Novel therapeutic approaches for hematological malignancies*



*Our aim is to identify and validate new therapeutic targets to enhance the efficacy of current pharmacological therapies.*



**Teacher:** Prof. Roberto Piva

## Research lines

- Functional screenings using shRNA, CRISPR/Cas9 and drug libraries to identify novel therapeutic targets.
- Validation of novel therapies in a panel of cell lines from hematological neoplasms and co-cultures to better represent the tumor microenvironment.
- Ex-vivo and in-vivo validation on patient-derived tumor cells, zebrafish and mouse models.
- Definition of molecular mechanisms regulating cell response to therapy.
- Exploitation of nanoparticles for targeted drug delivery selectively to tumor cells.

Number of available positions for stage and experimental thesis : 1+1





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# *Oncolmunology*

*The complex interaction between cancer and the immune system and how to exploit it for the design of anti-cancer treatments*



**Teachers:** Prof. Federica Cavallo; Prof. Elena Quaglino; Prof. Laura Conti

## Research lines

- Immunotargeting of xCT as an anti-cancer strategy
- Dissecting the contribution of xCT in the complex crosstalk between cancer and immune system
- Interaction of xCT with the mTORC2/AKT pathway
- Role of Chondroitin Sulfate Proteoglycan (CSPG)4 in melanoma and osteosarcoma
- Anti-CSPG4 vaccination in client-owned dogs affected by malignant melanoma or osteosarcoma
- Role of Teneurin (TENM)4 in breast and colon cancer progression
- Immunotargeting of TENM4 as an anti-cancer strategy
- Role of Toll-like Receptor (TLR)2 in the cross-talk between breast cancer and the local microbiota
- Development of theranostic nanosystems for TLR2 targeting in breast cancer



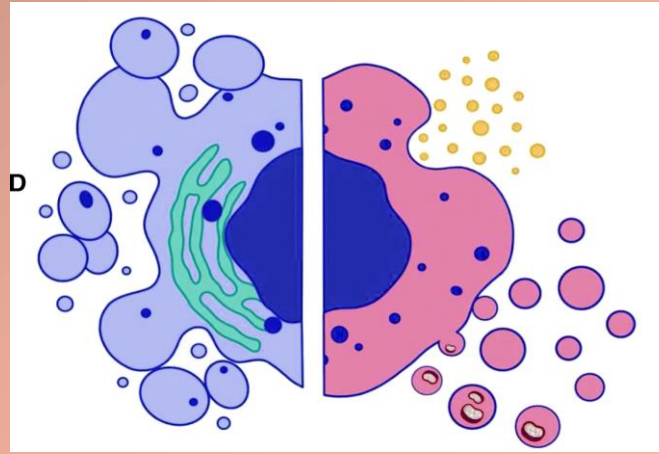
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# *Regenerative Medicine and extracellular vesicle lab*



Teacher: Prof. Benedetta Bussolati

## Research lines

Regenerative effect of EVs, with particular attention to cargo (miRNA, proteins) in models of chronic kidney damage or oncological disease.

Development of diagnostic tests based on urinary EVs as predictors of renal regenerative reserve.

Effect of bioproducts of mesenchymal stem cells (EVs, mitochondria) in pre-transplant organ perfusion



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# ***Tumor Immunology Lab – Centro di Biotecnologie Molecolari "Guido Tarone", Piazza Nizza 44***

*The overall goal of the research group is the  
characterization of the immune response in pancreatic  
cancer patients to develop new immunotherapeutic  
strategies.*



**Teachers:** Prof. Paola Cappello; Dr. Claudia Curcio; Prof. Francesco Novelli

**Team members:** Dr. Alessandro Scagliotti, Dr. Silvia Brugiapaglia; Dr. Giorgia Guadagnin; Dr.ssa Giorgia Tiberi; Dr. Ermes Candiello

## **Research lines**

- Characterization of the antibody response in pancreatic cancer patients
- Analysis of cell-mediated response in pancreatic cancer patients
- Development of pre-clinical models to design new therapeutic strategies
- Characterization of the IL17A and IL17F's role in the progression of pancreatic ductal adenocarcinoma
- Identification of novel immuno check-point molecules

Number of students who can be enrolled: 1

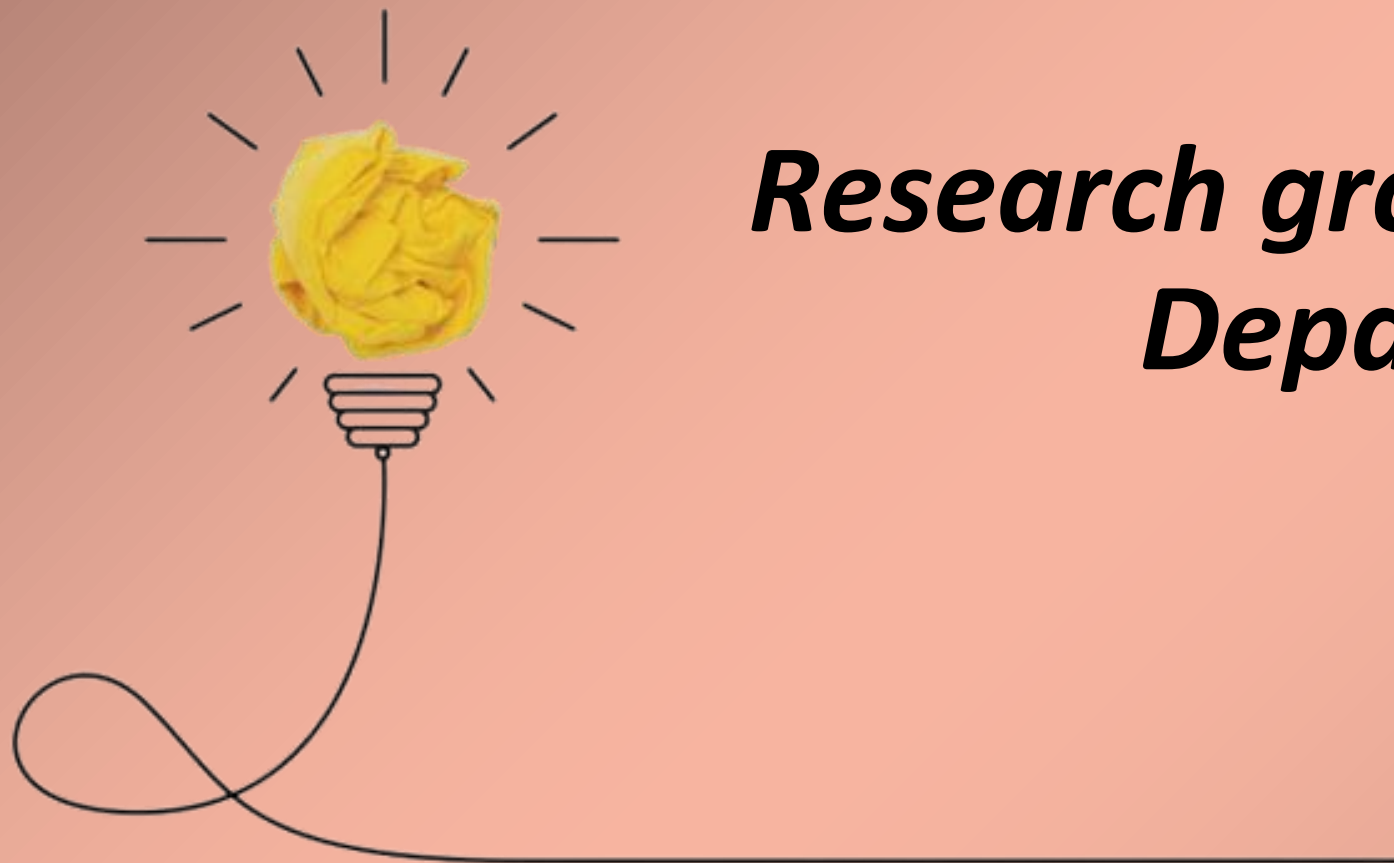




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# *Research groups from other Departments*



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**Department of Public Health and  
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# *Air Quality and Human Health*



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Department of Public Health and  
Pediatric Sciences



**Teacher:** Prof. Deborah Traversi    Research field MED/42: Hygiene and Environmental Science  
**Collaborators:** Dott. Elena Franchitti (PhD student SUSTNET); Dott. Cristina Pignata (TR)

## Research lines

### Air pollution and Human Health

The activity mainly consists in the development and application of experimental models with the aim of acquiring laboratory evidence on the human health impacts of air-dispersed environmental mixtures.

