The Ph.D. Course in Molecular Medicine (MM) at the University of Padova offers a highly competitive programme for a comprehensive education in the fields of Biochemistry, Biophysics, Molecular, Cell and Developmental Biology, Physiology, Microbiology, Virology and Gene Therapy. The Course offers state of the art working conditions in a challenging environment for talented researchers in the best academic research institution in Italy. MM offers a wide range of different programs. Students choose their field of interest under the direct supervision of one or more of the Ph.D. Course Board. The research project is complemented by advanced graduate courses designed to provide the students with state-of-the-art tools in selected areas of chemistry, materials science and biochemistry. Our students receive a broad training that prepares them equally well for careers in industry or academia. The Course enjoys strong ties with Italian and European private pharmaceutical enterprises allowing campus visits, seminars, and joint research activities.
# Ph.D. Board

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**Abbreviations**

- **DMM**: Molecular Medicine
- **DNS**: Neurosciences
- **DSF**: Pharmaceutical and Pharmacological Sciences
- **DiBio**: Biology
- **DISCOG**: Surgery, Oncology and Gastroenterology Sciences
- **PO**: Full Professor
- **RU**: Associate Professor
- **RTDA-RTDB**: Resercher
- **SSD**: Disciplinary Scientific Sector

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# Abbreviations

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Educational goals and Didactic program for the XXXVI series

NOTA: come richiesto da ANVUR con riferimento al requisito A8 nella valutazione relativa all'accreditamento per il XXX ciclo, abbiamo provveduto ad aggiungere gli "Educational goals and Didactic program" con le nuove attività pensate specificamente per il XXXVI ciclo, diverse da e complementari rispetto a quelle dello scorso anno. La presente nota verrà anche inserita nella scheda ministeriale per la valutazione relativa al XXXVI ciclo.

As per XXXVI series, the **Educational goals** and the **Didactic program** will follow the general settings of the previous series, but, at the same time, they will be characterized by the introduction of new research themes (also dealing with ERC, H2020, AIRC projects) and specificities.

**Educational goals** the main objective of the Ph.D. Course is to form scientists with biological knowledge to apply to medicine with the final aim to understand the molecular bases of diseases and develop new diagnostic systems and new therapeutic and preventative tools. This knowledge in the fields of biochemistry, biophysics, histology, physiology, microbiology and biotechnology, will provide the student with a wide professionalism aimed to ideate and develop biomedical research projects both basic and translational. Ph.D. students will be allocated in different research groups belonging to the Departments involved in the Ph.D. Course in order to develop a gradual training approach during the three-year course. The training will be integrated with the participation to national and international conferences, and meetings. Furthermore PhD students will have the possibility to spend a period of research in external national and international institutions.

**The didactic program** includes practical activity in the laboratory under the guidance of a tutor (the PhD Course offers a wide range of facilities - see facilities section), attendance to seminars given monthly and held by Italian and foreign invited speakers on themes of scientific relevance and topical interest.

Every 6 months a special seminar section (retreat) will be organized: each student will expose the advancement of his/her data to the other students and to the Board members of the Course.

PhD students will be invited to attend national and international meetings of interest for their research and to collaborate with other Italian and foreign research groups.

The teaching in the doctoral program is based on courses, some of them are specific and others are shared. They aim to provide a deep knowledge of the topics also thanks to practical training.

A **Basic Science Week** for the PhD Course of the Medical Area will be organized in collaboration with other PhD Courses: **Winter School** - the teaching activity (including modules of 90 minutes each and masterful readings) deals with different topics that range from basic sciences to general culture and with topics and methodologies of common interest and transversal to all doctoral courses in the medical area.

**Specificities**

Particular emphasis will be placed on the improvement of scientific writing and oral presentations in English, on bioinformatic competences (sequence and dataset analyses) and on communication skills. We plan to exercise students to write small grants to facilitate their participation to fellowship programs and larger grants to get acquainted with the forms for ERC application.

The novelty for this year will be the organization of a course on **Science Communication in Biomedicine and Bioscience**. The learning program of the course will be focused on simulations and on direct involvement of participants. Students will experiment how to effectively communicate scientific and technical information to different audiences, in various contexts and situations, using suitable language and to appropriate content and messages.

