Physics of Magnetic Resonance Spectroscopy in Vivo, ENAS 825

Course Directors
Graeme Mason, Robin de Graaf, Henk de Feyter

Location
MRRC Conference Room (TAC-N135)

Textbook
None

Time
Mondays and Wednesdays, 11:35am-1:00pm

Objectives
At the end of the course, attendees should
1) understand basic NMR theory.
2) grasp enough of pulse sequence requirements and pitfalls to provide some critique of presentations, grants, and manuscripts.
3) be able to discuss MR aspects of their projects before an audience of peers or grant reviewers.
4) be able to perform some experimental design, including proposals of MR techniques to select.
5) grasp enough MRS and MRI theory to design and critique studies of their own and of others.

Topic	Lecturer	Date
Basics of NMR - Nuclear Magnetization - Nuclear Induction - T_1 and T_2 relaxation - Chemical Shift	de Graaf	Sep 6
Basic MR methods - Pulse-acquire - Rotating Frame - Bloch Equations - Spin-echo and T_2* relaxation	Mason	Sep 11
Basic MR processing - Fourier transformation - Phasing - Chemical shift referencing	Mason	Sep 13 Sep 18
MR Hardware - Magnet - Magnetic field gradients - Tx and Rx chains	de Graaf	Sep 20 Sep 25
Prescan Adjustments - Tx power adjustment - Rx phase and gain adjustment - Shimming	de Graaf	Sep 27 Oct 2

Topic	Lecturer	Date
MR Coils - Coil types - Tuning and matching - Sensitivity	Mason	Oct 4
RF Pulses - Conventional (sinc, Gauss) - Frequency-selective - Adiabatic	de Graaf	Oct 9
Basics of MRI – 1 - Magnetic field gradients - K-space + FT reconstruction - GE and SE methods	Mason	Oct 11
Basics of MRI – 2 - K-space and fast MRI - MR image contrast (T_1, T_2, DTI, MTC)	de Graaf	Oct 16
No Class: October Recess		Oct 18
Functional MRI - BOLD - CBF/CBV	de Graaf	Oct 23
Basic MRS Methods - Single-Volume MRS: STEAM, PRESS, (s)LASER - Water suppression	Mason	Oct 25
Question/Answer Session *For questions on the problems in the notes, Drs. Mason and de Graaf are available to schedule meetings	de Graaf/ Mason	Oct 30
Midterm Exam	Mason	Nov 1
MR Spectroscopic Imaging - Outer Volume Suppression - MRSI acquisition - MRS processing and display	de Graaf	Nov 6
Spectral Editing - Scalar coupling - J-difference editing GABA, GSH, 2HG	de Graaf	Nov 8
MR Safety	Fulbright	Nov 13
Advanced MR Processing - Preprocessing - Integration - Spectral fitting (LCModel)	de Graaf	Nov 15
No Class: November recess		Nov 20
No Class: November recess		Nov 22
X-nucleus (other than ^{1}H)	De Feyter	Nov 27
Applications of MRS: Diabetes	De Feyter	Nov 29
Applications of MRS: Cancer	De Feyter	Dec 4
Applications of MRS: Neurological disease	De Feyter	Dec 6

Topic	Lecturer	Date
Question/Answer Sessions *For questions on the problems in the notes, Drs. Mason, de Graaf, and de Feyter are available to schedule meetings	de Graaf/ Mason/de Feyter	by appt
No Class: Reading Period		Dec 11
No Class: Reading Period		Dec 13
Final Exam	Mason	Dec 18