The methods applied include microbiology and cellular/molecular biology assay:

Evaluation of the effect of airborne fine particulate exposure on in vitro cellular models by studying the alteration of genetic profiles, the expression of genes involved in DNA repair mechanisms, various cytotoxicity end points;

Evaluation of human exposure to airborne bacterial endotoxins;

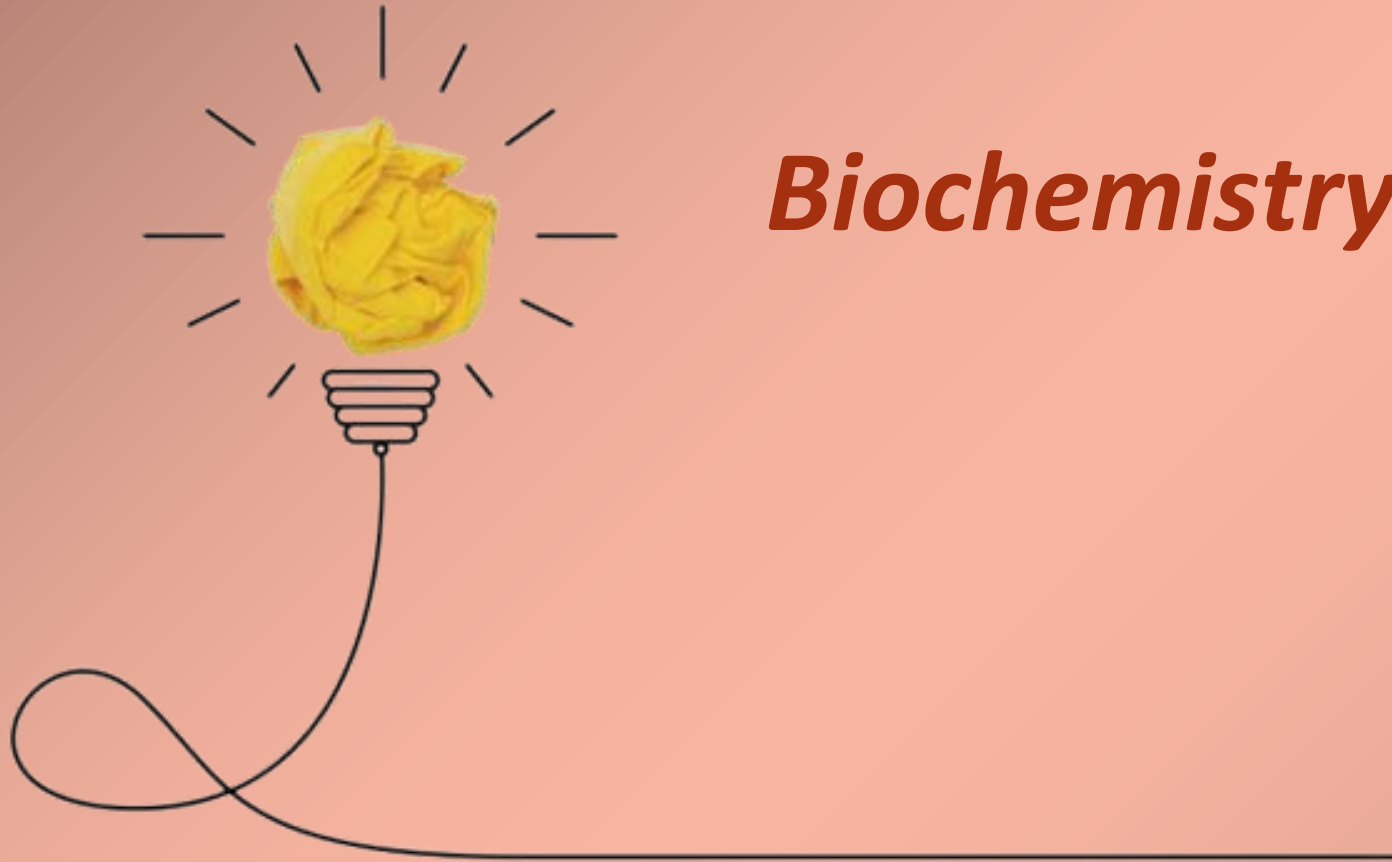
Study of the biological component of the aerosol with cultural and biomolecular methods and evaluation of the associated effects on human health.



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# *Biochemistry of cell metabolism*



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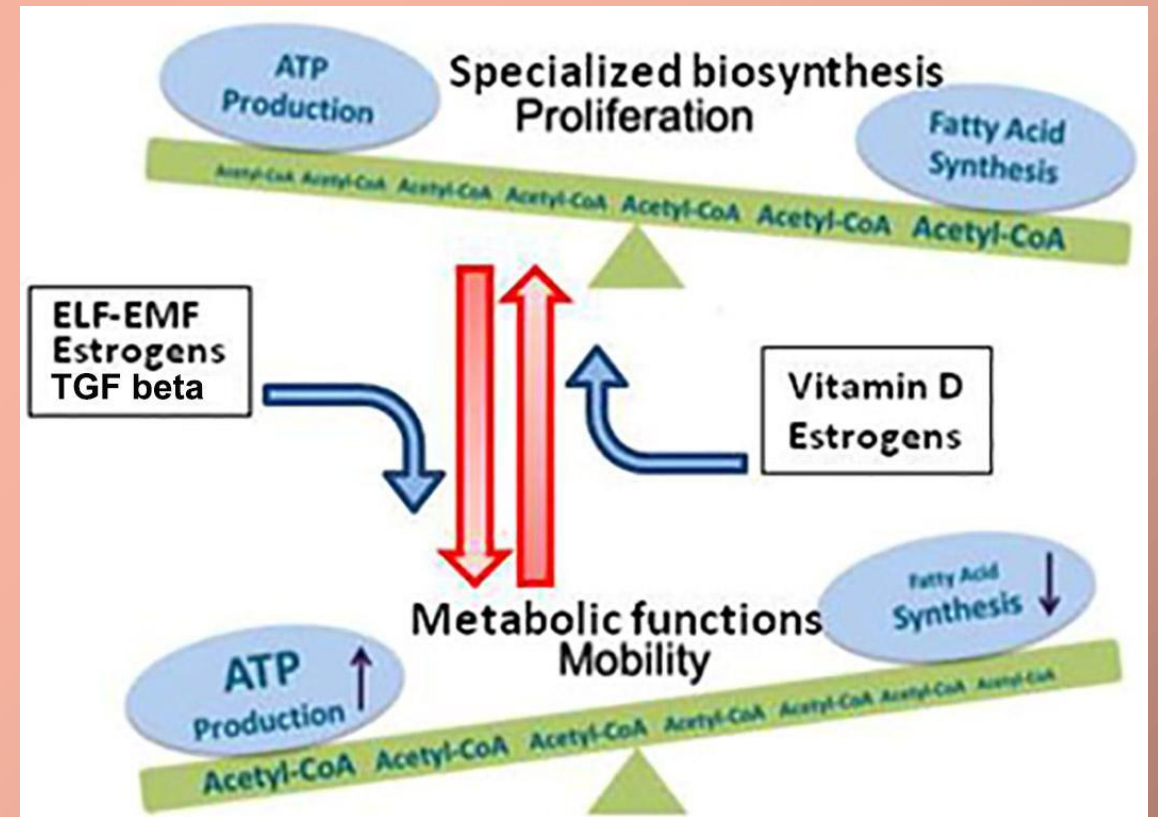
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## Biochemistry of cell metabolism

Teacher: Prof. Francesca Silvagno

SSD: BIO/10





## Lines of research

### **1. Cancer metabolism**

The aim of our research is to modulate the mitochondrial respiratory activity to reduce cancer cell growth. By different approaches, we investigate the effects of molecules and extracellular stimuli able to shift the metabolic balance towards the oxidative catabolism of nutrients, at the expenses of the biosynthetic pathways necessary for proliferation. Our latest studies focus on:

The effects of vitamin D on mitochondrial activity. Experimental models: keratinocytes, cancer cell lines, models of epithelial-mesenchymal transition

The environmental clues driving TGF beta signaling in epithelial-mesenchymal transition of pancreatic cancer

The signaling pathways of estrogens and SERMs modulating the mitochondrial respiratory activity of breast cancer cell lines

The effects of extremely-low frequency electromagnetic fields (ELF-EMF) on mitochondrial activity and cancer cell proliferation, with the aim of proposing a new technological approach in oncology (in collaboration with Politecnico di Torino).

### **2. Tissue metabolism**

We investigate the effect of temperature on mitochondrial metabolism and the role of amino acid availability on protein expression.

### **3. Nutraceuticals**

We characterize the efficacy of some natural molecules on metabolism and tissue health. We study the effects of galactooligosaccharides in several tissues (in collaboration with the Institut Agricole Régional, Aosta, Italy), the activity of melatonin in tissue regeneration (in collaboration with Banca della Cute, AOU Città della Salute e della Scienza, Torino, Italy), and the antioxidant and anti-inflammatory properties of natural compounds.





