

# RADIOLOGY

Web site: <https://med.stanford.edu/radiology.html>

Courses offered by the Department of Radiology are listed under the subject code RAD on the (<http://explorecourses.stanford.edu/CourseSearch/search/?view=catalog&catalog=&page=0&q=RAD&filter-catalognumber=RAD=on>) Stanford Bulletin's (<http://explorecourses.stanford.edu/CourseSearch/search/?view=catalog&catalog=&page=0&q=RAD&filter-catalognumber=RAD=on>) ExploreCourses web site (<http://explorecourses.stanford.edu/CourseSearch/search/?view=catalog&catalog=&page=0&q=RAD&filter-catalognumber=RAD=on>).

The Department of Radiology does not offer degrees. However, its faculty teach courses open to medical students, graduate students, and undergraduates. The department also accepts students in other curricula as advisees for study and research. Undergraduates may also arrange individual research projects under the supervision of the department's faculty. This discipline focuses on the use of radiation, ultrasound, and magnetic resonance as diagnostic, therapeutic, and research tools. The fundamental and applied research within the department reflects this broad spectrum as it relates to anatomy, pathology, physiology, and interventional procedures. Original research and development of new clinical applications in medical imaging is supported within the Radiological Sciences Laboratory.

## Faculty

*Emeriti: (Professors)* Herbert L. Abrams, Ronald Castellino, Barton Lane, Gerald Friedland, David A. Goodwin, Michael L. Goris, Henry H. Jones, William Marshall, I. Ross McDougall, Robert E. Mindelzun, Matilde Nino-Murcia, William H. Northway, Bruce R. Parker, Lewis Wexler, Leslie M. Zatz

*Chair:* Sanjiv Sam Gambhir

*Professors:* Patgrick Barnes, Richard A. Barth, Christopher F. Beaulieu, Bruce Daniel, Huy M. Do, Michael Federle, Nancy Fischbein, Dominik Fleischmann, Sanjiv Sam Gambhir, Gabriela Gayer, Gary H. Glover, Garry E. Gold, Robert J. Herfkens, Lawrence Hofmann, Dave Hovsepian, Debra M. Ikeda, R. Brooke Jeffrey, Peter Kane, Ralph Lachman, Barton Lane, Ann Leung, Craig Levin, Michael Marks, Tarik Massoud, Michael Moseley, Peter Moskowitz, Sandy Napel, Beverley Newman, Norbert J. Pelc, Allan Reiss, Brian Rutt, George Segall, F. Graham Sommer, Daniel Spielman, Daniel Y. Sze, Volney Van Dalsem, Joseph Wu

*Professor (Research):* R. Kim Butts-Pauly, Sylvia Plevritis

*Associate Professors:* Sandip Biswal, Francis Blankenberg, Frandics P. Chan, Terry Desser, Andrei H. Iagaru, Nishita Kothary, William Kuo, David Larson, John Louie, Eric W. Olcott, Sunita Pal, Geoffrey Riley, Erika Rubesova, Kathryn J. Stevens, Shreyas Vasanawala, Dorcas Yao, Greg Zaharchuk

*Associate Professors (Research):* Roland Bammer, Zhen Cheng, Heike Daldrop-Link, Rebecca Fahrig, Brian Hargreaves, Sylvia Plevritis, Jianghong Rao

*Assistant Professors:* Robert Dodd, Pejman Ghanouni, Howard Harvin, Gloria Hwang, Aya Kamaya, Sirisha Komakula, Amelie Lutz, Payam Massaband, Erik Mittra, Zina Payman, Peter Poulos, Jianghong Rao, Daniel Rubin, Rajesh Shah, Lewis Shin, Minal Vasanawala, David Wang, Joseph Wu, Kristen Yeom, Michael Zeineh, Ashwini, Zenooz

*Assistant Professors (Research):* Frederick T. Chin, Parag Mallick, Jennifer McNab, David Paik, Ramasamy Paulmurugan, Sharon Pitteri

*Clinical Instructors:* Bao Do, H. Henry Guo, Stefan Hura, Linda Morimoto

## Courses

### **RAD 101. Readings in Radiology Research. 1-18 Unit.**

Prerequisite: consent of instructor.

