NSCI-803
MAGNETIC RESONANCE IMAGING
Fall 2025

COURSE COORDINATOR

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INSTRUCTOR

Dr. Patrick Stroman

TEXTBOOK

The text book for this course is "Essentials of Functional MRI", by P. Stroman. One copy is available in Bracken Library, and it can be purchased on the publisher web site or Amazon. Information to support the course material will be obtained from various freely available on-line sources. Course materials in the form of PowerPoint slides for each lecture will also be provided.

EVALUATION

Mid-term examination	⅓ of grade
Final examination	⅓ of grade
Term project	⅓ of grade

REVIEW AND APPEAL OF GRADES

Students have the right to review their final examination papers.
For this purpose, final examination paper means the final examination question paper in a course and the graded answer paper written by the student, which by Senate policy, must be retained for a period of 12 months.
As a first step (and noting the time limitation), the student should request an informal review with the instructor.

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Lectures – Fall 2025

Lectures will be held 2 days/week (1.5 hours each) in Bracken Library (room TBD) and will be supplemented with copies of PowerPoint slides. The dates in the table below indicate the approximate dates of topics for each lecture.

Students will also be able to email questions to the instructor, and the answers will be posted online, with the intention of this being a searchable database so that all students can find previous questions, search answers etc.

Course Description:

This course is designed for graduate students who want to learn the theory and practice of magnetic resonance imaging for anatomical imaging, imaging of dynamic physiological processes, and MRI to detect neuronal function (functional MRI, fMRI).

The focus will be on teaching the principal ideas needed to fully understand the application of MRI, and its strengths and weaknesses, so that it can be used effectively as a research tool.

This course will require some understanding of basic chemistry, physics, and math. For example, some understanding of the basic structure of matter (molecules, chemical bonds, atoms, nuclei, electrons, protons, neutrons). Some understanding of the concepts of speed, velocity, force, momentum, and electric charge is needed, as well as familiarity with the idea of magnetic fields, and current and voltage.

Basic math is essential, understanding of vectors is useful, as well as some familiarity is needed with calculus such as the basic concepts of integrals and derivatives. However, students will not be expected to use anything but very basic math on assignments or tests, and all necessary concepts will be explained.

The course includes a term project that involves determining the optimal MRI parameters for a specific imaging task that will be given. This is supported by software that will do perform any required calculations, for a set of desired imaging parameters that are entered.

Week starting	Lecture Topics
Sept 9	1 Introduction, 2 Anatomy of MRI system
Sept 16	3 MRI signal origins
Sept 23	4 Magnetization not at equilibrium
Sept 30	5 Relaxation Theory
Oct 7	6 Spin-echo and Gradient-echo
Oct 14	*--mid-term break – no classes--*
Oct 21	*Mid-term exam sometime around this week* 7 Slice Selection, 8 Spatial Encoding
Oct 28	9 Imaging Options
Nov 4	10 Choosing Imaging Parameters
Nov 11	11 fMRI Data Acquisition
Nov 18	12 fMRI Analysis
Nov 25	13 fMRI Study Design
Dec 2	Term Project Due
Final Exam	*TBD*