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# *Cancer Cell Biology*

*Cell dynamics, metabolic reprogramming and  
molecular signalling in 3D cancer cell models.*

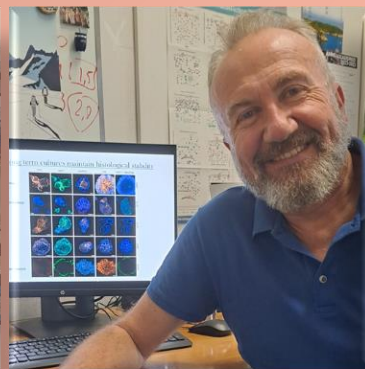


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**Teachers:** Dr. Valentina Monica, Prof. Luca Primo, Prof. Alberto Puliafito    **SSD:** BIO/10

**Collaborators:** Dr. Barbara Peracino (DSCB), Dr. Laura di Blasio

## Research lines

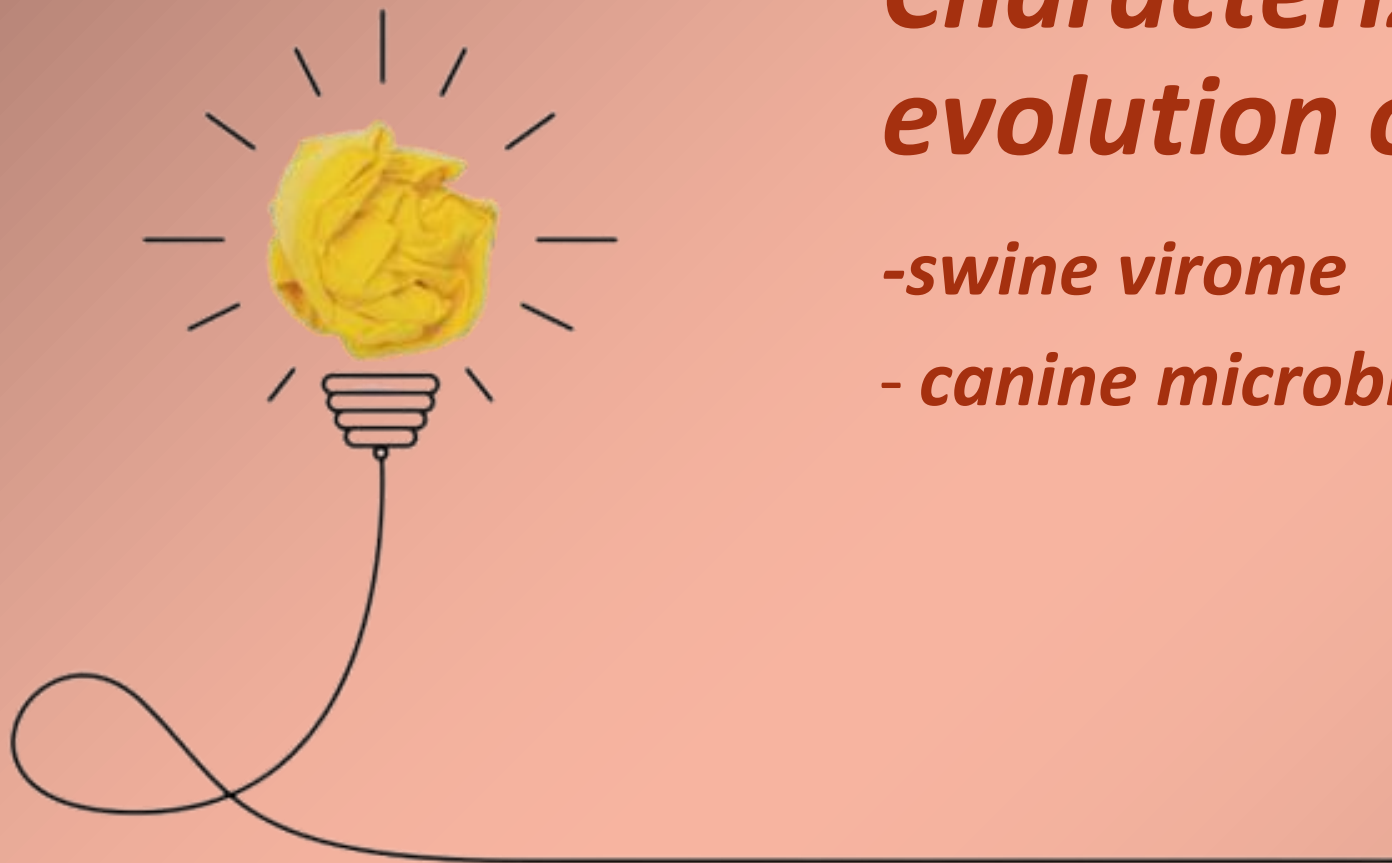
- Generation and characterization of 3D cellular models, including organoids derived from human tissues and cell aggregates.
- Development and improvement of imaging-based quantitative approaches for studying 3D cultures at cellular and molecular level.
- Exploiting metabolic reprogramming in patient-derived organoids and cancer cells.



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# *Characterization and evolution of*

*-swine virome*

*- canine microbiome during delivery*



**Teachers:** Prof. Luigi Bertolotti; Prof. Ugo Ala; Prof. Mario Giacobini - SSD: VET/05

## Research lines

### Genetic, phylogenetic and evolutionary characterisation of pathogens (viruses and bacteria)

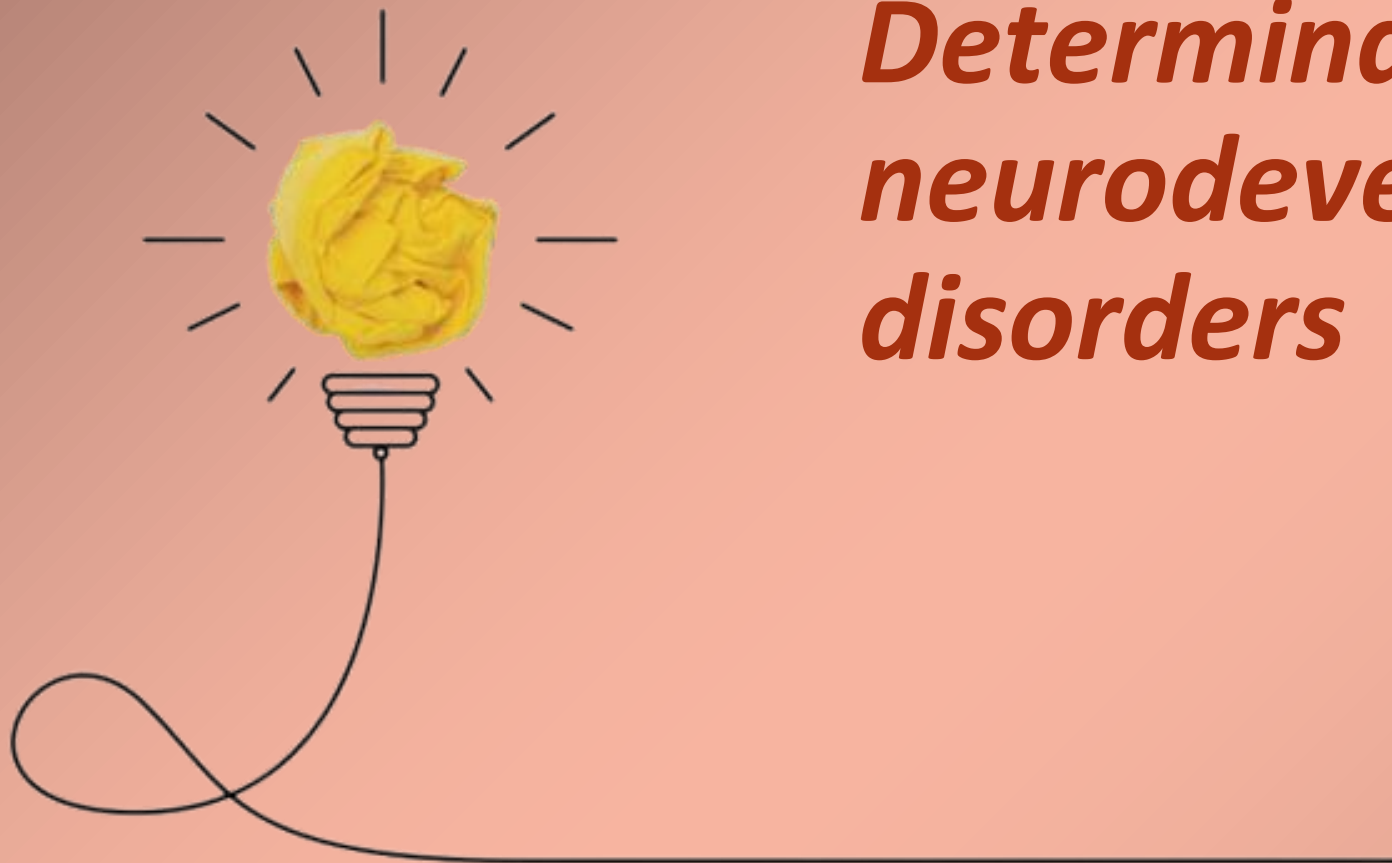
- Viral discovery and metabarcoding
  - Analysis of genomic sequences, using NGS techniques
  - Analysis of the structures of populations of infectious agents
- Molecular epidemiology
  - Host-pathogen interaction characterization
  - Phylogenetic evolution



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# *Determinants of rare neurodevelopmental disorders*



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**Teacher:** Prof. Maurizio Giustetto - SSD: BIO/16

## Research lines

### Determinants of rare neurodevelopmental disorders

- Study of morpho-functional alterations underlying autism spectrum disorders by using multidisciplinary approaches:
  - role of pathogenic mutations in the development, maturation and plasticity of cortical neuronal circuits
  - role of the CDKL5 gene in processes underpinning myelin organization, intercellular communication mediated by extracellular vesicles (exosomes) and in the regulation of epigenetic and gene expression processes
- Study of the effects induced by environmental pollutants on neuronal and synaptic maturation
  - impact of exposure to sub-toxic doses of herbicides on neurotransmission
  - role of herbicides in neurodegenerative disease (e.g.: Parkinson's Disease)

<https://neuroen.campusnet.unito.it/do/gruppi.pl/Show? id=38jd>





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# *Development of GC-MS and LC-MS/MS analytical methods for clinical and forensic investigations*



Teacher: Prof. Marco Vincenti

### Research lines

- Application of the state-of-art mass spectrometric techniques for: (1) targeted and untargeted cancer metabolomics from various biological matrices, (2) toxicological analyses of challenging alternative biological matrices (e.g., hair, oral fluid, dried blood spots), (3) workplace and roadside drug testing, (4) doping control.
- Development and application of machine learning strategies for data exploration, classification, class modelling, regression and interpretation.
- Trace analysis for forensic purposes.