### **RAD 199. Undergraduate Research. 1-18 Unit.**

Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

### **RAD 201. Introduction to Radiology. 1 Unit.**

This seminar is offered to pre-clinical medical students interested in learning about how image-based anatomy can reinforce their knowledge of gross anatomy as they progress through the term. This also serves as a refresher for MSII students. Within this seminar, students will explore image findings in human anatomy in the normal and diseased state. The course will also cover when to request X-Ray, Fluoroscopy, Ultrasound, CT, MRI, and Nuclear Medicine. There will be time to explore Radiology as a career choice as well as research opportunities in Radiology.

### **RAD 202. Introduction to Cardiac Image Processing Techniques. 1 Unit.**

Student lead: This course offers a unique opportunity for students to learn about the anatomy, function and physiology of the cardiovascular system by using advanced image processing technology based on CT and MRI. Students will learn to use different clinical software to visualize and interpret 3D and 4D images and to construct patient specific that can be used for surgical planning. Image data will be presented in the context of a clinical scenario, and student will learn about the cardiovascular anatomy and the pathogenesis of the disease being presented, while they practice image interpretation and model construction. The course will be held in the 3DQ Lab.

### **RAD 206. Mixed-Reality in Medicine. 3 Units.**

Mixed reality uses transparent displays to place virtual objects in the user's field of vision such that they can be aligned to and interact with actual objects. This has tremendous potential for medical applications. The course aims to teach the basics of mixed-reality device technology, and to directly connect engineering students to physicians for real-world applications. Student teams would compete guided assignments on developing new mixed-reality technology and a final project applying mixed-reality to solve real medical challenges. Prerequisites: (1) Programming competency in a language such as C, C++ or Python. (2) A basic signal processing course such as EE102B (Digital Signal Processing). A medical imaging course, while not required, will be helpful. Please contact the instructors with any questions about prerequisites.

### **RAD 220. Introduction to Imaging and Image-based Human Anatomy. 3 Units.**

Focus on learning the fundamentals of each imaging modality including X-ray Imaging, Ultrasound, CT, and MRI, to learn normal human anatomy and how it appears on medical images, to learn the relative strengths of the modalities, and to answer, "What am I looking at?" Course website: <http://bioe220.stanford.edu>. Same as: BIOE 220

### **RAD 221. Physics and Engineering of Radionuclide-based Medical Imaging. 3 Units.**

Physics, instrumentation, and algorithms for radionuclide-based medical imaging, with a focus on positron emission tomography (PET) and single photon emission computed tomography (SPECT). Topics include basic physics of photon emission from the body and detection, sensors, readout and data acquisition electronics, system design, strategies for tomographic image reconstruction, system calibration and data correction algorithms, methods of image quantification, and image quality assessment, and current developments in the field. Prerequisites: A year of university-level mathematics and physics. Same as: BIOE 221

**RAD 222. Physics and Engineering Principles of Multi-modality Molecular Imaging of Living Subjects. 3-4 Units.**

Physics and Engineering Principles of Multi-modality Molecular Imaging of Living Subjects (RAD 222A). Focuses on instruments, algorithms and other technologies for non-invasive imaging of molecular processes in living subjects. Introduces research and clinical molecular imaging modalities, including PET, SPECT, MRI, Ultrasound, Optics, and Photoacoustics. For each modality, lectures cover the basics of the origin and properties of imaging signal generation, instrumentation physics and engineering of signal detection, signal processing, image reconstruction, image data quantification, applications of machine learning, and applications of molecular imaging in medicine and biology research.

Same as: BIOE 222

**RAD 223. Physics and Engineering of X-Ray Computed Tomography. 3 Units.**

CT scanning geometries, production of x-rays, interactions of x-rays with matter, 2D and 3D CT reconstruction, image presentation, image quality performance parameters, system components, image artifacts, radiation dose. Prerequisites: differential and integral calculus. Knowledge of Fourier transforms (EE261) recommended.

Same as: BIOE 223

**RAD 224. Probes and Applications for Multi-modality Molecular Imaging of Living Subjects. 4 Units.**

We will focus on design, development, and application of imaging agents that target specific cellular and molecular aspects of disease. Covers the strengths and limitations of different imaging agents and how to optimize their design for image-guided intra-operative procedures, brain imaging, probing infection, or interrogating tumor metabolism. Emphasis this year will be on clinical molecular imaging, state-of-the-art strategies for early detection of dementia, imaging response to cancer immunotherapy, and how  $\gamma$ Deep Learning $\gamma$  can be used for probe design and high-throughput automated image analysis.

