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From molecules to cells: a translational path towards novel therapeutics

PROF. WANDA LATTANZI – ALESSANDRO ARCOVITO

Area of study:	Experimental biology, biochemistry, applied sciences
Area Code:	BL / CH 300
Credit	6 ECTS
Dates	08 – 19 June (2 weeks)

Course description/overview

This course will delve into innovative strategies for drug design, smart delivery, and biological testing exploited in modern medicine for the treatment of different conditions. Rooting on cellular and molecular mechanisms implicated in human diseases, a detailed emphasis will be devoted to explaining state-of-the-art biotechnologies, including AI-based computational tools, biochemical assembly of nanocarriers, stem cells and advanced cellular models.

Goals/learning objectives

At the end of this school the students will have gained knowledge on:

- general disease mechanisms affecting cellular organelles and compartments
- molecular cascades and signal transduction pathways enabling the identification of key molecular players
- workflow for in silico protein modeling and drug design
- drug delivery systems
- stem cells and cell-based disease modeling
- main functional assays exploited for in vitro drug testing.

Students will have the opportunity to delve into practical activities during simulated laboratory sessions, on paradigm disease models, aimed at acquiring technical competences for conducting an experimental path.

Course's pre-requisites

Students attending this school should have gained basic knowledge in chemistry, biochemistry and general biology, including ground knowledge in human genetics.

Course requirements

Students are expected to:

- attend lectures and participate in class discussions,
- attend the laboratory experiential sessions.

Grading

Class participation	25% of final grade (pass/fail)
Home and class assignments	25% of final grade
Final written exam	50% of final grade

Course readings and materials



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- Updated literature, tutorials, protocols and web-links will be provided by the instructors

Teaching methods

The teaching methods implement active learning activities, such as problem-based learning, self-learning, case studies and experimental activities both in simulated laboratory environments using online platforms for virtual laboratory scenarios (Labster, JoVE, BlackBoard platform with associated tools).

Site visits

Visit to research facilities and laboratories at Catholic University and Policlinico Gemelli university hospital.

Rules of conduct

Attendance: Attendance of the entire course is mandatory and this applies also to site visits'. See academic policies for further details.

Exam Date: The exam date cannot be re-scheduled. Should the dates of the final exams be moved for force major reasons, Cattolica International Office and the Professor will promptly inform you in class and/or via e-mail on the new date agreed. Absences to the exams will result in a failing grade in the course.

Bios of the instructors

Wanda Lattanzi, MD, PhD, is a medical geneticist and associate professor of cellular and experimental biology at the Università Cattolica S. Cuore, where she teaches in several bachelor's and master's degree courses, and oversees tutoring PhD students. She holds a documented and internationally renowned scientific expertise, cellular and molecular biology, and translational research, mostly focused on the study of rare disease pathophysiology, somatic stem cells, development of target therapies and tissue engineering strategies for tissue. Her enedvour is deeply rooted in translational research pursuing better care, including diagnostic and therapeutic strategies, for rare disease patients. She obtained funds for her research activity through the national and international agencies, and collaborates with a wide network of international groups in Europe and abroad. She currently coordinates a group of ten young researchers, PostDocs and PhD students.

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Alessandro Arcovito is full professor of biochemistry at the Università Cattolica del Sacro Cuore (UCSC) in Rome, where he teaches related disciplines in several master and bachelor degree courses, and leads a research group dedicated to the characterization of Drug Design and Delivery for smart drugs (smart3D). He has been involved in research activities for over 20 years in the field of protein biochemistry and structural biology. In particular, he has a well-documented expertise in the study of molecular recognition mechanisms between proteins and ligands, serving as a starting point for the development of next-generation drugs. This involves the use of leading spectroscopic techniques combined with time-resolved protocols, as well as advanced computational methods such as docking and molecular dynamics.

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Federica Tiberio is an assistant professor of cellular and experimental biology at the Università Cattolica del Sacro Cuore in Rome (Italy), where she teaches in several bachelor's and master's degree courses, and oversees tutoring students and PhD students. She obtained her Medical Biotechnology Master's degree in 2017 from the Università "La Sapienza" in Rome and in 2022 she completed her Doctorate in Experimental and Translational Medicine at Department of Life Sciences and Public Health at Università Cattolica del Sacro Cuore, in Rome. During her scientific career, Dr. Tiberio acquired a wide expertise in cellular and molecular biology mainly applied to skeletal disorders. In this context, she focused her experimental activities on the characterization of the pathogenic mechanisms involved in bone-related rare conditions and on the development of innovative therapeutic strategies for the treatment of these conditions.

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Elvira Ragozzino is a post-doc researcher at Università Cattolica del Sacro Cuore. She graduated in Medical Biotechnologies in 2014 at Università degli Studi di Napoli “Federico II” and obtained her PhD in Neurosciences in 2022 at Università Cattolica del Sacro Cuore. Over the past 8 years, Dr. Ragozzino has been involved in many research projects in the field of neuromuscular disorders and rare diseases. Her areas of expertise include skeletal muscle regeneration, molecular and cellular biology and her main interest is in the identification of tissue and circulating biomarkers for muscular dystrophies focusing on inflammation and extracellular vesicles. Contact: elvira.ragozzino@unicatt.it

Noah Giacon is a PhD student in Experimental and Translational Medicine at the Department of Basic Biotechnological Sciences, Università Cattolica del Sacro Cuore in Rome, where she also completed her Master's degree in Biotechnology for Personalized Medicine. Her research focuses on protein biochemistry, nanotechnology, and drug delivery systems for rare genetic and infectious diseases. She has developed PLGA-PEG-bis-sulfone nanoparticles for siRNA delivery in Crouzon syndrome and functionalized nanoparticles for targeted SARS-CoV-2 inhibition. She has particular expertise in Surface Plasmon Resonance technology for studying protein-protein interactions and protein binding to complex biological systems. She recently completed an EMBO Scientific Exchange Grant-sponsored research visit at the Danish Cancer Institute in Copenhagen, where she worked on functionalized PLGA-based nanoparticles for selective targeting of Group 3 medulloblastoma.

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Giorgia Canini obtained her Master's degree in Pharmaceutical Chemistry and Technology from La Sapienza University of Rome in 2021 and completed her PhD in Experimental and Translational Medicine at the Università Cattolica del Sacro Cuore in 2025. Her research focused on lysosomal storage disorders, with particular attention to drug repurposing and the structural analysis of enzymes involved in these conditions. She gained experience in computational methods applied to drug discovery and repurposing, including techniques such as molecular docking, molecular dynamics, and metadynamics. She also has extensive experience using high-performance computing and specialized software tools for biopharmaceutical research. She has worked in both academic and industrial settings, participating in interdisciplinary projects. This dual background has provided her with a comprehensive view of research, emphasizing the practical application of scientific results and therapeutic innovation. Her work integrates computational structural biology with translational research, aiming to accelerate the development of innovative therapies.

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Martina Salvati obtained her PhD in Experimental and Translational Medicine in 2025 at the Department of Life Sciences and Public Health at the Università Cattolica del Sacro Cuore in Rome, after completing her Master's degree in Biotechnology for Personalized Medicine in 2021 at the same institution. During her professional training, she gained extensive experience in cell and molecular biology applied to the study of disease mechanisms in the field of pediatric skeletal diseases and craniofacial defects. She has also been involved in several research projects, including the design and validation of siRNAs, the development of highly biocompatible nanodelivery systems for the intracellular delivery of therapeutic molecules, and the 3D printing of nano-functionalized inks for therapeutic applications in craniofacial malformations.

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