# *Development of Imaging biomarkers*



*The Research Unit of Torino of the IBB-CNR is focussed on:*

- *Novel imaging-based approaches for characterizing tumor microenvironment and response to therapy in preclinical tumor murine models*
- *Design of new MRI/Optical Imaging probes for cell labelling and for quantifying the expression of molecular targets overexpressed in tumoral and/or viral pathologies*
- *Identification and validation of new biomarkers for early diagnosis of liver diseases and of post-transcriptional regulation of gene expression in human gastrointestinal tumors*



**Teacher:** Prof. Dario Longo

**Collaborators:** Dr. Antonella Carella (post-doc); Dr. Ferial Romdhane (post-doc); Dr. Alessia Corrado (PhD student); Dr. Elisa Pirotta; Dr. Riccardo Gambino; Dr. Francesco Gammaraccio; Dr. Kranthi Kandula

## Research lines

- Development of imaging-based approaches for assessing tumor microenvironment properties (acidosis, vascularization, hypoxia) in preclinical cancer murine models
- Exploiting MRI-based techniques for non-invasive assessment of response to novel anticancer drugs in murine models
- Investigation of pH imaging as a novel biomarker for evaluating cancer aggressiveness and invasion and for monitoring renal functionality



Teacher: Dr. Valeria Menchise

## Research lines

- Design of Gd(III)-based probes for cellular labelling and Molecular Imaging through Magnetic Resonance Imaging.
- Design and synthesis of peptides for ligand/antiligand analysis.
- Multimodal(MRI/OI) diagnostic procedure that relies on the use of structure based designed nanosystems, properly planned to quantify the expression of molecular targets, overexpressed in tumoral and/or viral pathologies, such as CA IX and CA XII and RBD of Sars-Cov2 Spike protein.



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Teacher: Dr. Sharmila Fagoonee

## Research lines

Through a multidisciplinary approach including advanced molecular techniques such as RNA-seq and large-scale proteomics, as well as in vitro and in vivo studies, the two main and current research areas regard:

- Identification of circulating extracellular vesicles-based biomarkers for the early diagnosis of liver diseases.
- Studying post-transcriptional regulation of gene expression, in particular investigating the molecular mechanisms underlying the role of the RNA binding proteins and splicing factors, ESRP1 and 2, in the development of human gastrointestinal cancers.





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# *Development of innovative immunochemical methods of analysis*

- *Lateral Flow Immunoassay*
- *Enzyme-linked immunosorbent assay*



Teacher: Prof. Laura Anfossi

Collaborator: Dr. Fabio Di Nardo

## Research lines

- Application of immunochemical techniques for measuring a variety of substances for clinical, environmental and food analysis.
- Prototype development: from the immunogen design to the development and validation of a working immunoassay, through i) the preparation of reagents (protein/enzyme conjugates, gold colloidal-labelled immunoreagents); ii) optimization of key parameters (reagent feature/amount, reaction times...); iii) establishment of fit-for-purpose extraction protocols from complex matrices.



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# *Identification of molecular biomarkers and novel therapeutic targets in cancers*



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**DSCB**  
**Department of Clinical and Biological Sciences**

Teacher: Prof. Ymera Pignochino - SSD: BIO/11

## Research lines

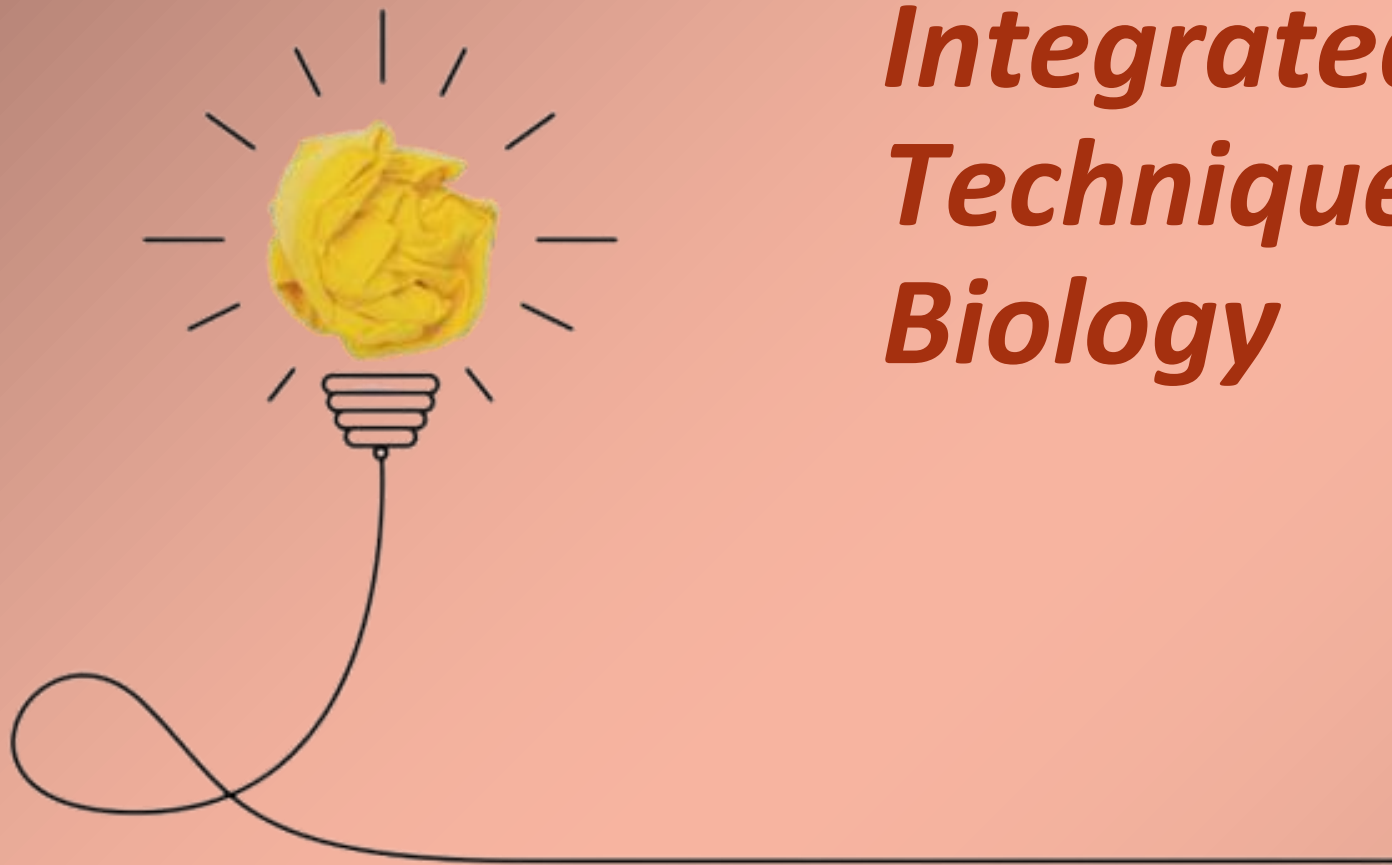
1. miRNA da esosomi plasmatici come marcatori predittivi di risposta alla terapia a bersaglio molecolare con imatinib nei tumori stromali gastro-intestinali (GIST)
2. Approcci di sequenziamento di nuova generazione per l'identificazione di biomarcatori predittivi di risposta alla terapia sperimentale con trabectedina e inibitori di PARP1 nei sarcomi dei tessuti molli –studio traslazionale e clinico di fase II
3. Sviluppo di nuove combinazioni di chemio-targeted e immuno terapia in modelli preclinici di sarcomi dei tessuti molli
4. Studio dell'interattoma tumore –stroma per l'identificazione di nuovi bersagli terapeutici in tumori rari e ultra-rari ( sarcomi, colangiocarcinoma e carcinoma adrenocorticale): analisi sistematica di modelli paziente-specifici (PDX)
5. RNA circolari nel tumore polmonare non a piccole cellule: ruolo funzionale e potenziali applicazioni nella diagnosi precoce



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# *Integrated Laboratory Techniques – Molecular Biology*



**Teacher:** Prof. Ferdinando Di Cunto - SSD: BIO/11

## Research lines

### Study the functions of microcephaly genes and their role in brain tumors

- Role of microcephaly genes in mitosis
- Role of microcephaly genes in DNA damage
- Study of microcephaly genes as drug targets
- Computational approaches for the study of human disease genes





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# *Laboratory of Immunogenetics, Department of Medical Sciences*



**Head of the Laboratory:** Prof. Ada Funaro

**Collaborators:** Dr. Erika Ortolan; Dr. Enza Ferrero; Dr. Yuliya Yakymiv; Dr. Sara Marchisio

## **Research lines**

- Study of the molecular mechanisms underlying the interaction between tumor cells and the microenvironment with particular reference to the role of ectoenzymes and cell surface receptors in models of skin cancers, acute myeloid leukemia and myeloma, using a multidisciplinary approach that includes functional in vitro assays, biochemistry of proteins, confocal microscopy, flow cytometry
- Identification of new potential pathways and therapeutic targets for the design of novel targeted therapies

Available place: 2



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# *Microbiome and Human Health*



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Department of Public Health and  
Pediatric Sciences



**Teacher:** Prof. Deborah Traversi    Research field MED/42: Hygiene and Environmental Science

**Collaborators:** Dott. Elena Franchitti (PhD student SUSTNET); Dott. Cristina Pignata (TR)

## Research lines

### Human microbiome in the personalised medicine

Investigations on the human microbiome with particular reference to the evaluation of indicators for dysbiosis and development of chronic diseases.

