

MOLECULAR AND CELLULAR PHYSIOLOGY

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

The Department of Molecular and Cellular Physiology is located in the Beckman Center for Molecular and Genetic Medicine.

A central goal of physiology in the post-genomic era is to understand how thousands of encoded proteins serve to bring about the highly coordinated behavior of cells and tissues. Research in the department approaches this goal at many levels of organization, ranging from single molecules and individual cells to multicellular systems and the whole organism. The faculty share common interests in the molecular mechanisms of cell signaling and behavior, with a special focus on structure/function analysis of ion channels and G-protein coupled receptors, and their roles at the cellular, organ, and whole-organism levels; the molecular basis of sensory transduction, synaptic transmission, plasticity and memory; the role of ion channels and calcium in controlling gene expression in neural and immune cells; and the regulation of vesicle trafficking and targeting, cell polarity, and cell-cell interactions in the nervous system and in epithelia. Research programs employ a wide range of approaches, including molecular and cell biology, biochemistry, genetics, biophysics, x-ray crystallography and solution NMR, electrophysiology, and in vitro and in vivo imaging with confocal and multi-photon microscopy.

Graduate Programs in Molecular and Cellular Physiology

The department offers required and elective courses for students in the School of Medicine and is also open to other qualified students with the consent of the instructor. Training of medical, graduate, and postdoctoral students is available. The program offers a course of study leading to the Ph.D. degree. No B.S. is offered, and an M.S. is offered only in the unusual circumstance where a student completes the course work, rotation, and the written section of the qualifying exam, but is unable to complete the requirements for the Ph.D.

Application and Admission

Applications are made through the Graduate Admissions (<http://gradadmissions.stanford.edu>) web site.

Applicants are assessed based on their undergraduate transcripts, test scores, research experience, statement of purpose and letters of recommendation that document exceptional potential, ability, or achievements.

Students admitted to the program are offered financial support covering tuition, a living stipend, and insurance coverage. Applicants are urged to apply for independent fellowships such as from the National Science Foundation. Fellowship applications are due in November of the year prior to matriculation in the graduate program, but MCP graduate students may continue to apply for outside fellowships after matriculation. Because of the small number of department-funded slots, students who have been awarded an outside fellowship have an improved chance of acceptance into the program.

Upon matriculation, each student is assisted in selecting courses and lab rotations in the first year and in choosing a lab for the dissertation

research. Once a dissertation adviser has been selected, a dissertation committee is composed to include the dissertation adviser and two additional MCP/Non-MCP faculty, to guide the student during their dissertation research. The student must meet with the dissertation committee at least once a year.

Doctor of Philosophy in Molecular and Cellular Physiology

Candidates for Ph.D. degrees at Stanford must satisfactorily complete a program of study that includes 135 units of graduate course work and research.

Study toward the Ph.D. is expected to occupy five years, including summers. The MCP course requirements for the program are as follows:

- MCP 221 Advanced Cell Biology
- MCP 207 MCP Bootcamp
- MCP 208 MCP Journal Club and Professional Development Series
- MCP 256 How Cells Work: Energetics, Compartments, and Coupling in Cell Biology
- BIOS 200 Foundations in Experimental Biology
- MED 255 The Responsible Conduct of Research, if funded on NSF or NIH training grants
- Advanced graduate courses or mini-courses for a minimum of 6 units total. These courses do not need to be MCP courses but must be in relevant scientific topic and approved by the Director of Graduate Studies.
- Two of the following courses:
 - BIOC 241 Biological Macromolecules
 - GENE 205 Advanced Genetics
 - NBIO 206 The Nervous System
 - BIO 230 Molecular and Cellular Immunology

Students are also required to participate in the Molecular and Cellular Physiology Seminar Series and attend the department scientific meeting.

Courses taken to meet program requirements must be taken for a letter grade and students must earn a minimum grade of at least a 'B' in every individual required course. Students must also maintain a minimum GPA of 3.0 by University policy. Failure to maintain the required grades and grade point average is taken as evidence of unsatisfactory progress in the program.

Students should complete their required courses within the first two years of study. Exceptions may be made in cases where it was impossible to schedule courses because they were not offered within a student's first two years. Students may petition the MCP graduate committee for variances in the specific courses required, and such petitions may be granted in special circumstances, in cases where a student's progress is otherwise exemplary.

