

ADMISSION TO DOCTORAL STUDIES

Session September 2025

Field of doctoral studies: Medicine

Doctoral supervisor: Prof. Dr. Dr. Monica FLORESCU

TOPICS FOR THE ADMISSION TO DOCTORAL STUDIES

TOPIC 1: *Nanomedicine in early diagnosis, disease monitoring, and evaluation of the efficacy and safety of drugs and therapies*

Contents / Main aspects to be considered - *Exploration and development of minimally invasive methods based on sensors, microfluidics, nanomaterials and biophysical for detection and quantification. The aim is to detect molecules (biomarkers, drugs) and specific biophysical parameters (mechanical, electrical, optical, transport) with medical relevance and correlate them with clinical impact.*

Possible applications: *internal medicine, metabolic diseases, infectious diseases, haematology, oncology, COVID-long, autoimmune or chronic inflammatory diseases*

Recommended bibliography:

- Haowei Duan, Shuhua Peng, Shuai He, Shi-Yang Tang, Keisuke Goda, Chun H. Wang, and Ming Li, Wearable Electrochemical Biosensors for Advanced Healthcare Monitoring, Adv. Sci. 2025, 12, 2411433.
- Arora, P., Bhagat, S., Krishnendu, M.R. et al. Emerging trends of biomedical nanotechnology in nutrition, health monitoring and disease diagnosis. 3 Biotech 15, 152 (2025).
- S. Bakhtiari doost, C. Musuroi, M. Volmer*, M. Florescu*, Optoelectronic Microfluidic Device for Point-of-Care Blood Plasma Viscosity Measurement, Lab on a Chip, 2024, 24, 3305.
- Ghazizadeh E, Naseri Z, Deigner HP, Rahimi H, Altintas Z. Approaches of wearable and implantable biosensor towards of developing in precision medicine. Front Med (Lausanne). 2024, 18;11:1390634.
- Kumari, M., Gupta, V., Kumar, N. et al. Microfluidics-Based Nanobiosensors for Healthcare Monitoring. Mol Biotechnol 66, 378–401 (2024).
- Raheja, I.K., Kumar, P., Rajashekarappa, K.K. et al. Nanobiosensors for Early Detection of Cancer: A Recent Update. Biomedical Materials & Devices (2024).
- Danfeng Lu, Chenxi Yang, Luyang Chen, Congjun Cao, Weimin Xia, Guanglei Li, Dan Wen, Advances in the noninvasive and minimally invasive sample collection for wearable electrochemical sensors, Electroanalysis. 2024;36:e202300385.

☒ Scientific Doctorate (full-time only)

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TOPIC 2: *Nanotherapeutic strategies for selective delivery, increased efficiency and reduced toxicity*

Contents / Main aspects to be considered - *Design, development, and validation of functional nanosystems for targeted delivery of drugs/bioactive compounds, optimized for the disease with a well-defined molecular profile. The aim will be to reduce systemic toxicity and increase therapeutic efficiency, through physicochemical characterization of the binding, diffusion, and*

