



Thesis Project Form

Title (tentative): In search of quantitative biomarkers for neuroblastoma diagnosis and prognosis

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Description

Motivation and application domain

Histology is based on the examination of cells, tissues, and organs through microscopy. The micro-structure of the specimen is then related to its biology and function (physiology) and disease (pathology). Histology is a routine procedure to detect, among others, neoplasms, hence diagnose cancer. Such diagnosis is usually based on the qualitative evaluation of the sample morphology performed on fixed and coloured tissue biopsies.

Neuroblastoma is the most common type of cancer in babies. It forms in certain types of nerve tissue and its diagnosis is based on the analysis of tissue biopsy and the prognosis is based on a qualitative grading based on histology.

New techniques and methods, compatible with the current sample preparation procedures, and capable to provide complementary (e.g. mechanical properties) and/or quantitative information would be of fundamental importance to support the pathologist for both diagnosis and prognosis.

Atomic force microscopy (AFM) is capable to measure surface topography and different physical/chemical properties of biological tissues with extremely high spatial resolution and sensitivity. Among such properties sample stiffness can be quantified by applying small sample deformations and measure the force applied.

General objectives and main activities

The main objective of this thesis work is to employ atomic force microscopy to measure clinically relevant parameters (i.e. biomarkers) for the diagnosis/prognosis of neuroblastoma from standard histological samples.

The activity includes i) establishing a measurement procedure for both topographical and mechanical characterization at the nanoscale, 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 perform experiments on real histological samples from donors suffering from different types of neuroblastoma; iii) to establish a data analysis procedure to extract quantitative biomarkers

Such activities will be conducted on close collaboration with pathologists directly involved in the clinical practice at the U.O.C. Anatomia Patologica of IRCCS Ospedale Pediatrico Gianni Gaslini.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn:

- the standard clinical histological procedures for neuroblastoma diagnosis and its basic physiopathology
- how to operate an atomic force microscope to perform high resolution imaging and dynamic mechanical analysis
- how to perform experiments and evaluate data obtained to extract clinically relevant biomarkers

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

Additional information

Pre-requisite abilities/skills: Genuine interest in taking ambitious challenges; aptitude toward experimental

work

Maximum number of students: 2