Qualifying Examination

All students in the program must pass a qualifying examination to advance to candidacy for the Ph.D. It is expected that students take the qualifying examination by the end of the Autumn Quarter in the second year of study. Failure to take the qualifying exam by the end of Autumn Quarter of the second year of study is taken as evidence of unsatisfactory progress in the program. In any case where a student thinks they need additional time to schedule and take their exam, a request must be submitted in writing to the Director of Graduate Studies

(DGS) by November 15 of Autumn Quarter. The DGS may opt to grant additional time in compelling circumstances that do not indicate poor progress, or may refer the matter to the graduate committee for further action.

Students are given two chances to unconditionally pass the qualifying examination. Failure to achieve an unconditional pass of the qualifying examination by the end of the Spring Quarter of the second year is grounds for dismissal from the program.

Students form a qualifying examination committee consisting of at least 3 faculty members (members of the academic council, including the dissertation advisor), at least one of whom must be a member of MCP. This committee should be formed by the end of Spring Quarter of the first year of study. The composition of this committee should be approved by the Director of Graduate Studies. Students should also check with the department's student services office to make sure to file all required paperwork by the end of Spring Quarter. The University maintains certain deadlines for filing for candidacy, and it is the student's responsibility to be aware of these deadlines.

Dissertation and University Oral Examination

The results of independent, original work by the students are presented in a dissertation. The oral examination is largely a defense of the dissertation.

Advisers and Advisory Committees

A graduate advisory committee, currently professors Feng, Kobilka, Maduke and Madison, advises students during the period before the formation of their qualifying committees.

Financial Aid

Students may be funded by their advisers' research grants, by training grants, by department funds, or by extramural funds. Students are encouraged to obtain funding from outside sources such as NIH and NSF.

COVID-19 Policies

On July 30, the Academic Senate adopted grading policies effective for all undergraduate and graduate programs, excepting the professional Graduate School of Business, School of Law, and the School of Medicine M.D. Program. For a complete list of those and other academic policies relating to the pandemic, see the "COVID-19 and Academic Continuity (<http://exploreddegrees.stanford.edu/covid-19-policy-changes/#tempdeptemplatetabtext>)" section of this bulletin.

The Senate decided that all undergraduate and graduate courses offered for a letter grade must also offer students the option of taking the course for a "credit" or "no credit" grade and recommended that deans, departments, and programs consider adopting local policies to count courses taken for a "credit" or "satisfactory" grade toward the fulfillment of degree-program requirements and/or alter program requirements as appropriate.

The Molecular & Cellular Physiology Department is in the process of making decisions concerning COVID-19 policies and will update this tab when those decisions have been made.

Graduate Advising Expectations

The Department of Molecular and Cellular Physiology is committed to providing academic advising in support of graduate student scholarly and professional development. When most effective, this advising relationship entails collaborative and sustained engagement by both the adviser and the advisee. As a best practice, advising expectations should be periodically discussed and reviewed to ensure mutual

understanding. Both the adviser and the advisee are expected to maintain professionalism and integrity.

Faculty advisers guide students in key areas such as selecting courses, designing and conducting research, developing of teaching pedagogy, navigating policies and degree requirements, and exploring academic opportunities and professional pathways.

Graduate students are active contributors to the advising relationship, proactively seeking academic and professional guidance and taking responsibility for informing themselves of policies and degree requirements for their graduate program.

For a statement of University policy on graduate advising, see the "Graduate Advising (<http://exploreddegrees.stanford.edu/graduatedegrees/>)" section of this bulletin.

Emeriti (Professors): W. James Nelson, Stephen J. Smith, Richard W. Tsien

Chair: Miriam B. Goodman

Professors: Axel T. Brunger, K. Christopher Garcia, Miriam B. Goodman, Brian K. Kobilka, Richard S. Lewis, Georgios Skiniotis, Thomas C. Sudhof

Associate Professors: V. Daniel Madison, Merritt C. Maduke

Assistant Professors: Liang Feng, Lucy E. O'Brien

Joint Professors: Steve Chu, William Weis

Courtesy Professors: John Huguenard, Anthony J. Ricci, Ron Dror

Courses

MCP 126. Neurons and Disease. 4 Units.

Diseases of the nervous system. First lecture of each week focuses on the clinical, epidemiological and behavioral aspects of a selected disease or syndrome. Second lecture exposes the cell biological, electrophysiological, biochemical and/or molecular biological processes that underlie each disease presented. Instructors maintain some flexibility in the diseases chosen for elucidation, but students can expect those covered to range from the relatively straightforward, for example Multiple Sclerosis (MS) or Amyotrophic Lateral Sclerosis (ALS), to the more complex, for example, Schizophrenia or Obsessive Compulsive Disorder (OCD). Prerequisite: Biology or Human Biology core.

