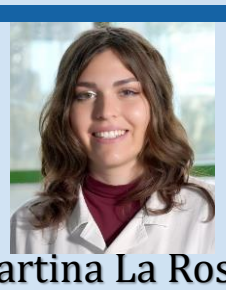
In-vitro scaffold-based models for tissue engineering applications



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In-vitro scaffold-based models for neural applications

Concept

Neurodegenerative diseases represent a growing global health challenge. These conditions involve the progressive degeneration of neurons, leading to significant motor and sensory impairments. Despite years of research, we still need innovative approaches to better understand their mechanisms and develop effective therapies.

Scaffold have emerged as powerful tools to study neurodegenerative diseases. These scaffolds, such as compact hydrogel or 3D bioprinted hydrogels, offer a platform to mimic the complex architecture of neural tissue. Notably, natural-based hydrogels exhibit biomimetic properties, closely resembling the native extracellular matrix found in neural tissue.

Scientific approach

This research project is proposed to fabricate different types of scaffolds for neural application. Alginate-based hydrogel are used alone or in combination with carbon nanotubes (CNTs). The process of bioprinting is explored to produce a bioink for generating a cell-laden hydrogel porous structure.

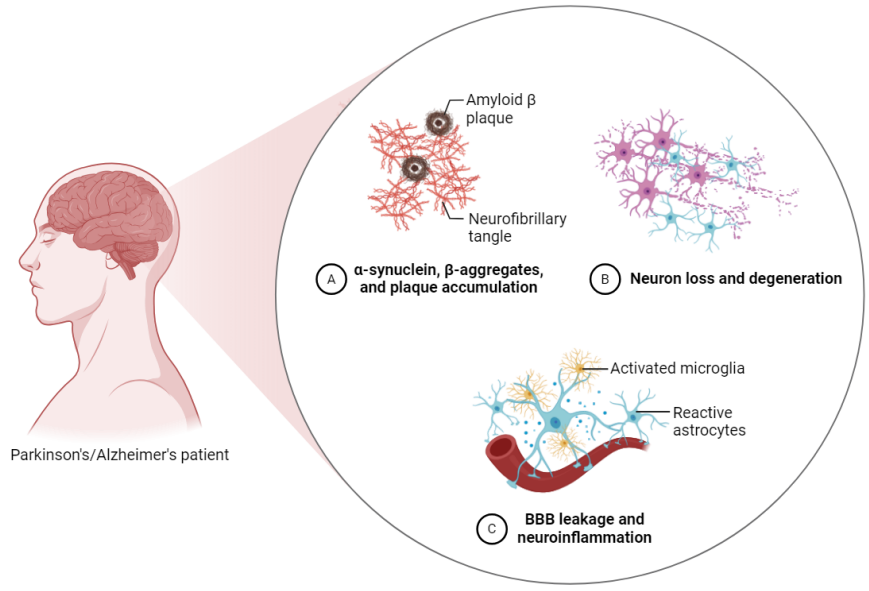
An extensive array of analytical techniques, including MTS assays, western blotting, immunohistochemistry, scanning electron microscopy (SEM), and fluorescence-activated cell sorting (FACS) analysis, is employed to explore biomolecule release dynamics and assess in vitro cell culture behavior.

Moreover, by integrating these scaffold systems into Organ-on-Chip (OoC) microfluidic platforms, the project will investigate both static and dynamic interplay of cellular processes within neural tissue environments.

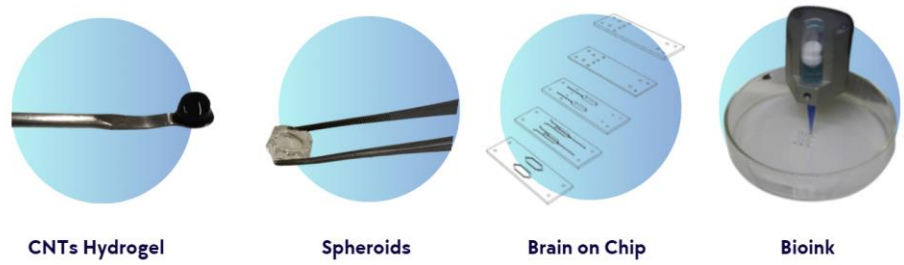
Research objectives

The primary objectives of my research are to establish a standardized approach for in vitro neurodevelopmental studies using scaffold-based models, and secondly, to advance our understanding of neurological diseases by deciphering their underlying mechanisms and developing innovative therapeutic solutions.

Neurodegenerative disease pathway



Scaffold fabrication and integration in OoC



Biological tests