A.D. 1308 unipg
DIPARTIMENTO DI SCIENZE FARMACEUTICHE

DOCTORAL PROGRAM IN PHARMACEUTICAL SCIENCES

Frontal teaching provided by the doctoral course

a.a. 2026-27

Prof. Luca Sancineto - University of Perugia	**2 CFU, 12h**	**EPDD**	**January 18–21, 2027**

Catalytic approaches in the synthesis of biologically relevant molecules

In the era of a green new deal and given the importance of catalysis for the development of sustainable synthetic processes, the aim of the course is to provide an overview of the most recent advancements regarding biomimetic and metal-based approaches. Particular emphasis will be devoted to biomimetic approaches in oxidative transformations, and metal catalysts employed in C-C bond formation and activation of otherwise unreactive C-H groups

Prof. Claudio Santi- University of Perugia	**2 CFU, 12h**	**EPDD**	**February 8–10, 2027**

Modern NMR techniques for structure elucidation

NMR spectroscopy is a very relevant technique for characterization of organic compounds, during the last couple of decades tremendous improvements have been made on the application of two-dimensional spectroscopy for the purpose of structural elucidation of organic compounds. Similarly new modern tools enable to study the interaction of small molecules with macromolecules, the reaction kinetics improving the possibility to define a reliable reaction mechanism. Course Outline: The course topics are organized 4 units: a) brief remind of basic concepts, principles and terminologies associated with NMR spectroscopy, b) introduction of various strategies and experiments in interpreting complex spectra and assign 3D-structures, c) nterpretation of various 1D and 2D NMR spectra of simple and complex organic molecules, d) novel tools in early phase drug discovery and mechanistic investigation.

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Prof. Tommaso Felicetti – University of Perugia	**2 CFU, 12h**	**EPDD**	**March 16-17, 2027**

Identification of RNA small molecule binders: techniques and therapeutic applications

RNA has emerged as a valuable therapeutic target, broadening the scope of the druggable genome beyond the limitations of traditional protein-centric paradigms. Targeting RNA with small molecules provides an opportunity to modulate gene expression, pre-mRNA splicing, and non-coding RNA functions in various therapeutic areas, such as oncology, infectious diseases, and neurodegenerative disorders. However, RNA targeting presents unique challenges, such as dynamic conformational landscapes and highly charged backbones. This requires a tailored understanding of recognition mechanisms, structural motifs, and binding modes, which differs from traditional protein-directed drug discovery.

This course provides a comprehensive overview of the principles, strategies, and biophysical methodologies used to identify and characterize small-molecule RNA binders. The 8-hour theoretical module begins with a historical perspective and an examination of clinically successful RNA-targeted drugs and advanced candidates. Students will explore key binding modes, such as intercalation, groove binding, and riboswitch modulation, and compare the advantages, limitations, and specific features of targeting RNA versus proteins. The course also focuses on translating and adapting established biophysical platforms to RNA targets. These platforms include Fluorescence Resonance Energy Transfer (FRET), 1D/2D Nuclear Magnetic Resonance (NMR), Surface Plasmon Resonance (SPR), Differential Scanning Fluorimetry (DSF), and MicroScale Thermophoresis (MST).

The 4-hour practical laboratory session provides basic experience in handling RNA samples and running a simple biophysical assay. Students will perform essential sample preparation steps, including thermal annealing to enable proper RNA folding. Using a long non-coding RNA (lncRNA) model, participants will set up a FRET assay to test reference ligands at fixed concentrations and observe binding-induced signals. The course offers an overview of RNA-targeted drug discovery and provides a practical introduction to handling RNA for FRET-based screening.

