Educational Activities
PhD in "Translational Medicine"
XXXIX Cycle: 2023/2024

List of PhD courses

Course	Languag	Lead Instructor	CFU	Course Description
English for Academic Skills.	English	CLA	3	The course aims to improve language skills, including speaking, pronunciation, writing and vocabulary in the field of the PhD Program. The teaching approach is communicative and learner-centered. The lessons will be dynamicand will include the use of videos and group works. Furthermore, participants will have the opportunity to conduct short oral presentations during the lessons, in order to share cultural and research experiences.
Evidenced-based medicine: basic principles and goals.		Prof. Ines Barone	1	The present course aims to provide the concept and principles of Evidence-based Medicine (EBM), as a means to improving the quality of healthcare. The program develops the knowledge and skills necessary for using scientific evidence in the clinical decision-making process and in translational research. Particular attention will be paid to systematic reviews, and meta-analyses, having a high level of evidence as represented by the evidence-based pyramid. The step EBM model will be also introduced.
Preclinical and clinical evidence for drug development.		Prof. Giacinto Bagetta Dr. Damiana Scuteri	2	The process of developing a novel drug is time consuming and costly. To increase the chances of successfully completing a clinical trial leading to the approval of a new drug, the choice of appropriate preclinical models is of extreme importance to better mimic the complexity of human disease mechanisms. The course aims to provide the principles of preclinical and clinical evidence for drug development, encompassing the activities that link drug discovery in the laboratory to initiation of human clinical trials.
R&D strategies for drug development: the value of meta-analysis and randomized confirmatory trials in preclinical research.		Prof. Diana Amantea	1	Rigorously conducted meta-analysis and randomized confirmatory trials are useful tools in preclinical research for drug development. The course will focus on the importance of validating experimental data through rigorous (e.g., inclusion/exclusion criteria, placebo/control, blinding, randomization, etc.) and widely applicable (e.g., multicenter studies, etc.) evidence. Attention will be drawn on recently approved protocols for preclinical research of neuroprotective strategies in ischemic stroke.

Regulatory, ethical and scientific aspects for the use of animals in research.		Dr. Rocco Malivindi	2	The course is aimed to give a general knowledge on the regulatory, ethical and scientific aspects for the use of animals in research. In particular, the following topics will be discussed: anatomy, physiology and ethology of animals used for scientific purposes; national regulations on animal research; management of animals used for scientific purposes; genetically modified animals; guidelines for the ethical use of animals in research; the 3 Rs and alternative methods to the use of animals for scientific purposes.
Nanomaterials for medicine	English	Prof. Gerardo F Goya	1	Nanomaterials have been widely used in medicine and pharmaceuticals because of their specific mechanical, optical and electrical behaviours. Nanomaterials are applied for the detection of biological molecules, imaging of diseased tissues and innovative therapeutics. The course aims to give a general introduction into the nanomaterials for medicine. In particular, the following topics will be discussed: introduction on nanomaterials and nanoparticles; the bio-nano interaction; biomedical applications of magnetic nanoparticles: possibilities and limitations; questions, open prospects, conclusions.
Innovative technologies for drug delivery		Dr. Giuseppe Cirillo Prof. Francesca Iemma	1	The course aims to explore recent developments in the synthesis and supply of nanomaterials for the controlled release of anticancer drugs with a special focus on targeted systems and systems sensitive to external stimuli systems. It will be highlighted how knowledge of the physio-pathological conditions of the tumor site may allow the design of intelligent systems capable of maximizing therapeutic performance. Particular emphasis will be given to the most suitable formulation techniques for the translation of intelligent nanomaterials into clinical practice.
Nanotechnologies and drug delivery: physicochemical properties of nanomaterials		Prof. Fiore Nicoletta Dr Manuela Curcio	1	The course aims to highlight the chemical-physical parameters (morphology, size distribution, surface charge) that may influence the performance of nanoparticle systems. This characterization is crucial to establish how the formulation can modify the pharmacokinetic profile of the drug, but also the degree of response of the carrier to external (application of magnetic and electric fields, hyperthermia) or internal (pH variation, redox state) stimuli at the tumor site. Furthermore, the empirical models useful for the description of the release kinetics will be discussed.
Flow cytometry and 'in vivo' Imaging.		Prof. Rosamaria Lappano	1	The course aims to give an overview of basic principles and applications of flow cytometry, a sophisticated technique used to analyze cells for a variety of purposes in translational research. The objective of the course is also to provide a thorough and updated knowledge of the rapidly evolving high- resolution 'in vivo' imaging technologies as a unique opportunity for studying biological processes of living organisms in real time on a molecular level. In particular, the following