Same as: BIOE 224

**RAD 225. Intro to Ultrasound Physics and Ultrasound Neuromodulation. 3 Units.**

This course covers the basic concepts of ultrasound physics including acoustic properties of biological tissues, transducer hardware, beam formation, and beam modeling. The course will then cover basic neuronal physiology and how ultrasound can be used to affect it. It will cover how we study ultrasound neuromodulation through animal models and human studies. The course will conclude with a series of lectures on the breadth of research on ultrasonic manipulation of behavior and psychiatric disorders. Course website: <http://bioe225.stanford.edu>.

Same as: BIOE 225

**RAD 226. MRI Spin Physics, Relaxation Theory, and Contrast Mechanisms. 3 Units.**

This course covers fundamental principles of magnetic resonance imaging (MRI) and spectroscopy (MRS) focusing on the analytic tools needed to understand interactions among nuclear spins, relaxation processes, and image contrast. Starting from a quantum mechanical description of NMR, we'll study J-coupling, the most mathematically tractable coupling mechanism, and its fundamental importance in MRS. Next, we will extend these concepts to develop NMR relaxation theory, which provides the foundation for analyzing multiple in vivo MRI contrast mechanisms and contrast agents.

Same as: BIOE 226

**RAD 227. Functional MRI Methods. 3 Units.**

Basics of functional magnetic resonance neuroimaging, including data acquisition, analysis, and experimental design. Journal club sections. Cognitive neuroscience and clinical applications. Prerequisites: basic physics, mathematics; neuroscience recommended.

Same as: BIOE 227, BIOPHYS 227

**RAD 228. Magnetic Resonance Imaging Programming Topics. 3 Units.**

Primarily for students working on research projects involving MRI pulse sequence programming. Introductory and student-initiated topics in seminars and hands-on labs. Image contrast mechanisms achieved by pulse sequences that control radiofrequency and gradient magnetic fields in real time, while acquiring data in an organized manner for image reconstruction. Prerequisites: EE 369B and consent of instructor.

**RAD 229. MRI Sequences and Signals. 3 Units.**

Magnetic Resonance Imaging (MRI) uses sequences of radiofrequency excitation and magnetic field gradients to generate a signal and form images. Numerous common and advanced sequences will be studied, including analysis techniques to predict signal and contrast levels, and to measure and reduce unwanted image artifacts. Prerequisite: EE 369B.

**RAD 230. Ultrasound Instrumentation for Imaging and Therapy. 1-2 Unit.**

This course teaches the physics, materials, modeling and processing steps involved in the design and fabrication of medical ultrasound transducers for diagnostic imaging and therapeutic applications. Students will learn how to consider various tradeoffs in the design and selection of clinical probes for particular uses, and a lab activity will reinforce the fundamentals of transducers and demonstrate how to assess probe performance in the real world.

**RAD 235. Advanced Ultrasound Imaging. 3 Units.**

The focus of this course is on advanced ultrasound imaging techniques for medical imaging applications. Topics include beamforming, adaptive beamforming, Fourier beamforming, synthetic aperture techniques, speckle, speckle reduction, k-space, harmonic imaging, coherence imaging, phase aberration, radiation force imaging, elastography, quantitative ultrasound, Doppler and flow imaging, ultrasounds modeling and advanced ultrasound theory.

**RAD 236. Analytical Methods in Biotechnology. 3 Units.**

This course provides fundamental principles underlying important analytical techniques used in modern biotechnology. The course comprises of lectures and hands-on laboratory experiments. Students will learn the core principles for designing, implementing and analyzing central experimental methods including polymerase chain reaction (PCR), electrophoresis, immunoassays, and high-throughput sequencing. The overall goal of the course is to enable engineering students with little or no background in molecular biology to transition into research in the field of biomedicine.

Same as: BIOS 212, EE 235

**RAD 260. Computational Methods for Biomedical Image Analysis and Interpretation. 3-4 Units.**

The latest biological and medical imaging modalities and their applications in research and medicine. Focus is on computational analytic and interpretive approaches to optimize extraction and use of biological and clinical imaging data for diagnostic and therapeutic translational medical applications. Topics include major image databases, fundamental methods in image processing and quantitative extraction of image features, structured recording of image information including semantic features and ontologies, indexing, search and content-based image retrieval. Case studies include linking image data to genomic, phenotypic and clinical data, developing representations of image phenotypes for use in medical decision support and research applications and the role that biomedical imaging informatics plays in new questions in biomedical science. Includes a project. Enrollment for 3 units requires instructor consent. Prerequisites: programming ability at the level of CS 106A, familiarity with statistics, basic biology. Knowledge of Matlab or Python highly recommended.

