



PhD program in Life, Environmental and Drug Sciences

Organized in the following curricula:

- BIOMEDICAL
- ANIMAL AND HUMAN BIOLOGY AND ECOLOGY
- DRUG SCIENCES

SCIENTIFIC AREAS	05 – BIOLOGICAL SCIENCES; 03 – CHEMICAL SCIENCES; 06 – MEDICAL SCIENCES;
COORDINATOR	PROF. ENZO TRAMONTANO
PLACE	DEPARTMENT OF LIFE AND ENVIRONMENTAL SCIENCES
LENGTH	3 YEARS
EDUCATIONAL GOALS AND RESEARCH AREAS	<p>The PhD program involves 38 professors (21 of biological areas, 16 of chemical areas, 1 of medical area) with multidisciplinary expertise in: biochemistry, genetics, microbiology, pharmacology, physiology, virology for the Biomedical areas; anthropology, comparative anatomy, ecology and zoology for the environmental area; organic chemistry, pharmaceutical chemistry and pharmaceutical technologies for the drug development area.</p> <p>The PhD program is organized in 3 curricula: i) <i>Biomedical</i>, in which the students will acquire competences in biochemistry, genetics and microbiology; ii) <i>Human and Animal Biology and Ecology</i>, in which the students will acquire competences in anthropology, comparative anatomy, ecology and zoology; iii) <i>Drug Sciences</i>, in which the students will acquire competences in organic chemistry, pharmaceutical chemistry and pharmaceutical technologies.</p> <p>With respect to the first year of the program, students of all the three curricula will have to:</p> <ul style="list-style-type: none"> – Possess a systematic understanding of a research theme in one of the above described investigational areas; – Master the analysis of biological and environmental phenomena and pharmaceutical problems by scientific methodologies and advances technologies currently used in the above described investigational areas; – Deal with problems in the above described investigational areas learning to ask questions scientifically relevant; – Demonstrate the ability to conceive, design, implement and perform experimental approaches to answer the identified questions. <p>With respect to the first year of the program, students of the different curricula will have the following learning objectives:</p> <p><i>Biomedical curriculum:</i></p> <p>The Curriculum provides a solid knowledge on complex biological systems focused on structural and functional biochemistry of proteins and nucleic acids, integrating notions focused on protein/ligand interactions (i.e. salivary proteins, or interaction viral proteins/small molecules), protein/protein interactions (i.e. viral vs cellular proteins interactions), proteins/nucleic acid interactions (i.e. DNA for proteins involved in autoimmune diseases, RNA for proteins involved in innate immune system down-regulation). In addition, the curriculum provides a solid knowledge also on nutrition applied to sport and biochemical processes linked to oxidative stress, respiratory, and hemodynamic stress due to muscular efforts.</p> <p>More specifically, the investigational areas for this curriculum are:</p> <ul style="list-style-type: none"> • Proteomics and peptidomics investigations of body fluids, tissues and cells (saliva, CSF, BALF, brain, etc.) by LC-MS and 2-DE-MS platforms to assess protein/peptide expression profile and PTMs in health and disease or drug-treated samples and to discover, identify and quantify new disease biomarkers.

- Proteomic analysis of fibromyalgic patient body fluids by 2-D electrophoresis to identify new pathological biomarkers.
- Molecular and kinetic characterization of enzymes and identification of bioactive elements in plant extracts.
- Identification and functional characterization of regulatory proteins involved in autoimmune disease pathogenesis.
- Identification, characterization and exploitation of new viral targets
- Analysis of human endogenous retrovirus sequences
- Evaluation of small molecules with anti-tyrosinase activity
- Evaluation of the hemodynamic response to physical exercise in patients with chronic-degenerative pathologies such as: heart transplantation, paraplegia, multiple sclerosis, diabetes, obesity, heart failure, hypertension.
- Hemodynamic consequence of muscle reflex activation (Metaboreflex) in both healthy individuals and patients.
- Evaluation of physical capacity in athletes and patients.

Animal and Human Biology, and Ecology curriculum:

The Curriculum provides a solid knowledge regarding the valorization of marine biodiversity with particular reference to fish and macro-invertebrate species that characterize the sea and inland waters of Sardinia. Solid skills will be acquired related to the ability to: i) plan interventions for the prevention, management, protection and conservation of natural resources, ii) assess the impact of anthropization, iii) design programs of environmental restoration, iv) carry out theoretical and experimental studies which will valorize seafood in quality and safety. In addition, the Curriculum provides a solid knowledge concerning the definition of micro-evolutionary processes of human populations, in the light of molecular, anthropometric, biodemographic, and osteological data, and those arising from the 'man-environment' interactions.

More specifically, the learning objectives for the first year include:

- The study of the natural environment in all its biotic and abiotic components for the analysis of processes, systems and productive problems with special attention to the marine and brackish ecosystems (sea and lagoons).
- The study, conservation and sustainable use of marine biodiversity in the Mediterranean. In particular, the following main topics will be addressed: reproductive cycles, estimates of abundance, distribution, recruitment mechanisms and bio-ecological correlations for Mediterranean teleosts, crustaceans, cephalopods and selachian species.
- The study of the anatomy of mammals and amphibians at various levels with particular attention to confocal laser microscopy on the innervation of the pancreas and the central nervous system.
- the analysis and systematics of fossil remains of the human lineage in the process of hominization and sapientization; applied research in the bioarchaeological field, in its osteological, paleo-demographic and molecular aspects; study of the evolution of cultures and subsistence strategies in their naturalistic aspects.
- Reconstruction of the history of human settlement through the study of bio-anthropological and molecular markers; bio-demographic studies; biodiversity of human populations in relation to the processes of adaptation; human biology applications useful to understand the different susceptibility to disease in human populations; evaluation of anthropometric characteristics and body composition in relation to the life cycle and motor activities.