The activity consists in the collection and analysis of human biological samples (faeces, saliva, nasopharyngeal swab) with the aim of determining the composition of the microbiota and its modulation in relation to the exposure profiles and final health conditions. The methods include microbiology and molecular biology tools.

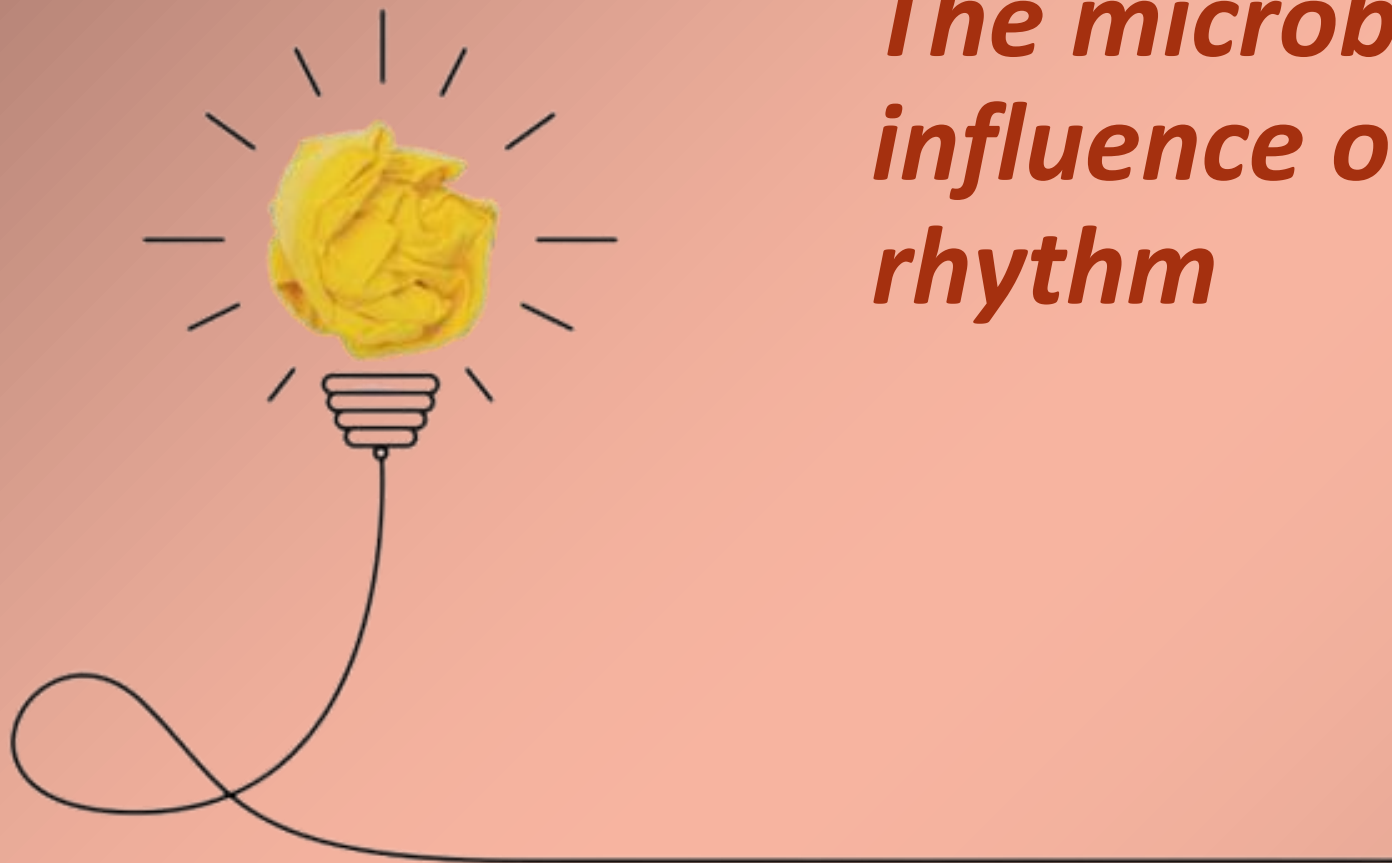
Health-literacy and citizen engagement: Investigations on the dissemination of knowledge and the use of personalized services for mapping the human genome and/or microbiome.



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# *The microbiome and its influence on the circadian rhythm*



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**Teachers:** Prof. Ugo Ala; Prof. Luigi Bertolotti; Prof. Mario Giacobini - SSD: BIO/13

## Research lines

### Gene Regulatory Networks and post-transcriptional regulation

- Analysis of conserved gene co-expression networks
  - Functional analysis of coding and non-coding transcripts
  - Disease Genes prediction
- Microbiome
  - 16S rRNA Gene Sequencing and Shotgun metagenomics
  - Human and Animal Microbiomes





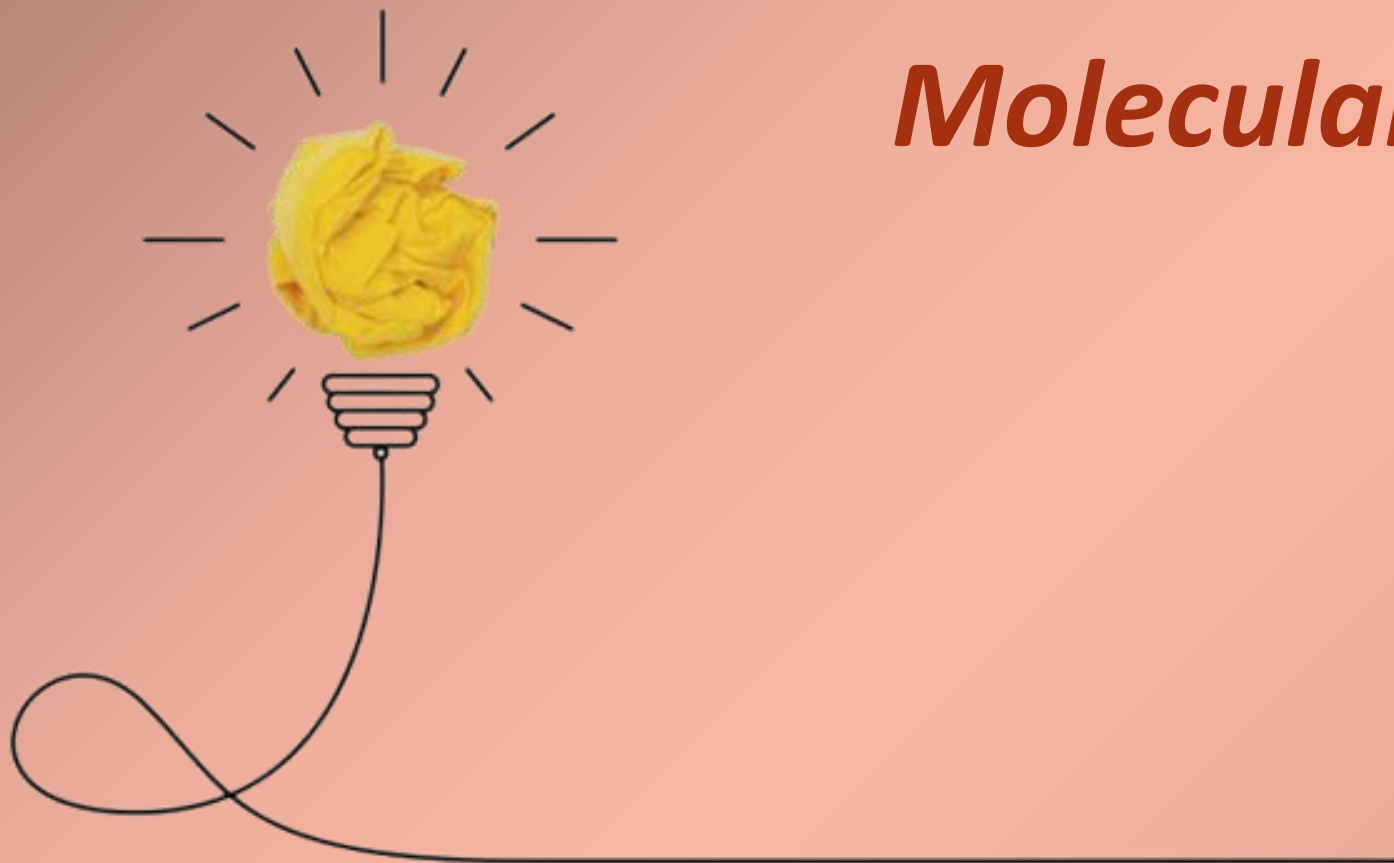
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# *Molecular Biochemistry*





