Internship Proposal

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Project Title:

Probing pancreatic cancer progression and treatment response with preclinical MRI Level:

Master

Project Summary:

Pancreatic cancer represents one of the deadliest cancer types [1]. The development of innovative treatment approaches relies heavily on advanced preclinical models of the disease [2], as well as non-invasive imaging methods for in vivo assessment of their efficacy. MRI is routinely used in the clinical management of pancreatic cancer [3]. In animal models however, the higher magnetic field strengths typically used render the technique more susceptible to abdominal movements such as breading, heart beating, and bowel peristalsis. Such limitations condition the use of fast pulse sequences, including echo-planar diffusion tensor imaging [4], and thus the ability to probe tissue microstructure in those models. Aim of the project: harnessing diffusion tensor echo planar imaging to derive sensitive imaging markers of pancreatic cancer progression and treatment response, using advanced mouse models of the disease and a state-of-the-art 3 Tesla preclinical MRI scanner.

Work to be developed by the student:

The experimental work will be carried out at the new Preclinical MRI lab of i3S. The student will first become familiar with the MRI terminology and the general work procedures in the Preclinical MRI lab, learning about basic and more advanced pulse sequences, including diffusion tensor imaging (DTI) and echo-planar imaging (EPI). The student will also learn about advanced mouse models of pancreatic cancer, including genetically modified mice and patient-derived xenografts available for the project. Then, she/he will assist in optimizing DTI-EPI for pancreatic cancer imaging using fixed tumor samples, including post-processing algorithms for noise reduction such as tMPPCA [5]. Finally, the student will assist during in vivo validation of the method with mouse-bearing tumors, and applications to probe pancreatic cancer progression and/or treatment response.

References:

1.Park, W., A. Chawla, and E.M. O'Reilly, Pancreatic Cancer: A Review. JAMA, 2021. 326(9): p. 851-862.

2.Ruivo, C.F., et al., Extracellular Vesicles from Pancreatic Cancer Stem Cells Lead an Intratumor Communication Network (EVNet) to fuel tumour progression. Gut, 2022. 71(10): p. 2043-68.

3.Farr, K.P., et al., Imaging Modalities for Early Detection of Pancreatic Cancer: Current State and Future Research Opportunities. Cancers (Basel), 2022. 14(10).

4.Nissan, N., et al., Diffusion tensor magnetic resonance imaging of the pancreas. PLoS One, 2014. 9(12): p. e115783.

5.Olesen, J.L., et al., Tensor denoising of multidimensional MRI data. Magn Reson Med, 2023. 89(3): p. 1160-1172.





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