Course Description

Course goals. By the end of the semester, students will:

- be comfortable with the hardware and software in the MR environment, to ensure safe operation and selection of the right equipment for a given experiment.
- be acquainted with the fundamental physical principles behind magnetic resonance imaging
- understand the possible types of image contrast and their uses in neuroscience
- be adept at modifying pulse sequence parameters to balance the inevitable trade-offs between signal-to-noise ratio, resolution and acquisition time.
- know how to modify an experimental protocol to minimize the impact of distortion and signal loss due to magnetic field inhomogeneities.

Logistics. The class will meet Mondays from 1:25-3:20 pm in Elliott Hall. Format for this portion is lecture, group discussion, and terminal work (computational simulations). For the lab portion, students will meet at the CMRR on Wednesdays either from 1-2pm or from 2-3pm. Assignments and supplementary materials will be posted on the course website: [http://vision.psych.umn.edu/~caolman/courses/PSY5065](http://vision.psych.umn.edu/~caolman/courses/PSY5065).

Grading and Attendance policies

The course is offered for three credits, graded on an A-F basis (A: 93 – 100, A-: 90 – 92, B+: 88 – 89 …, C-: 70 – 72; students taking the course pass/fail will receive an S (satisfactory) for grades higher than D+.)

- Attendance and participation (including submission of weekly assigned exercises) will constitute 70% of the grade.
  - 30% of the course grade will be based on weekly assignments, which will be given full credit if completed and turned in on time. Arrangements for submitting late assignments must be made before the due date to receive partial credit.
  - 40% of the course grade will be based on an attendance sheet that will be passed around at every class period. Excused (pre-arranged or sick) absences will be counted as attendance.
- A mid-term (take-home) exam will constitute 15% of the grade.
- A final (take-home) exam will constitute 15% of the grade.
Background readings

Background readings will be selected from either current journal articles or the following texts, and made available a week before the relevant lecture. Readings will be drawn primarily from the following texts:


A good primary reference for understanding the physics of imaging is:


Weekly assignments

Short problem sets will be handed out each Monday during class and due that Friday at 5pm. They are designed to provide concrete instantiations of the material covered in the lecture and lab and will vary in format: short-answer, multiple choice, matching, calculation and/or data simulation/analysis. Matlab™-based simulations and demonstrations will be used heavily in lecture and assignments.

Mid-term and Final exams

Both mid-term and final exams will each consist of three multi-part questions, one for each module covered in the 1\textsuperscript{st} (midterm) and 2\textsuperscript{nd} (final) half of the semester. Exams will be open book, short answer and require only pen and paper to complete. Format will vary, but will include matching images to pulse sequence diagrams, describing the origins of depicted artifacts, and providing brief definitions of technical terms.