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**Referent Teacher:** Prof. Riccardo Taulli - SSD: BIO/10

**Other teachers & associates:** Dr. Francesca Bersani; Dr. Francesca Picca

## Research lines

- Defining the mechanisms of adaptation to molecular therapies in lung cancer
- Generation and characterization of a tumor organoid platform to evaluate the efficacy of new therapeutic approaches in thoracic malignancies
- Dissecting the molecular circuits responsible of the trans-differentiation from lung adenocarcinoma to neuroendocrine microcytoma



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# *Neuronal plasticity, neuronal circuits and sex-biased differences in emotional, cognitive and metabolic disorders*



## Research group

Teacher: Prof. Carola Eva

Collaborators: Dr. Alessandra Oberto RU; Dr. Ilaria Bertocchi RTDA; Dr. Antonino Casila PhD student

## Research lines

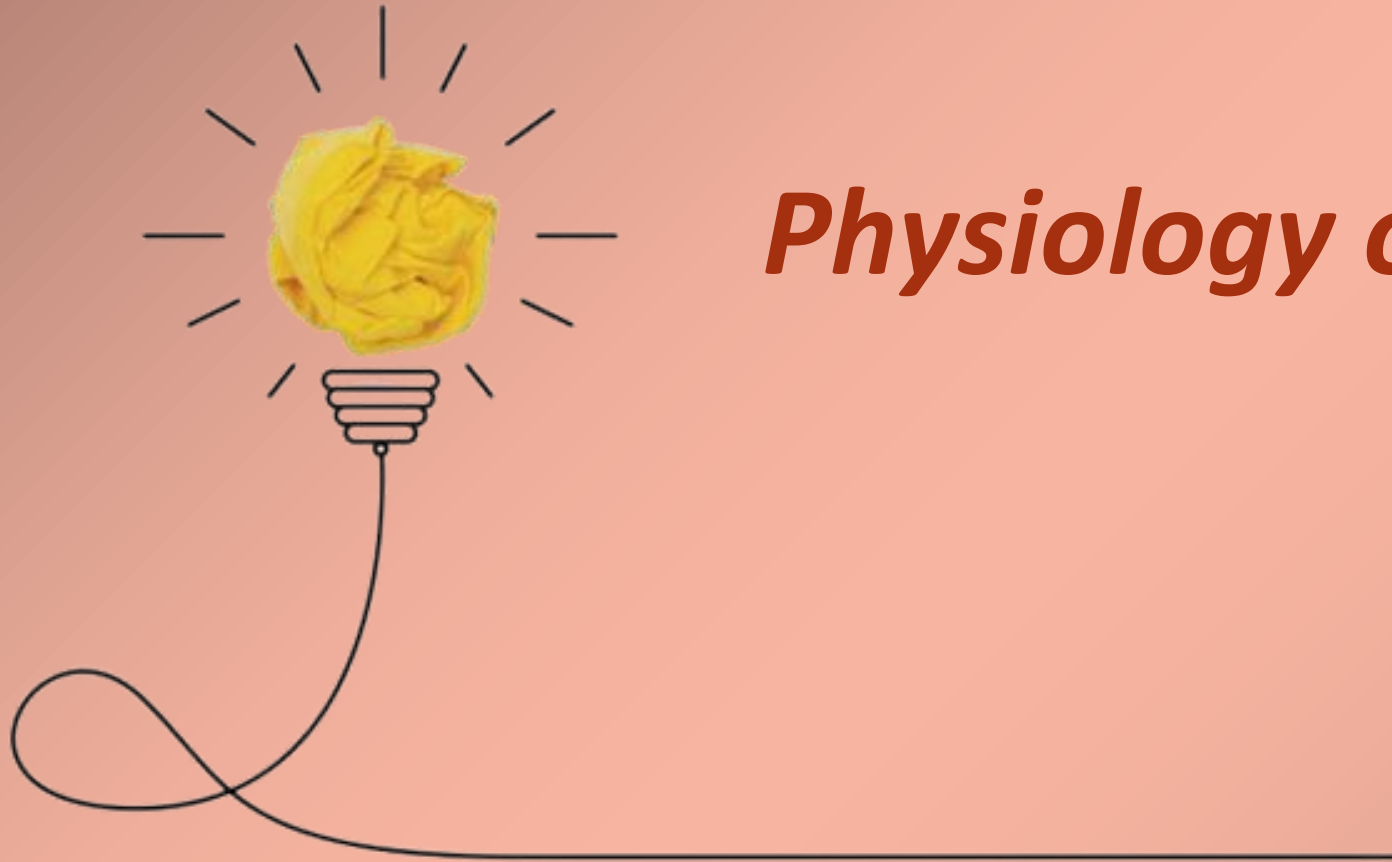
- Perineuronal nets: a new therapeutic target for fragile X syndrome
- Neuronal plasticity and neuroinflammation in a murine model of developmental and epileptic encephalopathies
- Role of NPY-Y1R system on sexually dimorphic vulnerability to metabolic syndrome and cognitive disorders



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# *Physiology of Reproduction*



**Teacher:** Dott. Paola Toschi - SSD VET02

Anatomy and physiology of animal models course

## **Research lines**

- Early placenta development (sheep model):  
Establishment of an in vitro model to study trophoblast differentiation during early pregnancy.  
Establishment of an in vitro model to study different strategies of placental adaptation under stressed condition, with a main focus on autophagy.
- Maternal nutrition and offspring development (sheep/bovine model):  
Physiological and epigenetic modification in somatic tissue and gametes of offspring exposed to in utero maternal undernutrition

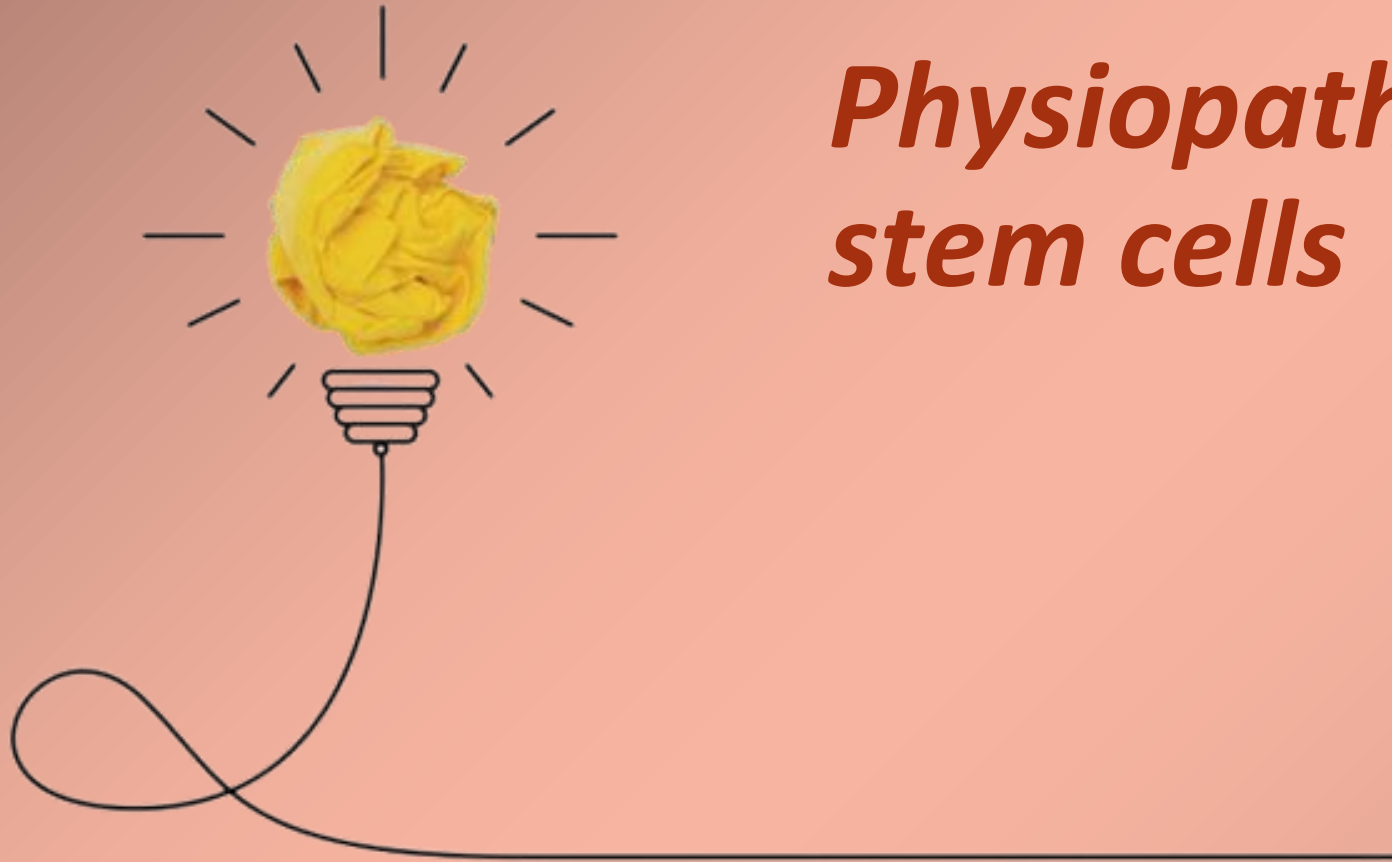




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# *Physiopathology of neural stem cells*



Annalisa Buffo



Valentina Cerrato



Martina Lorenzati



Gabriela Gomez



Roberta Parolisi

**Teacher:** Prof. Annalisa Buffo Associate Professor of Physiology, Department of Neuroscience, University of Torino

## Research lines

1. Development and functions of the rodent and human cerebellum. Employed approaches: sc/snRNAseq and high resolution histology;
2. Development of pluripotent stem cell based cell replacement strategies in preclinical models of neurodegeneration. Employed approaches: in vitro generation of human neural cells, in vivo studies of human grafted cells survival, integration, function;
3. Rodent and human glia: differentiation potential, role in brain physiology and pathology.