			topics will be discussed: concepts, sample preparation, applications and recent advances of flow cytometry; fluorescence microscopy basics; probes and optimized approaches for fluorescence live cell imaging.
Strategies for the identification of new diagnostic targets in molecula medicine.		Dr Graziantonio Lauria	1	Description of the clinical, biochemical, and molecular features of six Caucasian patients from Italy, Spain, and North America affected by mitochondrial carnitine-acylcarnitine translocase deficiency.
Novel cellulose materials for advanced applications.		Prof. Paola Costanzo	2	Cellulose, the most abundant biopolymer on Earth, represents a great challenge both from a chemical and environmental point of view. Research on cellulose ideally fits within many research programs both at the national and international level, since it complies with the Sustainable Development Goals defined by the United Nations in 2015. Cellulose became one of the main topics of research worldwide in brief time, due to its wide natural availability, biodegradability, and chemical–physical properties. In the recent years, many examples of new cellulose materials were developed not only as synthetic catalysts [1], but also for water remediation [2], bio-composites development [3], and for different biomedical applications [4]. The current knowledge on its classification, preparation, functionalization, and applications will be presented, outlining its versatility in these frameworks.
Systems coding & classification for recovery from the information within healthcare.		Dr. Erika Pasceri (PhD)	1	The course aims to provide students basic elements and methodological as well as procedural skills applicable to the health domain, with a particular focus to coding and classification systems for the management of electronic documents. The course also aims to provide students with methodologies and techniques related to information retrieval procedures employed over specialized databases within the health domain.
Use of primary cellular and organotypic cultures in preclinical studies: focus on neurodegenerative diseases		Dr. Annagrazia Adornetto	1	The course aims to discuss the advantages and disadvantages of primary cellular and organotypic cultures as well as their potential to investigate the complex mechanisms of human neurodegenerative diseases.
Biotechnologies for translational medicine		Dr. Pietro Rizza	2	The main objective of the course is to provide a deep knowledge on the major technologies and innovative approaches concerning the development of recombinant molecules with therapeutic activity, such as recombinant antibodies, vaccines, peptides, biosensors etc. Moreover, methods for protein isolation and purification from tissue or cells will be discussed. After attending the course, the students will be able to discuss

				critical points, experimental designs and interpretation of the results about the topics presented.
The Role of Proteomics in Cancer.		Dr. Luca Gelsomino	1	Proteomics, the primary tool for proteome research, is a relatively new and extremely dynamic branch of science focused on evaluating protein expression. This science, therefore, aims at the identification of proteins, the quantification, the characterization of post-translational modifications, the elucidation of the structure and function and the description of possible interactions. Cells, serum and tissues can represent possible biological samples from which important information can be extracted in order to identify new prognostic and predictive biomarkers in the oncology field. Overall, proteomics could become a powerful tool in translational cancer research. This course aims to provide the knowledge related to the main proteomic techniques and their application in basic and translational research.
Transcriptomic analysis		Prof. Erika Cione	1	After completing the Human Genome Project and beginning the post-genomic era, global transcriptome analysis has become indispensable in basic research, translational, and clinical studies. This approach is feasible and practical for analyzing gene expression profiles in different spatial or temporal samples and identifying essential genes. Prosigna and EndoPrectict IVD diagnostic tests are examples of transcriptomic-based analysis. The present course aims to provide the concept and principles of the biochemical molecular techniques for global transcriptome analysis focusing on real data coming from Prosigna and EndoPrectict transcriptomic-based analysis.
Research and innovation.	English	Liason Office	3	The training program PhD 3.0 is addressed to stimulate the valorisation of PhD Student research results through a path aimed at identifying and managing European Union funds (i.e. Marie Sklodowska Curie Actions), the protection of Intellectual Property and the main methods of technology transfer (Enterprise Creation).
Translational cancer research I	English	Prof. Bruno Simoes	1	The course aims to highlight the different hallmarks of cancer, describing the strategies by which a cell may acquire the hallmark, explaining why each hallmark is beneficial/needed and listing examples of hallmarks functional importance in cancer. A particular attention will be paid on cancer stem cells, and the following topics will be discussed: i) cancer initiation in tissue-specific stem and progenitor cells; ii) the cancer stem cell hypothesis; iii) evidence for and against cancer stem cells; iv) resistance of cancer stems cells to current