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Prof. Franco Lombardo-CmaxDMPK,LLC	**2 CFU, 12h**	**EPDD**	**April 5–7, 2027**

Short course on ADME-PK and physiochemical properties of Drugs

This course will cover all aspects of drugs ADME ranging from in silico, in vitro and in vivo methods to study Absorption, Distribution, Metabolism and Excretion, with reference to the physiological and physicochemical bases underlying the pharmacokinetics of drugs.
Each section will be divided in two modules covering different topics. Great emphasis will be placed on physicochemical properties of drugs, with lipophilicity impact at the core, and structure properties relationships (QSPRs). Some pharmacokinetics aspects and calculations, with reference to human PK and dose prediction will be covered in all sections.

Professor Oluwatoyin A. Odeku, Professor of Pharmaceutics, Faculty of Pharmacy, University of Ibadan, Nigeria	**3 CFU, 18h**	EPDD	**May 10, 11, 13, 17, 18, 20, 2027**

Excipient Development for Advanced Pharmaceutical Formulations

The course addresses the critical need to evolve pharmaceutical excipients from inert components into multifunctional materials required by modern drug delivery systems, nanomedicines, biologics, and personalized medicine. The rationale stems from the essential role excipients play in determining product quality, safety, efficacy, manufacturability, and therapeutic performance. To overcome existing technological challenges and support sustainable, innovative formulations—such as natural sources and smart, stimuli-responsive materials—the course equips PhD students with comprehensive expertise in excipient design, characterization, regulatory science, and industrial translation.
The 18-hour PhD-level curriculum (3–4 ECTS) comprises six thematic lectures. Teaching methods include interactive lectures, functional characterization studies, engineering strategies (e.g., chemical/physical modifications, co-processing), case studies on sustainable excipient sources (including African medicinal plants), and the application of Quality-by-Design (QbD) and artificial intelligence.
Student performance and mastery of learning outcomes are evaluated through the development and presentation of novel excipient research proposals in a student seminar, alongside critical evaluations of excipient functionality, drug-excipient compatibility,

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Prof. Maria Letizia Barreca - University of Perugia	**2 CFU, 12h**	EPDD	**June 30, July 1 and 2, 2027**

Exploring Computer-Aided Drug Discovery:Theory and Practice

This course is designed for PhD students aiming to delve into the interdisciplinary field of computer-aided drug discovery (CADD). Combining theoretical foundations with practical applications, the course offers a comprehensive overview of modern computational techniques used in the identification and development of new therapeutic compounds. Students will explore key topics such as molecular modeling, virtual screening, pharmacophore modeling, ADME prediction and machine learning
approaches in drug design. The course includes hands-on experience with state-of-the-art software tools and real-world case studies, fostering the ability to tackle complex challenges in drug discovery. By the end of the course, students gwill have gained a thorough understanding of the principles underlying CADD. This knowledge will empower them to effectively participate in and contribute to multidisciplinary projects where this expertise is crucial, thereby enhancing their ability to drive innovation in both academicand industrial settings.

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Prof. Elisabetta Albi - University of Perugia	**2 CFU, 12h**	PTN	**July 12-13, 2027**

Application of RT-PCR in basic and clinical research

Reverse transcription-polymerase chain reaction (RT-PCR) is a relatively simple and inexpensive technique to determine the expression level of target genes and is widely used in basic and biomedical science research. In the course, it will be explained how obtaining high quality and intact RNA is the most important critical step for performing RT-PCR as the RNA is easily degradable due to the difficulty of completely inactivating the RNAse. The study of RNA integrity and the synthesis of cDNA will be shown. The practical demonstration of the use of cDNA Reverse Transcription kit will follow. The importance of housekeeping genes as well as data analysis will be explained. Examples of analyzes will be made in basic research experiments such as normal or cancerous cells and/or clinical research such as lymphocytes extracted from patient blood.

Prof. Andrea Capotorti - University of Perugia	**2 CFU, 12h**	**EPDD**	**To be defined**

Elements of statistic:Introductory Course

This course offers an overview of the key concepts in descriptive and inferential statistics. Topics include data collection and organization, measures of central tendency and variability, graphical representations, and an introduction to probability and statistical inference. It is designed for learners who wish to develop essential tools for critically and effectively analyzing data, even without an advanced mathematical background.