Further information at : <https://www.nico.ottolenghi.unito.it/eng/Research/Research-Groups/Physiopathology-of-neural-stem-cells>



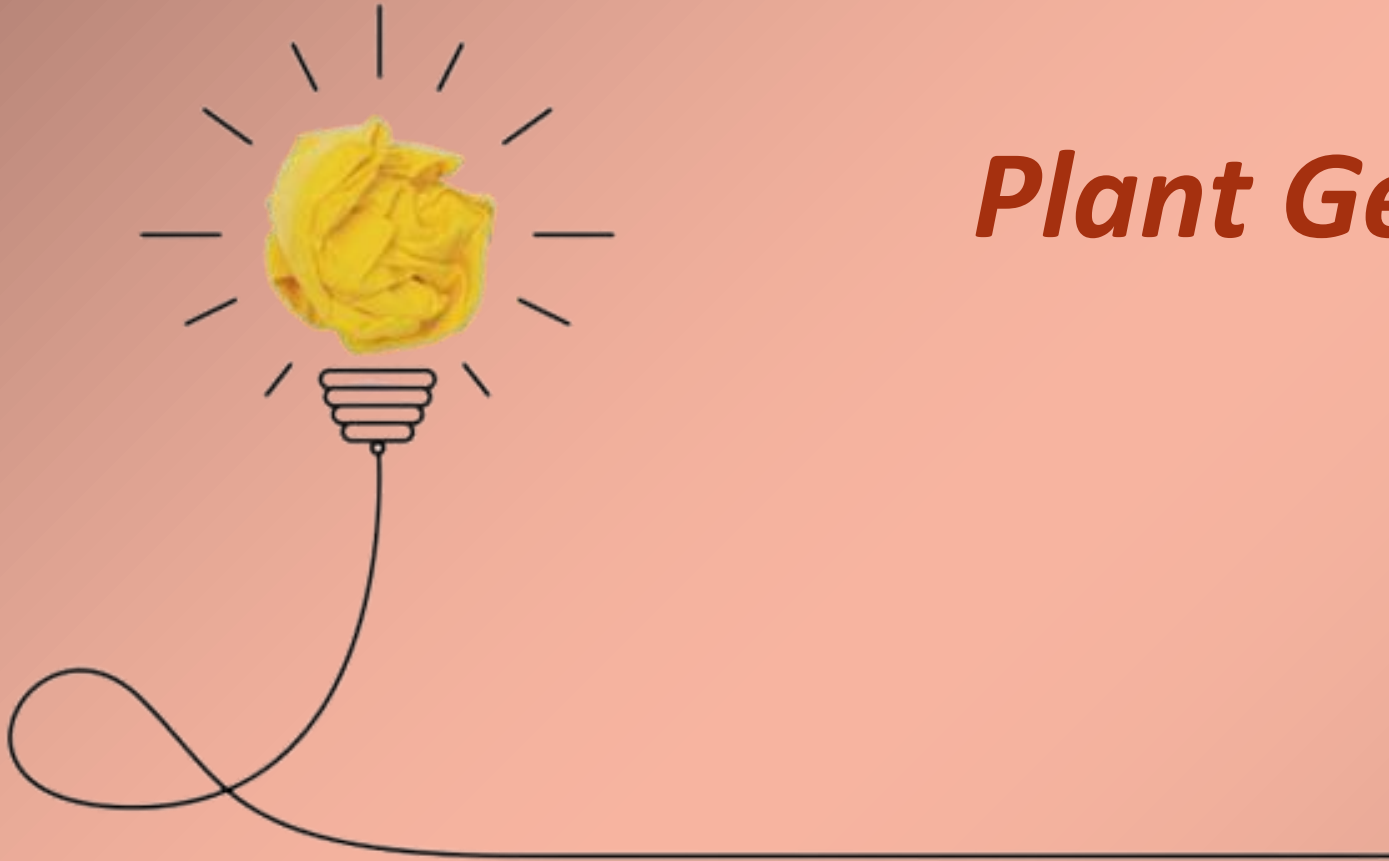
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# *Plant Genetics*





Teachers: Prof. Cinzia Comino; Prof. Lorenzo Barchi - SSD: AGR/07

## Research lines

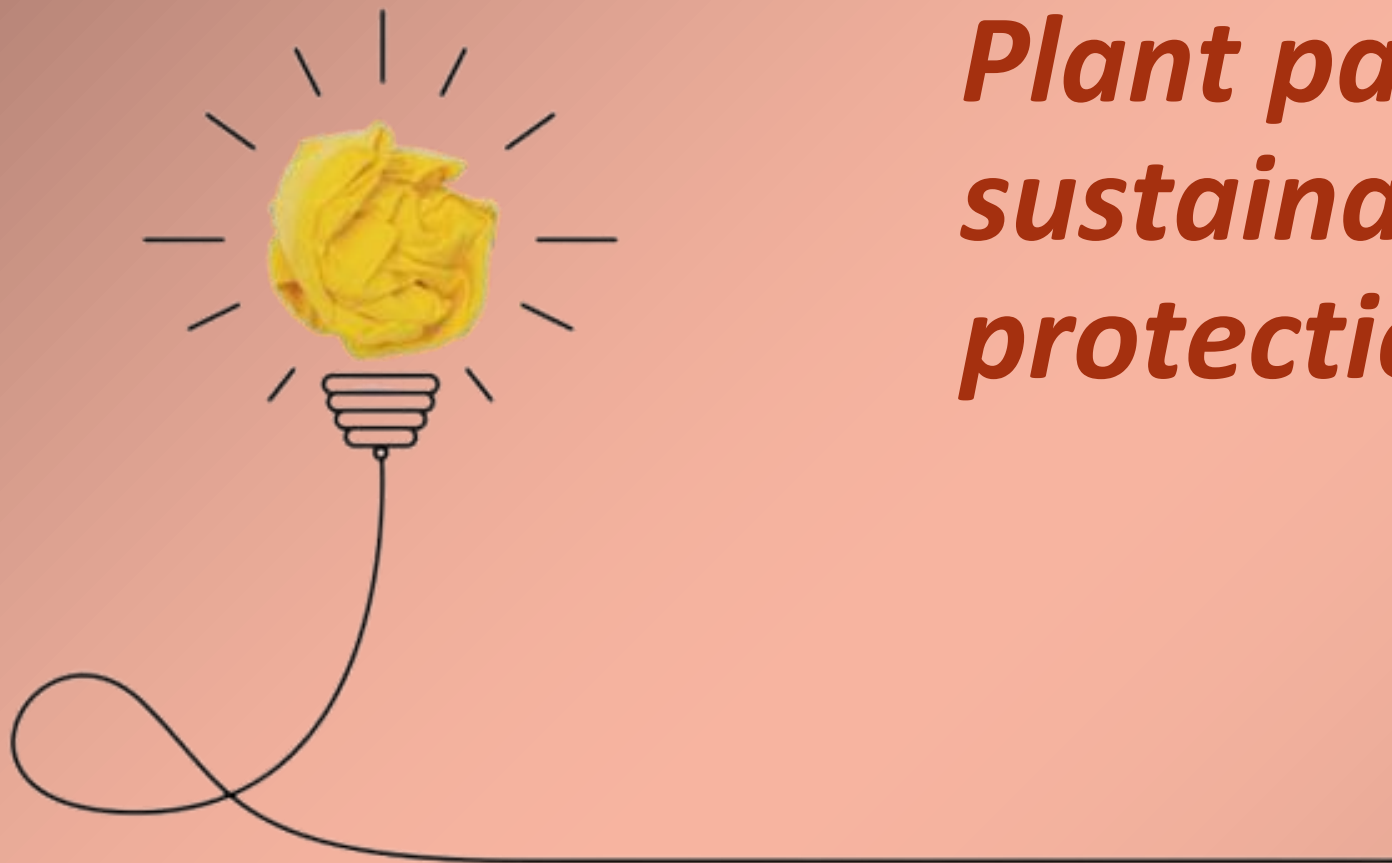
- **Plant functional genomics:** *application of the cutting edge technologies (RNA-seq, Bisulfite sequencing, metabolic engineering, genome editing) to carry out functional genomics studies in plants.*
- **Structural genomics and bioinformatics:** *study of the genomes of economical important crops cultivated in Italy (as eggplant, pepper and artichoke), to identify key genes for breeding, to provide information on mechanism underlying crop evolution, fruit characteristics, and to move forward a pan-genome view of the species.*
- **Safeguard and enhancement of biodiversity in crop species:** *developing of sustainable conservation strategies of crops through the exploitation of the in-situ and ex-situ conserved materials.*
- **Development of genetic maps, QTL analyses and genome wide association studies in crop species:** *genetic linkage maps development, QTL analyses and genome wide association analyses are key tools widely used in plant genetics and breeding to carry out genome analysis, as well as to identify genomic regions associated with agronomic and qualitative traits useful in marker assisted selection (MAS) programs.*