				therapies; v) s.tem cell signalling pathways as potential targets for cancer therapy.
Translational cancer research II	English	Prof. Suzanne Fuqua	1	The present course aims to give a general introduction into the translational cancer research. The course encompasses a series of lectures on problems in clinical breast cancer diagnosis and treatment, breast development, and evolution of breast cancer, and approaches to translational breast cancer research.
From Ethnobotany to Phytotherapy.		Prof. Filomena Conforti Prof. Rosa Tundis Prof. Giancarlo Statti	3	The present course aims to provide an overview of the knowledge and practices related to the use of medicinal plants. In particular, the following topics will be discussed: i) ethnomedicinal uses of plants, with a special focus on Mediterranean Region; ii) preparation and characterization of phytocomplexes; iii) innovative phytotherapy application.
Molecular Cell Biology: 1) Cancer cell metabolis: the role of nutrients 2) Serine and one carbon metabolism in cancer 3) Targeting cholesterol for anti-cancer therapy 4) Estrogen receptors-mediated apoptosis in hormone-dependent cancers 5) Steroid hormones in cancer progression		Prof. Vincenzo Pezzi Prof. Ivan Casaburi Prof. Rosa Sirianni Prof. Adele Chimento Prof. Francesca De Amicis	1 1 1 1 1	The present course aims to provide an overview of the molecular mechanisms related to cancer cell biology. The following topics will be discussed: i) Cancer cell metabolism, with a special focus on the role of nutrients; ii) Serine and one carbon metabolism as a crucial process for cancer growth and progression; iii) Targeting cholesterol metabolism as a promising potential anti-cancer drug therapy; iv) Estrogen receptors-mediated apoptosis in hormone- dependent cancers; v) Steroid hormones in cancer initiation and progression.
Neuroimaging biomarkers of Parkinson's disease and Parkinsonism.		Prof. Paolo Perrotta	1	As new pharmacological and surgical treatments developed, neuroimaging became one of the most promising biomarkers for diagnosis of Parkinson's disease and Parkinsonism and monitoring disease progression. The present

				course aims to review Magnetic Resonance Imaging (MRI)-related biomarkers in Parkinson's disease and Parkinsonism, with a special focus on the latest techniques, such as neuromelanin and nigrosome imaging, which have the potential to assess nigral and extra-nigral pathology from a microstructural and biomolecular perspective.
Acute myeloid leukemia: molecular basis and target therapy.		Dr. Ernesto Vigna	1	Recently, it has been demonstrated that some somatic mutations (IDH1, IDH2, TP53, DNMT3A, TET2 and "spliceosome genes") are related to a significantly higher risk of inducing AML. Mutations leading to activation of tyrosine kinase receptors such as FLT3, c-kit and RAS signaling machinery are included into class I mutations, while RUNX1/ETO, CBFbeta/MYH11 and PML/RAR alpha, which are hybrid transcripts mutations generated by well-known recurrent chromosomal abnormalities such as t(8;21), inv(16) and t(15;17) respectively, represent examples of class II mutation. Mutations of the transcription factors RUNX1, CEBP alpha and MLL also fall into the latter group. A third class of genes, encoding epigenetic modifiers, including DNMT3A, IDH1, IDH2, TET2, ASXL1 and EZH2, also appear to play a significant role in the pathogenesis of LAM, although the mechanism by which these aberrations contribute to leukemic phenotype is still poorly understood known. AML is a very heterogeneous disease in terms of clinical and bio-molecular features with different onset and clinical outcome depending on morphological and cytogenetic subtypes. Recent molecular analyses have broadened our understanding of this heterogeneity with potential application towards new therapeutic possibilities. Interestingly, although many leukemic blasts in the individual patient show similar morphological features, only about 0.5% of these cells with an immature CD34+/CD38- phenotype have the ability to form colonies in vitro and generate leukemia in immunodeficient mice. These cells, termed clonogenic, display many features in common with normal hematopoietic stem cells, including the presence of resistance mechanisms to a variety of cytotoxic drugs. Based on sophisticated molecular analyses, it has been demonstrated that multiple subclones with different patterns of molecular abnormalities are present at diagnosis, with the subsequent possible expansion, under the selective pressure of chemotherapy treatment cycles, of different subclones. The heterogeneity of leukemia cells in an individual patient has obvious implications for the use and development of therapies targeted at the products of these genetic mutations; moreover, the heterogeneity of leukemic stem cells can also nullify the efficacy of specific antibodies and pharmacological agents. Several intrinsic biological

