

Physics of Magnetic Resonance Spectroscopy in Vivo, ENAS 825a

Course Directors

Graeme Mason, Robin de Graaf

Location

MRRC Conference Room, N-135 TAC-MRRC

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
<i>Basics of NMR</i> <ul style="list-style-type: none">- Nuclear Magnetization- Nuclear Induction- T₁ and T₂ relaxation- Chemical Shift	de Graaf	Sept 12
<i>Basic MR methods</i> <ul style="list-style-type: none">- Pulse-acquire- Spin-echo and T₂* relaxation- Stimulated-echo	Mason	Sept 17
<i>Basic MR processing</i> <ul style="list-style-type: none">- Fourier transformation- Phasing- Chemical shift referencing	Mason	Sept 19
<i>MR Hardware</i> <ul style="list-style-type: none">- Magnet- Magnetic field gradients- Tx and Rx chains	de Graaf	Sept 24
<i>MR Coils</i> <ul style="list-style-type: none">- Coil types- Tuning and matching- Sensitivity	Mason	Sept 26
<i>MR Safety</i>	Fulbright	Oct 1

Topic	Lecturer	Date
No Class		Oct 3
No Class		Oct 8
RF Pulses <ul style="list-style-type: none"> - Conventional (sinc, Gauss) - Frequency-selective - Adiabatic 	de Graaf	Oct 10
Basics of MRI – 1 <ul style="list-style-type: none"> - Magnetic field gradients - K-space + FT reconstruction - GE and SE methods 	Mason	Oct 15
October Recess		Oct 17
Basic MRS Methods <ul style="list-style-type: none"> - Single-Volume MRS (STEAM, PRESS, (s)LASER) - Water suppression 	Mason	Oct 22
Basics of MRI – 2 <ul style="list-style-type: none"> - K-space and fast MRI - MR image contrast (T₁, T₂, DTI, MTC) 	de Graaf	Oct 24
Functional MRI <ul style="list-style-type: none"> - BOLD - CBF/CBV 	de Graaf	Oct 29
MR Spectroscopic Imaging <ul style="list-style-type: none"> - Outer Volume Suppression - MRSI acquisition - MRS processing and display 	de Graaf	Oct 31
Question/Answer Sessions *For questions on the problems in the notes, Drs. Mason and de Graaf are available to schedule meetings	de Graaf/ Mason	By appt
Midterm Exam	Mason	Nov 5
Spectral Editing <ul style="list-style-type: none"> - Scalar coupling - J-difference editing - GABA, GSH, 2HG 	de Graaf	Nov 7
Prescan Adjustments <ul style="list-style-type: none"> - Tx power adjustment - Rx phase and gain adjustment - Shimming 	de Graaf	Nov 12
X-nuclei MRS <ul style="list-style-type: none"> - ²H, ⁷Li, ¹³C, ¹⁷O, ¹⁹F, ²³Na, ³¹P 	Mason	Nov 14
No Class: Thanksgiving break		Nov 19
No Class: Thanksgiving break		Nov 21
Direct and Indirect ¹³ C MRS <ul style="list-style-type: none"> - nOe - Polarization transfer - POCE - Decoupling 	Mason	Nov 26

Topic	Lecturer	Date
Applications of MRS <ul style="list-style-type: none"> - Diabetes - Cancer - Stroke Neurodegenerative disease	de Feyter	Nov 28
Advanced MR Processing <ul style="list-style-type: none"> - Preprocessing - Integration - Spectral fitting (LCModel) 	de Graaf	Dec 3
<i>Question/Answer Sessions</i> *For questions on the problems in the notes, Drs. Mason and de Graaf are available to schedule meetings	de Graaf/ Mason	By appt
<i>Final Exam</i>	Mason	Dec 17