**For the new year series**, we will carry out an entirely new set of seminar and courses, complementary to last year ones, focusing on:

- Genomics
- Big data analysis
- Single cell analysis
- Multiomics

Please note that among the specificities of this year Educational goals, we are planning other courses which PhD students can optionally attend (organized by University of Padova in collaboration):

- **English language courses** (organized by Centro Linguistico di Ateneo – CLA) with the aim of developing the linguistic skills necessary for writing research/projects, scientific publications and acquiring fluency in conversation; this attitude will also be deepened in the context of the seminars planned in the training course;

- **PhD Educational week on Transferable skills; International Summer and Winter School & Short Courses** aimed to enhancing the so-called "transversal skills" of doctoral students and providing them with the tools useful also for a better understanding of the aims of the International Programs and ways of accessing funding in order to facilitate the presentation of proposals to the calls;

- **Contamination LAB Veneto** (extracurricular training course) is a multidisciplinary contamination project involving also PhD students. The goal is to promote the culture of enterprise and innovation, interdisciplinarity and the dissemination of new learning models and to enhance the results of scientific activity also in relation to the protection of intellectual property.
Research topics

**Basic research** are focused on the identification of molecular mechanisms driving cell differentiation, stemness, and involved in the pathogenesis of infectious, genetic, degenerative and neoplastic diseases. In particular: signal transduction mediated by growth factors and hormones; enzymes involved in the redox homeostasis of proteins involved in differentiation; genes involved in extracellular matrix biosynthesis; mechanical stimula and wound repair; physiopathological basis of reproduction; micronutrients and vegetal antioxidants in degenerative and neoplastic diseases and in the aging; hepatitis C pathogenesis and hepatic fibrosis mechanisms; alteration of liver function after liver transplantation; structure and function of viral genes; genetic and biochemical mechanisms of resistance to antiviral drugs; characterization of the bacterial pathogenetic mechanisms; molecular basis of the physiopathological mechanisms of the nervous system; development and characterization of murine models.

**Translational research** aim to develop preventative agents (vaccines), diagnostic and therapeutic tools, including gene therapy, new anticancer drugs, and regenerative medicine. In particular: development of viral and bacterial vectors for gene therapy and vaccine delivery; development of new tools of molecular diagnostics based on "omic" sciences; bioelectronics and nano-biotechnologies: new materials at nanometric scale for the development of biosensors; biomarkers and predictability of the response to the therapy of chronic inflammatory gut diseases; development of diagnostic approaches and sterility therapy; cell and gene therapy of infectious, degenerative and neoplastic diseases; stem cells from peripheral blood, adipose tissue, enteric nervous system, and IPS (induced pluripotent stem cells); metallic, polymeric, and biological biomimetic surfaces; design, synthesis, and delivery of cell adhesion, growth, pro- and anti-angiogenic factors; in vitro reconstruction of vascular, tracheal, esophageal, liver tissue engineered substitutes; drug target finding; drug delivery.
Facilities

Laboratory space of about 2500 m$^2$. This space includes about 200 work-stations and is fully equipped with “state of the art” scientific instruments as i) high throughput DNA sequencing system, ii) real time quantitative PCR systems, iii) confocal microscope, iv) electronic microscope, v) cytofluorimeters, vi) fluorescent microscopes, vii) DNA microarray Hybridization station, viii) microarray scanner, ix) mass spectrometers, ix) traditional and next generation DNA sequenators, x) SNP and mutation analyzers, xi) 10X genomics single cell analysis.

- BL2 and BL3 Laboratory to manipulate dangerous infectious agents and recombinant microorganisms
- Certified animal house for GMO manipulation
- Microinjection system for transgenesis
- Laboratory of proteomics and protein chemistry
- Bioinformatic laboratory
The work of the Department involves various fields which all converge on the study of biology and human pathology. The Department comprises personnel with reciprocal competences in biochemistry, biophysics, microbiology, virology, tissue, cell and molecular biology, environmental and forensic toxicology, infectivology and clinical medicine, chemotherapy, epidemiology, public health, and occupational medicine.

Cultural contiguity among these areas derives from integration between biomedicine and evidence-based medicine. Cultural contents stand out for their complementarity, with a central theme in advanced analytics and precise computational analysis.

The Department also works on advanced chemical and biochemical analyses and expects growing interest in bio- and nanotechnologies and other "–omic" technologies.

**Main Laboratories**

- Acidi Nucleici
- Biochimica generale e metabolismo
- Laboratorio di Neurofisiologia
- Laboratory of Pluripotent Stem Cell biology
- Mechanobiology Laboratory
- Medicina Computazionale
- MycoLab
- Sviluppo Antivirali
- Trasduzione del segnale e cellule staminali