				characteristics of leukemia cells per se can predict sensitivity to chemotherapy. The great importance of cytogenetics on the initial response and long-term survival was already highlighted in the early 80s and has recently been confirmed by numerous trials of cooperative groups. For example, patients with AML defined as core binding factor [t(8;21), inv(16) and t(16;16)], AML-CBF, are particularly responsive to anthracycline-ARA-C combination and at high doses of ARA-C and have an approximately 60% chance of cure without the need for allogeneic hematopoietic stem cell transplantation Patients with NPM1 mutations have a favorable outcome even with chemotherapy alone, while FLT3 mutations, which cause constitutional activation of the receptor and consequent stimulation of cell proliferation, confer a poor prognosis with a more marked negative effect if such mutation occurs in homozygous. When these mutations occur in association, the presence of the FLT3 mutation cancels the positive effect of the NPM1 mutation, and the patient's prognosis is lower than that expected in the presence of a NPM1 mutation with wild type FLT3.
Chronic lymphocytic leukemia and multiple myeloma: pathogenetic, prognostic and therapeutic aspects.		Dr. Massimo Gentile	1	The course aims to provide students pathogenetic, prognostic and therapeutic advances in the field of chronic lymphocytic leukemia and multiple myeloma.
Bibliographic research and writing of a scientific article.		Dr. Nicola Ramacciati	1	This course will teach students how to use the PubMed search engine effectively, including how to formulate search queries, use filters, and evaluate search results. In addition, to Instruct students on how to identify and assess the quality of research articles and to provide students with practice in conducting research using PubMed.
Preparation of heterocycles with potential pharmacological activity.		Prof. Loredana Maiuolo	2	The course will present a range of synthetic preparations of some heterocyclic compounds such as isoxazolidines, 1,2,3-triazoles, pyrazoles and hybrid molecules containing a triazole core, also discussing their potential biological activity.
Preclinical research for a rationale development of natural products		Dr. Laura Rombolà	1	Natural products have played a key role in drug discovery for different therapeutic areas and could offer special features in comparison with conventional synthetic molecules, which confer both advantages and challenges for the drug discovery process. Selection of appropriate preclinical models is a critical step in reproducing the complexity of human disease mechanisms. The course will focus on the study of natural products in anxiety disorders.

Biochemical tools to unmask metabolic targets for cancer therapy.		Dr. Luca Frattaruolo	1	This course aims to introduce the tools and strategies useful for the study of tumor energy metabolism, as well as the biochemical mechanisms underlying new pharmacological agents which target several metabolic pathways. In particular, some biochemical approaches able to monitor the cellular glycolytic flux will be highlighted, such as the measurement of extracellular acidification rate (Seahorse technology) and the expression level and activity of key glycolytic enzymes. In addition, some methods useful for the study of mitochondrial integrity and functionality will be analyzed, emphasizing those that allow the evaluation of pivotal mitochondrial processes in energy homeostasis and redox state.
Mechanisms of Action in Photodynamic Therapy.		Dr. Gloria Mazzone	1	The present course aims to provide a general introduction into the Photodynamic Therapy, as an effective and valuable clinical procedure for the treatment of a broad range of diseases. In particular, the following topics will be proposed and deeply discussed: i) the origins of the phototherapy; ii) the light, oxygen, and chromophores; iii) photophysics and photochemistry of the photodynamic therapy; iv) type I and type II photoreactions; v) the effects of the reactive oxygen species (ROS) generated by photodynamics.
Metal-based compounds in light-activated cancer therapy.		Dr. Marta Erminia Alberto	1	The course will provide an overview of the new anticancer approaches that make use of light irradiation to trigger the toxicity of a drug in a spatially and time -resolved manner. In particular, the increasing importance of transition metal complexes in photodynamic therapy (PDT) and photochemotherapy (PCT) will be discussed, with a particular focus on their photochemistry and photophysical properties.
How to write a scientific paper and present research data successfully.		Prof. Paola Tucci	1	Dissemination and communication of research results are important aspects of the research process, in order to be accessible to other scientists and have an impact on the greater scientific community, as well as, represent an invaluable skill. The main formats for reporting research to an academic or scientific community are written papers and oral presentations. Thus, the course will aim to enhance the student's skills who need to publish their biomedical research and/or present them to an international audience. The course will raise students' awareness of the qualities of good scientific writing and speaking while at the same time giving them some suggestions that can help them to improve scientific written and oral communication skills.

