External Master Thesis Project

Engineering a 3D Bone Metastasis Model to Study Senescence in Prostate Cancer

Location: Bellinzona, Switzerland
Duration: 9–12 months
Start: July/September

Partners involved: Ente Ospedaliero Cantonale (Regenerative Medicine Division, Institute for Translational Research, Bellinzona, Switzerland - Prof. Matteo Moretti)

Project Overview

Prostate cancer (PCa) is a leading cause of cancer-related mortality, mainly due to incurable bone metastases. Despite advances (androgen deprivation therapy, taxanes, AR inhibitors), effective strategies to stop metastatic progression remain limited.

Therapy-induced senescence (TIS) is an emerging factor that promotes a pro-tumorigenic microenvironment via the senescence-associated secretory phenotype (SASP). In bone, senescent stromal cells may reshape the niche, enhancing tumor growth, metastasis, and therapy resistance.

Progress is limited by the lack of physiologically relevant human in vitro models. This project aims to address this by developing a **biomimetic 3D human bone metastasis model**. The thesis can be tailored toward engineering or biological aspects based on the student's interests.

Research Objectives

- Engineer a 3D trabecular bone-like structure using advanced microfabrication
- Reconstruct the cellular bone microenvironment
- Introduce cancer cell lines
- Study how TIS and SASP reshape the bone niche and promote metastasis

Methods & Technologies

Microfabrication & Biofabrication

- DLP 3D printing
- CAD design

Cell Biology

- From primary human BMSC culture to bone cells populations
- Cancer co-culture systems
- Tumor spheroids

Analysis

- Senescence assays (SA-β-gal, γH2AX, p16/p21)
- Confocal imaging
- Functional assays (migration, invasion)
- Molecular profiling (qPCR, IF)

- Quantitative data/image analysis

Candidate Profile

- Background in **bioengineering, biotechnology**, biology, or related fields
- Interest in cancer biology, tissue engineering, or microfabrication
- Strong motivation for interdisciplinary research

Preferred:

- Experience/interest in cell culture or tissue engineering
- Basic programming/data analysis (Python or MATLAB)

What You Will Gain

- Hands-on experience with advanced 3D biofabrication
- Work with primary human cells and co-culture systems
- Exposure to translational cancer research
- Interdisciplinary skill set (engineering + biology)

How to Apply

Send:

- CV
- Short motivation letter

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