Same as: BIOMEDIN 260, CS 235

**RAD 280. Early Clinical Experience in Radiology. 1-2 Unit.**

Provides an observational experience as determined by the instructor and student. Prerequisite: consent of instructor.

**RAD 299. Directed Reading in Radiology. 1-18 Unit.**

Prerequisite: consent of instructor.

**RAD 301A. Diagnostic Radiology and Nuclear Medicine Clerkship. 5 Units.**

VISITING: Open to visitors. TYPE OF CLERKSHIP: Selective 1.

DESCRIPTION: This clerkship is currently offered in a completely virtual environment. This is the core radiology clerkship designed for students going into any medical subspecialty, including radiology. The four-week course has traditionally been lecture-based and provides a framework for understanding the role of various medical imaging modalities in diagnosis and management of a broad range of medical disorders. Emphasis is placed on learning the benefits and drawbacks of radiography, ultrasound, computed tomography, magnetic resonance imaging, nuclear medicine studies, and basic interventional techniques for application to clinical practice. Core concepts that apply across medical subspecialties, including radiation exposure, the utilization (and risks) of radiographic contrast agents, and effective ordering of imaging studies are covered. Students are taught by radiology faculty, fellows, and residents including sessions focused on essential topics in chest, abdominal, neurological, and musculoskeletal imaging. Sessions on pediatric imaging, breast imaging and obstetric ultrasound are also included. Online radiology texts and other web based materials will be made available to all participants. Two quizzes are administered during the course and must be passed for credit. PREREQUISITES: Medicine 300A, Pediatrics 300A, or Surgery 300A strongly advised. Visiting students wishing to do this clerkship must receive prior approval from the Clerkship Coordinator before applying. PERIODS AVAILABLE: 5, 6, 11, 12 for 2020-21 and 4, 5, 8, 9 for 2021-22 and 2022-23, full-time for 4 weeks, 22 students per period. CLERKSHIP DIRECTOR: Christopher Beaulieu, M.D., Ph.D. and Bryan Lanzman, M.D. CLERKSHIP COORDINATOR: Ann Vo, 650-497-5407, annvo@stanford.edu. REPORTING INSTRUCTIONS: Where: Instructions on Canvas; Time: Check schedule in Canvas. CALL CODE: 0. OTHER FACULTY: Radiology faculty, fellows, and residents. LOCATION: SUMC.

**RAD 302A. Nuclear Medicine Clerkship. 5 Units.**

VISITING: Open to visitors. TYPE OF CLERKSHIP: Elective. DESCRIPTION: Acquaints students with the basic principles of nuclear medicine, the instrumentation used, the gamut of procedures available, and the judgments used to select specific diagnostic or therapeutic procedures and interpret results. The experience should be especially helpful for students planning a career in diagnostic radiology, nuclear medicine, cardiology, or oncology. The student experience includes instruction in radiologic physics, instrumentation, responsibility for selected isotopic procedures, daily teaching rounds for review of all cases studies, and special conferences. Please note: Visiting students must obtain approval from the Department prior to applying for this clerkship. Please email requests to Sofia Gonzales (sofias@stanford.edu). PREREQUISITES: Medicine 300A. PERIODS AVAILABLE: 1-12, full-time for 4 weeks, 1 student per period. CLERKSHIP DIRECTOR: Benjamin Franc, M.D. CLERKSHIP COORDINATOR: Sofia Gonzales (650-724-9139), Room H2200. REPORTING INSTRUCTIONS: Where: Nuclear Medicine Clinic, Second Floor, C21; Time: 8:30 am. CALL CODE: 0. OTHER FACULTY: C. Aparici, G. Davidzon, B. Franc, F. Moradi. LOCATION: SUMC.

