Tissue penetration via helical microrobots in Vitro

Penetration of tissues using helical robots is influenced by several parameters. Some parameters are related to the setup used to control the helical robots such as the strength of the magnetic field, magnetic field gradient, and rotation frequency of the rotating dipole fields. Another parameter that affects the penetration process is related to the type of tissue since certain tissues are harder than others. Here we will focus on penetration of several types of tissues including heart, liver and brain tissue and assessing the ability of helical microrobots to penetrate the different types of tissues.

Objective
Helical microrobots have proved their efficiency in drilling/grinding blood clots (Fig.1). Magnetic field strength, magnetic field gradient, actuation frequency, and the geometry of the helical microrobots influence the grinding time [1]. It is essential to investigate the ability to penetrate tissues since that could prove beneficial in performing simple operations.

Tasks
• Control of helical microrobot [2] and drilling of several types of tissues;
• Investigating the influence of the type of tissue on the penetration rate;
• Investigating the influence of several parameters related to the magnetic field on the penetration rate

Materials
• HeliMag is available in MNRLab;
• The tissues have to be prepared and microrobots have to be fabricated;
• Phosphate buffered saline and catheter segments [3].

PREREQUISITES
Students are expected to have a working knowledge of control theory, differential equations, linear systems, statics, kinematic and dynamics, dynamics at low Reynolds numbers. Familiarity with programming, especially with Matlab, LabVIEW, and C++.

OTHER NOTES
This project will involve a weekly meeting with the instructors and progress reports have to be prepared. All reports should be written in academic paper format.

1. References