BIOENGINEERING AND MEDICAL-SURGICAL SCIENCES

CRT/DIMEAS/DISAT - 3D printed functional responsive DNA based hydrogel

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Context of the research activity	The current technologies used for DNA recognition (sequencing) are well consolidated, but have limitations, concerning both the analysis times and the need for equipped laboratories. This doctoral project aims to develop devices capable of rapidly reacting to specific DNA sequences, through a structural modification of the materials constituting the device, in order to obtain a rapid and unambiguous response to the desired nucleotide sequences. The device will be made via light-induced fabrication of synthetic/DNA hybrid materials.
Objectives	The research program of the Ph.D. candidate is based on the development of 3D printed responsive materials DNA base. DNA-based structures have emerged as a versatile component for nanoscale construction of soft materials. Multiple structural, functional properties and versatility in conjugation with other biomolecules made DNA the material of choice to use in various biomedical applications. DNA-based hydrogels significantly attracted attention in recent years owing to their properties and applications in biosensing, bioimaging, and therapeutics. DNA hydrogels are used either as structural material or as functional entities to make hybrid constructs with various biomedical applications. Further, DNA hydrogels will be 3D printed. The possibility to 3D shape hydrogels is attracting an enormous interest in the biomedical field both for their application as scaffold or for the design of new medical hydrogels. Digital light processing (DLP) printing can create layer-by-layer models with high resolution and printing speed, regardless of the layer complexity and area. The vision and potential of 3D printed DNA based hydrogels makes them as an emerging class of therapeutically important devices for theragnostic and other biological applications. The future of DNA-based hydrogels looks promising as they continue to evolve into an emerging class of theragnostic

	devices and other biological applications. Ongoing research aims to enhance their biocompatibility, functionality, and responsiveness to create smarter, more efficient biomedical tools. The versatility of DNA hydrogels combined with 3D printing positions them as pivotal components in the advancement of personalized medicine, targeted therapies, and sophisticated diagnostic systems.

Skills and competencies for the development of the activity	Working on the development of functional 3D printed based hydrogel requires a multidisciplinary skill set encompassing, biomaterials, cell and molecular biology, microfluidics, data analysis, collaboration, problem-solving, ethical considerations, and a commitment to continuous learning. By combining these competencies, candidates can contribute to the advancement of this exciting and promising field. The optimal candidate should have previous direct experience of 3D printing and on DNA manipulation.