**RAD 303A. Specialty Clerkship in Diagnostic Radiology. 5 Units.**

VISITING: Open to visitors. TYPE OF CLERKSHIP: Elective. DESCRIPTION: Provides subspecialty radiology reading room experience for students considering a career in radiology or other specialties. Students work alongside residents, fellows, and faculty to actively interpret and communicate diagnostic radiology studies. Up to 12 students can be accommodated per session, with a maximum of two students on each subspecialty service at a time. Typically, students spend two weeks in each of two subspecialties. (Subspecialty rotations and interventional radiology are listed elsewhere in the course catalog.) For Rad 303A, subspecialty rotations include: Chest (primarily ICU radiographs and CT), Cardiovascular (inpatient and outpatient CT and MRI), Abdominal CT (primarily inpatient and emergency), Abdominal US (primarily inpatient and emergency), GI Fluoroscopy, Musculoskeletal (primarily radiography), Neuroradiology (inpatient and emergency), Body MRI, Pediatric Imaging, Breast Imaging, and Nuclear Medicine. Similar rotations are also possible at the Palo Alto Veterans Administration Medical Center. PREREQUISITES: Visiting students wishing to do this clerkship must receive prior approval from the Clerkship Coordinator before applying. Stanford students are asked to inform the clerkship coordinator of enrollment for coordination with subspecialty services. PERIODS AVAILABLE: 2-12, full-time for 2 weeks or 4 weeks, 12 students per period. CLERKSHIP DIRECTOR: Christopher Beaulieu, M.D., Ph.D. CLERKSHIP COORDINATOR: Ann Vo, 650-497-5407, annvo@stanford.edu. REPORTING INSTRUCTIONS: Where: TBA (email 4 weeks prior); Time: TBA. CALL CODE: 0. OTHER FACULTY: Staff. LOCATION: SUMC.

**RAD 304A. Pediatric Radiology Clerkship. 5 Units.**

VISITING: Open to visitors. TYPE OF CLERKSHIP: Elective. DESCRIPTION: Our clerkship is designed to give you an overview of the exciting field of pediatric radiology. The rotation includes a comprehensive curriculum including a wealth of didactic and clinical conferences, directed reading assignments, interactive online teaching modules, and image interpretation with our outstanding pediatric radiology faculty. You will be exposed to all radiologic imaging modalities including MRI, CT, ultrasound, fluoroscopy, and plain radiography and will have the unique opportunity to participate in perinatal imaging including prenatal ultrasound and fetal MRI. If time allows, additional exposure to Nuclear Medicine, Interventional Radiology, and Neuroradiology is available. Students will be expected to give a short presentation of an interesting imaging case to faculty and fellows at the end of their rotation. Visiting students wishing to do this clerkship must receive prior approval from Clerkship Coordinator before applying. PREREQUISITES: Radiology 301A or a similar general radiology clerkship or consent of instructor. PERIODS AVAILABLE: 1-12, full-time for 2 or 4 weeks, 2 students per period. CLERKSHIP DIRECTOR: Jayne Seekins, D.O. CLERKSHIP COORDINATOR: Ann Vo (650-497-5407, annvo@stanford.edu). REPORTING INSTRUCTIONS: Where: LPCH (Radiology Dept. Secretary); Time: 8:30 am. CALL CODE: 0. OTHER FACULTY: R. Barth, F. Blankenberg, F. Chan, H. Dahmouh, H. Daldrop-Link, L. Donnelly, D. Frush, C. Guimaraes, S. Halabi, S. Josephs, D. Larson, M. Lungren, H. Nadel, B. Newman, E. Rubesova, J. Seekins, A. Thakor, S. Vasanawala, K. Yeom, E. Zucker. LOCATION: LPCH.

**RAD 305A. Interventional Radiology Clerkship. 5 Units.**

**VISITING:** Open to visitors. **TYPE OF CLERKSHIP:** Elective. **DESCRIPTION:** Interventional radiology (IR) has become integral to the practice of modern medicine. In 2013, the American Board of Medical Specialties recognized IR as a primary specialty distinct from diagnostic radiology. Subsequently, the ACGME approved the formation of a new IR residency training program ([http://www.sirweb.org/clinical/IR\\_DR\\_cert.shtml](http://www.sirweb.org/clinical/IR_DR_cert.shtml)), which has begun at Stanford. This 3 week elective introduces medical students to image-guided, minimally invasive vascular and nonvascular interventions and is appropriate for students considering residency training in IR as well as those interested in learning more about the field in general. Students will be exposed to a broad range of IR procedures, including interventional oncology, peripheral vascular (venous and arterial), genitourinary, gastrointestinal, and pediatric interventions. This elective provides students experience in basic IR skills such as vascular access, placement of venous access catheters and ports, and image-guided biopsies and drain placement. Students are encouraged to take part in more advanced procedures such as chemoembolization, radioembolization, and TIPS. Our service operates like a surgical subspecialty and students are expected to be an integral part of the IR team and actively participate in the pre-procedure evaluation and post-procedure care of our patients. Students may attend various departmental and interdepartmental conferences. Interested students are encouraged to give a short presentation on an interesting case at the end of the rotation. Note: Visiting students interested in rotating through this clerkship must receive prior approval from the Clerkship Coordinator before applying. **PREREQUISITES:** Surgery 300A, Medicine 300A and Radiology 301A recommended but not required. **PERIODS AVAILABLE:** 2-12, full-time for 2 weeks or 4 weeks, 3 students per period. **CLERKSHIP DIRECTOR:** David S. Wang, M.D. **CLERKSHIP COORDINATOR:** Ann Vo, 650-497-5407, [annvo@stanford.edu](mailto:annvo@stanford.edu). **REPORTING INSTRUCTIONS:** Where: H3652; Time: 7:30 am. **CALL CODE:** 0. **OTHER FACULTY:** L. Hofmann, D. Hovsepian, G. Hwang, N. Kothary, W. Kuo, J. Louie, D. Sze. **LOCATION:** SUMC.