<p><i>time-release of drugs/bioactive compounds through artificial membranes, real-time monitoring of the interaction between the delivery system and the model membrane, and their correlation with the clinical impact.</i></p> <p>Possible applications: <i>oncology, dermatology, rheumatology/inflammation, chronic lung diseases, diabetes, neurology.</i></p>
<p>Recommended bibliography:</p> <ul style="list-style-type: none"> ➤ Arora, P., Bhagat, S., Krishnendu, M.R. et al. Emerging trends of biomedical nanotechnology in nutrition, health monitoring and disease diagnosis. 3 Biotech 15, 152 (2025). ➤ K. Ukaegbu, E. Allen, K. K. H. Svoboda, Reactive Oxygen Species and Antioxidants in Wound Healing: Mechanisms and Therapeutic Potential, International Wound Journal, 2025; 22:e70330. ➤ Cheng X, Xie Q, Sun Y. Advances in nanomaterial-based targeted drug delivery systems. Front Bioeng Biotechnol. 2023;11:1177151. ➤ A. Hiwrale, S. Bharati, P. Pingale, A. Rajput, Nanofibers: A current era in drug delivery system, Heliyon, 9 (9), 2023, e18917. ➤ M. David, T.A. Enache, L. Barbu-Tudoran, C. Bala, M. Florescu, Biologically Synthesized Gold Nanoparticles with Enhanced Antioxidant and Catalytic Properties, Pharmaceuticals, 2024, 17(9), 1105. ➤ Yang, L., Zhang, D., Li, W. et al. Biofilm microenvironment triggered self-enhancing photodynamic immunomodulatory microneedle for diabetic wound therapy. Nat Commun 14, 7658 (2023). ➤ Singh B, Kim K, Park MH. On-Demand Drug Delivery Systems Using Nanofibers. Nanomaterials (Basel). 2021 Dec 16;11(12):3411.
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<p>TOPIC 3: <i>Study of protein-ligand interactions and conformational fluctuations in pathological context: integrative approach for diagnosis and therapy</i></p>
<p>Contents / Main aspects to be considered - <i>Investigation of the molecular mechanisms involved in the interaction between human proteins and biological ligands (drugs, functionalized nanoparticles), of the molecular mechanisms of thermal denaturation and aggregation, with emphasis on conformational changes of proteins under pathological conditions, biophysical methods for detection and quantification, and correlation with clinical impact.</i></p> <p>Possible applications: <i>haematology, oncology, neurology (neurodegenerative diseases).</i></p>
<p>Recommended bibliography:</p> <ul style="list-style-type: none"> ➤ Beć, K.B.; Grabska, J.; Huck, C.W. Near-Infrared Spectroscopy in Bio-Applications. Molecules 2020, 25, 2948. ➤ Sun X, Dyson HJ, Wright PE. Role of conformational dynamics in pathogenic protein aggregation. Curr Opin Chem Biol. 2023 Apr;73:102280. ➤ N. Cazacu, C. G. Chilom, M. David, M. Florescu*, Conformational changes in the BSA-LT4 complex induced by the presence of vitamins: spectroscopic approach and molecular docking, International Journal of Molecular Sciences, 2022, 23, 4215. ➤ Aguzzi, A., O'Connor, T. Protein aggregation diseases: pathogenicity and therapeutic perspectives. Nat Rev Drug Discov 9, 237–248 (2010). ➤ Andreas Barth, Infrared spectroscopy of proteins, Biochimica et Biophysica Acta (BBA) - Bioenergetics, 1767(9), 2007, 1073-1101. ➤ Berthomieu, C., Hienerwadel, R. Fourier transform infrared (FTIR) spectroscopy. Photosynth Res 101, 157–170 (2009).
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TOPIC 4: *Evaluation of the clinical and molecular impact of contaminants and physical environmental factors on health: correlation with molecular and functional biomarkers*

Contents / Main aspects to be considered - *Study of the relationship between the level of exposure to contaminants and physical environmental factors and the changes occurring in the body (dysfunctions in the haematological, endocrine, inflammatory, and oxidative profile, metabolic or epigenetic changes). The analyses will employ biophysical methods to evaluate the physiological and molecular effects associated with exposure, correlate the intensity and duration of exposure with the severity of clinical and molecular changes, identify clinically relevant biomarkers for early diagnosis, monitoring, and prevention for chronic exposure, and correlate them with clinical impact.*

Possible applications: *endocrinology, haematology, internal medicine, oncology, autoimmune or inflammatory diseases, pulmonary diseases, neurology, occupational medicine, and public health/epidemiology.*

Recommended bibliography:

- Lafta, Methaq hadi, et al., Toxic effects due to exposure heavy metals and increased health risk assessment (leukemia), Reviews on Environmental Health, vol. 39, no. 2, 2024, pp. 351-362.
- de Lima Andrade, E., da Cunha e Silva, D.C., de Lima, E.A. et al. Environmental noise in hospitals: a systematic review. Environ Sci Pollut Res 28, 19629–19642 (2021).
- Kumah, E.A., Fopa, R.D., Harati, S. et al. Human and environmental impacts of nanoparticles: a scoping review of the current literature. BMC Public Health 23, 1059 (2023).
- Pezeshki, Hoda et al., Per- and poly-fluoroalkyl substances as forever chemicals in drinking water: Unraveling the nexus with obesity and endocrine disruption – A mini review, Heliyon, 11(4), e42782.
- Campanale, C.; Massarelli, C.; Savino, I.; Locaputo, V.; Uricchio, V.F. A Detailed Review Study on Potential Effects of Microplastics and Additives of Concern on Human Health. Int. J. Environ. Res. Public Health 2020, 17, 1212.
- Talapko, J.; et al. Health Effects of Ionizing Radiation on the Human Body. Medicina 2024, 60, 653.
- Bartel, L.; Mosabbir, A. Possible Mechanisms for the Effects of Sound Vibration on Human Health. Healthcare 2021, 9, 597.

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Doctoral supervisor,

Prof. dr. dr. Monica FLORESCU

Coordinator of the field of doctoral studies,

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