MATERIALS SCIENCE AND TECHNOLOGY

AMMIN/DISAT - Multifunctional structures for tissue regeneration

Funded By	Dipartimento DISAT Politecnico di TORINO [P.iva/CF:00518460019]
Supervisor	VITALE BROVARONE CHIARA - chiara.vitalebrovarone@polito.it
Contact	FIORILLI SONIA LUCIA - sonia.fiorilli@polito.it
Context of the research activity	Regenerative medicine requires advanced systems for the localized delivery of drugs, ions, and bioactive molecules to support tissue repair. Biofabricated scaffolds offer promising platforms for several biomedical applications involving both hard and soft tissues.
Objectives	Innovative solutions in the biomedical field increasingly require the localized and sustained delivery of therapeutic agents, including drugs, therapeutic ions, nutrients, and bioactive molecules, to support biological functions and promote tissue regeneration. In particular, bone tissue engineering and wound healing applications benefit from the controlled release of bioactive cues capable of stimulating cellular responses, enhancing tissue repair, and improving healing outcomes. At the same time, the development of advanced three-dimensional structures that replicate the architecture and functionality of native tissues has become a central objective in regenerative medicine. Technologies such as electrospinning and 3D printing enable the fabrication of biomimetic scaffolds with tailored composition, porosity, and mechanical properties, providing suitable environments for cell growth and tissue regeneration. The integration of controlled delivery systems within these structures offers the opportunity to create multifunctional platforms capable of simultaneously supporting tissue regeneration and delivering therapeutic agents. Furthermore, the growing emphasis on sustainability in biomedical research calls for the development of materials and manufacturing processes that combine high performance with environmental and economic responsibility. This approach aligns biomedical innovation with the principles of resource efficiency, sustainable design, and circular material use. The research activities aim to: • Develop bioactive delivery systems based on particles capable of encapsulating and releasing therapeutic agents, including drugs, ions, nutrients, and other bioactive molecules, for applications in bone regeneration and wound healing. • Design and fabricate multifunctional biomimetic scaffolds using advanced manufacturing technologies, such as electrospinning and 3D printing,

	integrating controlled-release systems to promote tissue regeneration and therapeutic activity. • Establish sustainable biomedical materials and manufacturing strategies that combine high regenerative performance with resource efficiency, environmental responsibility, and circular material use.

Skills and competencies for the development of the activity	Background in Biomedical Engineering. Expertise in organic and inorganic particles for drug release. Expertise in 3D printing (including open source softwares) and electrospinning technologies (including coaxial set-up). Experience in characteristion techniques including rheological assessment and microtomography investigations. Expertise in vitro cell testing. Scientific paper drafting.