

**BME: 495-0-21 Functional Imaging
2016 Spring**

Lecture Time and Room: T, TR 6:00-7:30 pm, Lunt Hall 104

Instructors:

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Prerequisite:

BME 327 (Magnetic Resonance Imaging) or BME 325 (Introduction to Medical Imaging) advisable.

Course Description:

The course will provide a broad overview of imaging applications that are beyond simple anatomic depiction. While MRI will be predominantly discussed modality, there will be discussions regarding other modalities and highlight the major pros and cons with each of them. Principles of tracer methods used in imaging, fMRI contrast mechanisms, scanning techniques, temporal and spatial limits and both research and clinical applications will be discussed. The concepts of molecular imaging of specific molecular events will also be presented. The lectures by instructors and other experts from this region will be combined with students' presentations and discussions of current papers describing applications of the methods introduced in the lectures. By the end of the course, students should have a fundamental knowledge of cutting-edge functional imaging techniques and their applications in research and clinical practice.

The Canvas-based Course Management System (CMS) will be used for passing out class notes, handouts, and announcements. Please check regularly. Recent reviews on the subjects presented in the lectures will be provided.

Grading System:

Written Research Proposal.....40%
Presentations (including Proposal)30%
Classroom Participation30%
(attendance included)

Textbooks:

Clinical Perfusion MRI: Techniques and Applications
Peter Barker, Xavier Golay, and Gregory Zaharchuk
Cambridge University Press, 2013

Introduction to Functional Magnetic Resonance Imaging Principles & Techniques
By Richard B. Buxton
Cambridge University Press, 2002

Functional MRI an introduction to methods
Edited by Peter Jezzard, Paul M. Matthews, Stephen M. Smith
Oxford University Press, 2001

Functional MRI
Edited by C.T.W. Moonen & P.A. Bandettini
Springer-Verlag, 2000

Diffusion and Perfusion Magnetic Resonance Imaging Applications to Functional MRI
Edited by Denis Le Bihan
Raven Press, 1995

Imaging Drug Action in the Brain
Edited by Edythe D. London
CRC Press, 1993

In-vivo magnetic resonance spectroscopy
Guest-editor, M. Rudin
NMR, basic principles and progress; vol 26
Springer-Verlag, 1992

Magnetic resonance spectroscopy diagnosis of neurological diseases
Else Rubaek Danielsen, Brian Ross
M. Dekker, 1999 (Galter Library)

Syllabus for BME 495-0-21: Functional Imaging

Date	Subject
March 31	Functional Imaging – more than anatomy (Prasad)
April 5	Perfusion-based and Flow-based functional MRI: principles, imaging techniques, applications (Prasad)
April 7	ASL & QSM - Guest Lecturer Prof. Huan Tan, Univ. Chicago
April 12	Neuro fMRI demo – Evanston Hospital – Dr. Doug Burman, NorthShore University HealthSystem
April 14	PET imaging - Guest Lecturer Prof. Chin Tu Chen, Univ. Chicago
April 19	Diffusion tensor imaging applications - Guest Lecturer Prof. Konstantinos Arfanakis, IIT
April 21	Student paper reviews (2) - <i>Assign topics for student research proposals</i> (provide template)
April 26	Non-neuro fMRI applications (heart, kidney, lung, etc.) (Prasad)
April 28	Neuro fMRI applications – Guest Lecturer Prof. Todd Parrish, Northwestern
May 3	Resting State fMRI – Guest Lecturer Prof. Todd Parrish, Northwestern
May 5	Student paper reviews (3)
May 10	Magnetic Nanostructures: Diagnostic and Theranostic applications – Guest Lecturer Prof. Vinayak Dravid, Northwestern University
May 12	In-utero diffusion imaging in hypoxia-ischemia model to predict post-natal outcomes (Alex Drobyshesky)
May 17	Metabolic imaging: biochemical events, principles of MR Spectroscopy, intrinsic & extrinsic multinuclear probes, localized MR spectroscopy techniques (single voxel, multi voxel), data analysis, applications - Guest Lecturer – Dr. Venkatasubramanian, NorthShore University HealthSystem
May 19	Student paper reviews (2)
May 24	Molecular imaging: principles, MRI contrast agents, scanning methods, applications (Wyrwicz)
May 26	Student research proposal presentations (2)
May 31	Student research proposal presentations (2)
June 2	Student research proposal presentations (3)
June 7	Written proposals due
June 13	Grades due

Guest Lecturers:

Prof. Huan Tan, Ph.D.
Research Associate (Assistant Professor) of Surgery
University of Chicago
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Prof. Chin-Tu Chen, Ph.D.
Associate Professor of Radiology
University of Chicago
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Douglas Burman, Ph.D.
Project Manager
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Prof. Konstantinos Arfanakis, Ph.D.
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Prof. Todd Parrish, Ph.D.
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Prof. Vinayak Dravid, Ph.D.
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