MCP 156. How Cells Work: Energetics, Compartments, and Coupling in Cell Biology. 4 Units.

Open to graduate and medical students, and advanced undergraduates. Dynamic aspects of cell behavior and function, including cellular energetics, homeostasis, heterogeneity of membranes, structure and function of organelles, solute and water transport, signaling and motility. Emphasis is on the principles of how coupling of molecular processes gives rise to essential functions at the cellular level. Mathematical models of cell function. Student presentations. Same as: MCP 256

MCP 199. Undergraduate Research. 1-18 Unit.

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

MCP 207. MCP Bootcamp. 1-3 Unit.

Hands-on, week-long immersion in methods and concepts related to the physiology of cell signaling. Required of all first-year MCP students; other PhD students may enroll with consent of instructor.

MCP 208. MCP Journal Club and Professional Development Series. 1-2 Unit.

This class will entail discussion of current research in Molecular and Cellular Physiology (Journal Club) and sessions devoted to career development. Enrolled learners will gain experience in designing and delivering professional oral presentations and writing accessible lay summaries of primary research. They will also receive guidance in how to give and receive critiques following a rubric. Learners will choose research papers following a theme to be determined collaboratively. Career and professional development class sessions will provide information on a variety of topics related to career development and strategies for navigating research environment in productive and healthy ways (see below). The class will meet 8 times per quarter, with 4 Journal Club and 4 Professional Development sessions per quarter. Journal Club sessions will consist of one member of the class giving an oral presentation on the topic of a current relevant research paper, followed by critique and discussion. Learners will prepare written critiques of these talks. The Professional Development session will consist of a series of lectures, discussions, or workshops designed to foster a better understanding of the practices and processes that are critical for navigating paths toward a research career, but which are not generally covered in a classroom setting. These sessions might include such topics as mentor/mentee relationships, authorship, navigating peer review, issues of diversity and respectful workplace, wellness, experiences Stanford alumni in their own career paths, and other topics, including those suggested by class participants. The class will be graded on participation and on the writing assignments, including critiques and lay summaries. The course will be required for MCP graduate students in their first 3 years of study, and open to all predoctoral graduate students. The broader membership of the MCP scientific community will be encouraged to participate including postdocs (with permission of the course director).

MCP 221. Advanced Cell Biology. 4 Units.

For Ph.D. students. Taught from the current literature on cell structure, function, and dynamics. Topics include complex cell phenomena such as cell division, apoptosis, signaling, compartmentalization, transport and trafficking, motility and adhesion, and differentiation. Weekly reading of current papers from the primary literature. Advanced undergraduates may participate with the permission of the Course Director. Same as: BIO 214, BIOC 224

MCP 222. Imaging: Biological Light Microscopy. 3 Units.

This intensive laboratory and discussion course will provide participants with the theoretical and practical knowledge to utilize emerging imaging technologies based on light microscopy. Topics include microscope optics, resolution limits, Köhler illumination, confocal fluorescence, two-photon, TIRF, FRET, photobleaching, super-resolution (SIM, STED, STORM/PALM), tissue clearing/CLARITY/light-sheet microscopy, and live-cell imaging. Applications include using fluorescent probes to analyze subcellular localization and live cell-translocation dynamics. We will be using a flipped classroom for the course in that students will watch iBiology lectures before class, and class time will be used for engaging in extensive discussion. Lab portion involves extensive in-class use of microscopes in the CSIF and NMS core microscopy facilities. Same as: BIO 152

MCP 256. How Cells Work: Energetics, Compartments, and Coupling in Cell Biology. 4 Units.

Open to graduate and medical students, and advanced undergraduates. Dynamic aspects of cell behavior and function, including cellular energetics, homeostasis, heterogeneity of membranes, structure and function of organelles, solute and water transport, signaling and motility. Emphasis is on the principles of how coupling of molecular processes gives rise to essential functions at the cellular level. Mathematical models of cell function. Student presentations. Same as: MCP 156

MCP 299. Directed Reading in Molecular and Cellular Physiology. 1-18 Unit.

Prerequisite: consent of instructor.

MCP 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.

MCP 399. Graduate Research. 1-18 Unit.

Students undertake investigations sponsored by individual faculty members. Research fields include endocrinology, neuroendocrinology, and topics in molecular and cellular physiology. Prerequisite: consent of instructor. (Staff).

MCP 801. TGR Project. 0 Units.**MCP 802. TGR Dissertation. 0 Units.**