**RAD 306A. Neuroradiology Clerkship. 5 Units.**

**VISITING:** Open to visitors. **TYPE OF CLERKSHIP:** Elective. **DESCRIPTION:** Our clerkship provides students with further exposure to basic and advanced neuroimaging of the brain, spine, and head and neck. The curriculum will be tailored to the specific interests of the student incorporating participation in real-time read-out and consultations with our residents, fellows, physician colleagues, and Neuroradiology faculty, didactic and clinical conferences (e.g. weekly interesting case conference and tumor board). Students will learn the utility of CT and MRI in diagnosing and treating diseases of the central nervous system and head and neck in both the pediatric and adult populations and will also have the unique opportunity to participate in fluoroscopy-guided lumbar punctures for CSF collection, intrathecal chemotherapy administration, and myelograms. Students are expected to give a short presentation of a case of their choice to fellows and/or faculty at the end of the clerkship rotation. **PREREQUISITES:** Visiting students wishing to do this clerkship must receive prior approval from the clerkship coordinator before applying. Stanford students are asked to inform the clerkship coordinator of enrollment. Once enrollment is confirmed, students are asked to email the course co-director, Bryan Lanzman at [bryan3@stanford.edu](mailto:bryan3@stanford.edu), for further details. **PERIODS AVAILABLE:** 1-12, full time for 2 weeks or 4 weeks, 2 students per period. **CLERKSHIP DIRECTOR:** Bryan Lanzman, M.D., Michael Iv, M.D., and Max Wintermark, M.D. **CLERKSHIP COORDINATOR:** Ann Vo, 650-497-5407, [annvo@stanford.edu](mailto:annvo@stanford.edu). **REPORTING INSTRUCTIONS:** Where: Grant S031A; Time: 9:00 am. **CALL CODE:** 0. **OTHER FACULTY:** Neuroradiology faculty. **LOCATION:** SUMC, LPCH.

**RAD 370. Medical Scholars Research. 4-18 Units.**

Provides an opportunity for student and faculty interaction, as well as academic credit and financial support, to medical students who undertake original research. Enrollment is limited to students with approved projects.

**RAD 398A. Clinical Elective in Diagnostic Radiology & Nuclear Medicine. 5 Units.**

**VISITING:** Closed to visitors. **TYPE OF CLERKSHIP:** Elective. **DESCRIPTION:** Provides an opportunity for a student in the clinical years to have a clinical experience in Diagnostic Radiology or Nuclear Medicine, of a quality and duration to be decided upon by the student and a faculty preceptor in the Department. The student must make individual arrangements with a faculty member in Diagnostic Radiology or Nuclear Medicine. Please note: Students cannot add 398A clerkships directly to their fishbowl schedules through the regular shuffles. Please contact Caroline Cheang in the Office of Medical Student Affairs at [cheang@stanford.edu](mailto:cheang@stanford.edu) or 650-498-7619 with the faculty preceptor's name and email address to add this clerkship. **PREREQUISITES:** None for Diagnostic Radiology; Medicine 300A for Nuclear Medicine. Consent of the designated faculty preceptor and approval by Advisor. **PERIODS AVAILABLE:** 1-12. **CLERKSHIP DIRECTOR:** Christopher Beaulieu, M.D., Ph.D. **CLERKSHIP COORDINATOR:** Ann Vo, 650-497-5407, [annvo@stanford.edu](mailto:annvo@stanford.edu). **REPORTING INSTRUCTIONS:** Where: TBA (designated faculty preceptor); Time: TBA. **CALL CODE:** 2 (varies with preceptor). **OTHER FACULTY:** Staff. **LOCATION:** SUMC, LPCH.

**RAD 399. Graduate Research. 1-18 Unit.**

Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

**RAD 802. TGR Dissertation. 0 Units.**