Drug Sciences Curriculum

The Curriculum aims at providing a sound knowledge designed to form qualified drug experts. In particular, in-depth analysis will concern synthesis and extraction of drugs and bioactive molecules, analysis of structure-activity relationships, study and application of analytical methods for drug identification and dosage, formulation and development of traditional and innovative (drug delivery systems) pharmaceutical dosage forms to improve biopharmaceutical properties; characterization of stability and quality control of the final medicinal products, and pharmaceutical technologies applied to regenerative medicine. More specifically, the learning objectives for the first year include :

- Drug design and synthesis by special methods and synthetic approaches; structures and analysis of molecules of biological interest; phytochemical applications.

	<ul style="list-style-type: none"> • Synthesis and study of organic materials and biological compounds and • characterization by spectroscopic techniques and computational chemistry. • Preformulation, biopharmaceutical principles, design, development and control of a conventional or innovative (Drug Delivery Systems) pharmaceutical dosage form; pharmacokinetics and metabolism. <p>At the end of the PhD program the student must be able to:</p> <ul style="list-style-type: none"> – Perform independent research activities in one of the following fields: animal biology, biochemistry, ecology, genetics, human biology, microbiology, molecular biology, pharmaceutical chemistry, pharmaceutical technology, pharmacology, physiology, virology; – Have a systematic knowledge and understanding of a research area in one of the above investigational fields; – Analyze, with wide and deep perception, biological and environmental phenomena and pharmaceutical problems by scientific methodologies and advances technologies currently used in the above described investigational areas; – Deal with problems in the above described investigational areas learning to ask questions scientifically relevant; – Conceive, design and perform experimental approaches to answer the identified questions; – Give a scientific original contribution in a research area within the above described investigational fields, showing to have acquired capacities of critical analysis, evaluation and synthesis of new and complex ideas, adequate to the biological and chemical system complexities; – Communicate the results of research, in both written and oral forms, to peers as well as to the national/international academic community – Interact with academic, technological and professional environments – Promote within academic and professional contexts, technological, social and cultural advancement in a knowledge based society. <p>The PhD students, at the end of the program, will obtain high competences in one of the above described investigational areas, a complete judgment autonomy, an adequate communication skill, a high ability to learn new information and apply new technologies to one of the listed research areas. Therefore they will be able to:</p> <ul style="list-style-type: none"> – Perform research activities in academia and research centers; – Perform research activities in companies focused on biomedical, environmental and drug development activities; – Perform promotion and developmental activities regarding innovation technologies, new technology design and management in biomedical, environmental and drug development fields; – Perform professional activities related to i) the study and understanding of biological phenomena at molecular, genetic and microbiologic level; ii) the regulated and incremental use of biotic resources in the environmental field; iii) the design and development of new molecules and release systems in the pharmaceutical field; – Perform advice activities in biomedical, environmental and pharmaceutical fields;
ADMISSION TESTS	ASSESSMENT OF QUALIFICATIONS, CURRICULUM VITAE, WRITTEN TEST AND INTERVIEW. ALL ADMISSION TESTS CAN BE CONDUCTED IN ENGLISH
ADMISSION TESTS FOR FOREIGN APPLICANTS	ASSESSMENT OF QUALIFICATIONS, CURRICULUM VITAE AND INTERVIEW (ALSO VIA SKYPE)
DATE AND PLACE OF ADMISSION TESTS	WRITTEN TESTS: DECEMBER 6, AT 10:00 A.M., ROOM 17 CITTADELLA DI MONSERRATO, CAGLIARI INTERVIEW: DECEMBER 12, AT 9:30 A.M. THE PLACE WILL BE NOTIFIED THE DAY OF THE WRITTEN TEST.
TOPICS OF THE WRITTEN TEST	<i>Biomedical curriculum</i> Structure, function and metabolism of biological macromolecules. Structures and replication strategies of animal viruses and mechanism of interaction with host cells. Bioenergetic of human movements.

	<p><i>Human and Animal Biology and Ecology curriculum</i> Animal and Human Biology, and Ecology curriculum: study of the animal and human biodiversity (ecological, morphological and evolutionary aspects) with special attention to the methods and applications related to the management and conservation of natural resources, the ecological processes and the 'man-environment' interactions.</p> <p><i>Drug Sciences Curriculum</i> Nanotechnological applications to drug delivery. Ethanol psychopharmacology in light of its metabolism. Genetic manipulations in neuro-psychopharmacology research. Biopharmaceutical properties of medicines. Conventional and modified release dosage forms. Methodologies and issues related to discovery, design and development of drugs. Chemotherapeutic agents. Drugs acting on the cardiovascular system, affecting the immune system active, or acting on the central nervous system.</p>
POSITIONS	12
SCHOLARSHIPS	6 (1 OF WHICH RESERVED FOR FOREIGN CANDIDATES)
POSITIONS WITHOUT SCHOLARSHIP	6
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