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# *Plant pathology and sustainable crop protection*





**Teachers:** Prof. Davide Spadaro

SSD: AGR/12

## Research lines

- Fungal and bacterial diseases of fruit and nut trees, vineyard and cereals
- Postharvest diseases of fruit and vegetables
- Mycotoxins and mycotoxigenic fungi
  
- Epidemiology of plant diseases
- Diagnostics, surveillance and monitoring of plant pathogens
- Sustainable crop protection
- Microorganisms for biological control
  
- Plant, air and soil metabarcoding and metagenomics
  
- Fungal pathogen genomics and transcriptomics

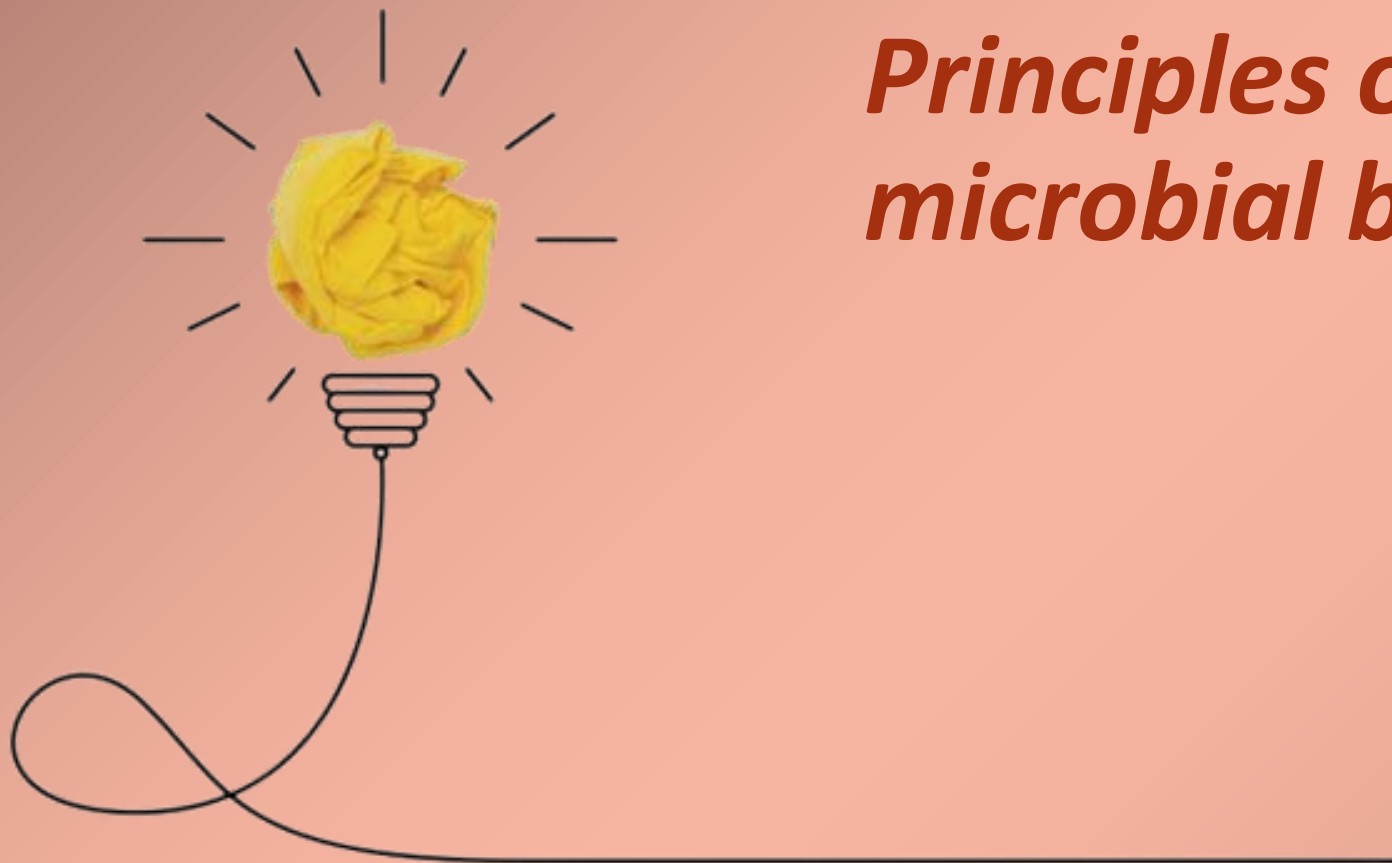




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# *Principles of plant and microbial biotechnologies*



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**Teachers:** Prof. Luisa Lanfranco - SSD: BIO/01 (3 CFU)

## Research lines

### Plant-microbe interactions

- Study of plant-microbe interactions with particular attention to the arbuscular mycorrhizal (AM) symbiosis
  - Molecular mechanisms underlying the colonization process, including the role of small RNAs
  - Impact at local and systemic level of the AM symbiosis on the host plant and responses to stresses
  - Role of apocarotenoids - strigolactones and zaxinone – on plant growth and biotic interactions
  - The virome of AM fungi



**Teacher:** Dott. Roberta Gorra - SSD: AGR/16 (3 CFU)

## Research lines

### Soil Microbial Ecology and Bioremediation

- Study of complex microbial ecosystems and the influence on environment and artificial systems.
  - Biodiversity as in function of soil management
  - Microbial processes involved in fertility and plant production
  - Microbial Ecology in Bioremediation systems Ecologia microbica di sistemi di biorisanamento
  - Microbial biofilms



***Quality of the sludge, produced by  
waste water treatment or organic  
fraction municipal solid waste  
treatment, and human health impact***



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Department of Public Health and  
Pediatric Sciences



**Teacher:** Prof. Deborah Traversi    Research field MED/42: Hygiene and Environmental Science

**Collaborators:** Dott. Elena Franchitti (PhD student SUSTNET); Dott. Cristina Pignata (TR)

## Research lines

### Biological risk of bio-solids produced by the treatment of organic solid waste and/or wastewater

- Evaluation of the presence and persistence of pathogens (bacteria and viruses);
- Evaluation of the methanogenic component;
- Evaluation of the presence and persistence of resistome.

The activity mainly consists in the development and application of experimental models with the aim of acquiring laboratory evidence regarding the reduction of the biological risk associated to the sludge produced by the waste treatment plants (organic solid and liquid).

The methods applied include environmental microbiology, cellular and molecular biology protocols.



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Ministero dell'Università e della Ricerca



# *Theranostic in Nuclear Medicine: from diagnosis to therapy*

*Molecular imaging and radionuclide therapy*





**Teacher:** Prof. Deandreis Désirée - PA MED/36, Department of Medical Sciences

### **Research lines**

- Principles of Radiopharmacy and set up of new radiopharmaceuticals
- Biomarkers extraction by Molecular Imaging with Positron Emission Tomography (PET)/computed tomography (CT) in oncology and neurology
- Advanced Molecular Imaging analysis
- Radiomics



UNIVERSITÀ  
DI TORINO

Dipartimento di  
Biotecnologie Molecolari  
e Scienze per la Salute

2023 - 2027  
**DIPARTIMENTO  
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# *To see or not to see: organic chemistry applied to chemical biology*

- *Synthesis and application of fluorescent probes in bilayer membranes, nucleic acids and their derivatives*
- *Synthesis and studies of molecular photoswitches for photopharmacology*
- *Synthesis of natural plant hormones for biomedical applications*
- *Development of biocatalytic processes in sustainable conditions*



**Teachers:** Prof. Andrea Fin (Department of Chemistry); Dott. Francesca Cardano (Department of Chemistry);  
Prof. Marco Blangetti (Department of Chemistry); Prof. Cristina Prandi (Department of Chemistry)

SSD (CHIM/06)

## Research lines

- Synthesis and photophysical characterization of novel biocompatible fluorophores.
- Phospholipids membrane bilayer investigation by fluorescent probes in artificial liposomes as model of cell membrane.
- Synthesis and functionalization of emissive nucleobases and their biological derivatives.
- Synthesis of fluorescent probes for nucleic acids and enzymatic processes investigation.
- Synthesis and photophysical evaluation of molecular photoswitches for photopharmacology and drug delivery.
- Synthesis and characterization of natural molecules of biological interest.
- Cascade biocatalytic processes development in eutectic mixture.