Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **129** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Comparison of Cylindrical and Spherical Geometric Models to Infer Cell Sizes in a Celery Sample

Monday 7 June 2021 15:45 (5 minutes)

Temporal diffusion spectroscopy (TDS) has been used to infer axon sizes using geometric models that assume axons are cylinders. A celery sample was imaged to test if the importance of other geometric models. The vascular bundles and collenchyma tissue (˜20 µm cells) in celery can be modeled as containing cylindrical cells. Whereas the parenchyma cells are rounder and are 3-4 times larger in diameter. Thus we imaged celery to test TDS with oscillating gradient spin echo (OGSE) to see if the spherical cell model and cylindrical cell model infer significantly different cell sizes to determine how important the geometrical model is.
A small section of a celery stalk was cut to fit inside a 15 mL sample tube filled with water. The image slice was chosen to be perpendicular to the length of the celery stalk. The sample was imaged using a 7T Bruker AvanceIII NMR system with Paravision 5.0 and BGA6 gradient set with a maximum gradient strength of 430357 Hz/cm, and a 3.5 cm diameter bird cage RF coil. Each 20 ms apodised cosine gradient pulse ranged from n = 1-20, in steps of 1. Two different gradient strengths were used for each frequency and gradient pulses were separated by 24.52 ms. A 1mm thick slice was acquired with the following imaging parameters: 2 averages, 2.56 cm FOV, TR = 1250 ms, TE = 50 ms, matrix 128 x 128, 200 µm in plane resolution, acquisition time 26.67 minutes per scan (scans performed = 40, 17.78 hours).
The inferred diameters of cells in celery (14±6µm to 20±12µm) were not statistically different when using the two different geometric models. This is the first step toward understanding the importance of geometric models for TDS.
The authors wish to acknowledge funding from NSERC and Mitacs.

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Session Classification: M3-3 MR and PET Imaging - Part 1 (DPMB) / Imagerie RM et TEP - Partie 1 (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)