



Thesis Project Form

Title (tentative): Mechanical characterization of tissue biopsies and scaffolds toward an in vitro 3D model of solid tumors

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Description

Motivation and application domain

Sarcoids are one of the most common tumors found in horses. Sarcoids are skin tumors that can develop anywhere on the horse's body. They are relatively benign masses under most circumstances unless they are irritated, in which case they can become more invasive and grow quickly (aggressive sarcoid). Bovine papillomavirus are associated with the pathogenesis of sarcoid disease and thus equine tumors are an invaluable model in comparative oncology. In order to develop personalized therapies and to apply the 3R principles in research, there is the need of developing advanced in vitro tissue models.

Atomic force microscopy (AFM) is capable to measure surface topography and mechanical properties of soft biological tissues with extremely high spatial resolution and sensitivity. Here we want to apply this technique to evaluate sarcoid viscoelasticity in order to develop hydrogels and scaffolds with similar mechanical properties to develop a representative 3D advanced in vitro model of the tumoral tissue

General objectives and main activities

The main objective of this thesis work is to employ atomic force microscopy to measure mechanical properties (i.e. complex elastic modulus) of fresh tissue biopsies in order to drive the design and fabrication of hydrogels able to recapitulate the main characteristics of the native tissue.

The activity includes i) establishing a measurement procedure for the mechanical characterization of both tissue samples and hydrogels, based on a state of art atomic force microscope (<https://www.bruker.com/en/products-and-solutions/microscopes/bioafm/jpk-nanowizard-4-xp-bioscience.html>); ii) to fabricate collagen based hydrogels iii) to perform experiments, analyse the data and compare the results to feedback in the hydrogel/scaffold fabrication process

Such activities will be conducted on close collaboration with researchers of the Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta who will provide samples and support the activity.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn:

- how to design, organize, and conduct experiments, including sample preparation and data evaluation
- how to design and fabricate hydrogels with controlled mechanical properties
- how to operate an atomic force microscope to perform quasi static and dynamic mechanical analysis

Place(s) where the thesis work will be carried out:

Additional information

Maximum number of students: 1