Urological pathologies: new diagnostic therapeutic approaches based on artificial intelligence (AI)		Dr. Michele Di Dio	2	Nowadays technologies are strictly embricate with medicine developing. In respect to the past, last years are characterized by tumultuous innovation in healthcare area. Diagnostics tools and softwares enriched with Artificial Intelligence that makes Surgery easier and more precise are the last frontiers in this area. Especially 3D-guided surgeries associate with organ-specific 3D-virtual models derived from standard imaging lead us into the realms of augmented reality and mixed reality surgery, with the primary objective of improving surgical planning and intraoperative guidance. We are able to maximize surgeon awareness during procedures, taking advantage of the information provided by virtual models of real anatomy. At the beginning the augmented reality surgery tools were semi-automatic, but we soon transitioned to augmented reality platforms powered by artificial intelligence, with subsequent automatic overlapping of the 3D augmented reality images. Another step was the creation of an immersive platform for a virtual reality experience, in the Metaverse. The surgeons have the possibility to navigate the 3D virtual models of the patients in a virtual environment, sharing the surgical planning even if located in different sites. In this landscape the boundaries of physical geography dissolve, and this virtual realm facilitates collaborative learning, discussions, and surgical innovations. 3D BioDigital Virtual Models of the patients' anatomy will be a Digital Twin of the organs and will be an unprecedent level of precision and customization that has the potential to further improve the realism and the accuracy of immersive surgical planning. The course will be a window on the future of surgery that will await us.
Natural bioactive compounds: extraction and characterization by advanced methodologies.		Dr. Lucia Bartella	2	The main objective of the present course is to provide fundamental knowledge on the structure and properties of the most important natural bioactive compounds, holding a broad range of biological activities. The course also aims to discuss the relative methods used for the extraction, isolation and purification of these molecules from plant and food matrices. Particular attention will be paid to the characterization and quantification analysis using the most recent and innovative chemical methodologies.
microRNA: biology, function and analysis tools.		Prof Adele Vivacqua	1	The course attempts to provide knowledge on the biology and functions of the microRNAs, short sequences of noncoding RNAs that, binding to and suppressing the expression of target mRNAs, are involved in different patho-physiological conditions. In addition, the course will show the main methods for the study of miRNA expression, including the bionformatic tools for the 'in silico' analysis of the target mRNAs.

Extracellular vesicles in translational medicine.		Prof. Cinzia Giordano	1	The course aims to provide an overview of the extracellular vesicles in translational medicine. Extracellular vesicles are small lipid bilayer particles released by all cell types that have been reported to regulate the complex intracellular communication pathways in both physiological and pathological conditions. In recent decades, the study of extracellular vesicles biology has gained growing interest, representing an active area of cancer research with many potential clinical applications. Thus, during the course, the following topics will be discussed: extracellular vesicles biology; experimental approaches to study extracellular vesicles; extracellular vesicles as potential biomarkers and therapeutic tools.
Food and bioactive lipids.		Prof. Pierluigi Plastina	1	The course will give an insight into the chemistry, nutrition and health properties of bioactive lipids deriving from the diet.
Bio optical properties of human skin and uses of electromagnetic radiation in medical science.		Dr. Marta Erminia Alberto	1	The electromagnetic spectrum and the associated types of light are especially useful in the field of medicine. Outlined are the way in which each type of electromagnetic radiation interacts with biological tissues, firstly analysing the main bio optical properties of human skin and the endogenous and exogenous factors affecting its complex optics, then examining particular applications they're used in, with a focus on both diagnosis and emerging therapies.
Advanced mass spectrometry for food safety and quality.		Prof. Leonardo Di Donna	2	The present course will provide the basic knowledge of mass spectrometry, the ionizing sources (atmospheric pressure chemical ionization, electrospray ionization, and ambient mass spectrometry), and analyzers (quadrupole, time of flight, orbitrap, tandem mass spectrometry, hybrid mass spectrometer). Particular emphasis will be given on the analysis of phenols in extra virgin olive oil using advanced mass spectrometry techniques and on the profiling of the triacylglycerols component of vegetable oils using ambient mass spectrometry methods.