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2015-2016 ACADEMIC YEAR

GRADUATE PROGRAM OFFICERS and PERSONNEL

Graduate Program Director

Yana Zavros, Ph.D., Chair
Judith Heiny, Ph.D.
Christian Hong, Ph.D.
Nelson Horseman, Ph.D.

Recruitment Committee

Christian Hong, Ph.D., Chair
Judith Heiny, Ph.D.
Nelson Horseman, Ph.D.

Pre-Qualifying Advisor

Yana Zavros, Ph.D., Chair

Curriculum Committee

Yana Zavros, Ph.D., Chair
Christian Hong, Ph.D.
Bryan Mackenzie, Ph.D.

Program Enrichment

John MacLennan, Ph.D., Chair
Christian Hong, Ph.D.
Bryan Mackenzie, Ph.D.

Physiology Student Organization President

Robert Koncar

Physiology Student Organization Vice-President

Nina Bertaux-Skeirik

Physiology Student Social Chair

Hesam Hakimjavadi

Graduate Program Manager

Jeannie Cummins

Program Website

http://med.uc.edu/systemsbiology
ADMISSIONS

Requirements
The prospective student is required to have a baccalaureate degree from an accredited undergraduate institution and a strong background in the sciences; students are expected to have an overall GPA of at least 3.0, with particular emphasis placed on having excellent performance in the advanced science courses. Qualified students with specific deficiencies in their undergraduate preparation will be guided to remedy these either before, or during the early part of, their graduate education. All applicants are required to take the general aptitude test of the Graduate Record Exam (GRE). An advanced test (biology, molecular biology, biochemistry, chemistry, mathematics, or physics) is recommended but not required.

Special Requirements for International Students
Students whose native language is other than English must demonstrate proficiency in English by submitting scores for the Test of English as a Foreign Language (TOEFL) before they can be considered for admission. The minimum acceptable TOEFL score is 100-internet based. All international students will be required to pass either the Spoken English exam (TSE) with a score of at least 50, or the Oral English Proficiency Test (OEPT) administered by the University. Students who do not pass the TSE exam before enrollment will be required to take English as a Second Language course during Fall semester of their first year before taking the OEPT test. The OEPT may be retaken once if necessary. The OEPT or the TSE must be passed prior to enrollment for the second year. Information can be obtained at www.ets.org.

Procedures
Interested students should first complete the online application at www.grad.uc.edu, fill out the personal statement, and pay the $65.00 application fee ($70.00 for international students). Before being considered, applicants must submit:
  • An official transcript of all undergraduate and any graduate training.
  • A personal statement describing their interest in graduate study.
  • Three letters of reference assessing the applicant’s academic ability research potential and character.

Interview Process
When possible, applicants are invited to spend the day with students and faculty. The interview provides an opportunity for the applicant to meet the faculty and graduate students, see the program’s research facilities and learn more about the training offered by the program. Interviews conducted at this time will contribute significantly to the committee’s admission decision.

Timing
Applications and all supporting documents are accepted at any time, but first consideration is given to those submitted by January 1 for admission beginning the following Fall. All applications will be reviewed by the Recruitment Committee. Offers of admission are
generally made by March 1. Classes begin in late August at the beginning of the Fall semester.

FINANCIAL SUPPORT

Tuition
Except in special cases, graduate students will receive full remission of these fees for each academic year.

Stipend
The current 12-month stipend in the Systems Biology and Physiology Program is $30,000. Students are encouraged to apply for funding through fellowships from research foundations and other national groups as alternative (and prestigious) means of support. For those students who are accepted with full stipend support, if the student receives an additional external fellowship (excluding training grants) that pays a stipend equal to or less than the routine SBP stipend, the student will receive the standard SBP stipend plus a supplemental stipend equal to 15 percent of the external funding that directly supports the stipend, up to $2,000/year. If the student receives a fellowship that offers a stipend greater than the routine SBP stipend, the student gets the entire offered stipend amount. Students are not required to teach, and are expected to devote full time to their academic research and training; however there are teaching opportunities available for students interested in this kind of experience. Stipends are initially provided by the College of Medicine but once the student has chosen a laboratory, the Dissertation Advisor will assume this responsibility.

Health Insurance
Students are provided Student Health Insurance and are automatically enrolled at the beginning of Fall and Spring semesters during class registration. Those students wishing to waive the health insurance are required to do so online and must provide documentation of coverage by an external source.

The Graduate Student Health Insurance Award for 2015-16 will cover the cost of a single student plan for Fall and Spring semesters, and Summer semester as well for those receiving coverage Spring term. To receive this award you are required to apply online for it during the application period and meet all award criteria: Your stipend will meet or exceed the minimum amount required for eligibility, which is $2,400 per semester from UC Payroll for each of the pay periods, election and payment for Fall semester health insurance, and a minimum of 1 credit hour of enrollment in Fall and Spring terms. If you enroll for less than 6 credit hours in any of the academic semesters, you are required to complete the University Health Insurance enrollment form prior to the beginning of that semester. You may see the Graduate Program Manager to complete the form and have it mailed to the Student Health Insurance office.

Travel
Financial support is available for travel to scientific meetings at which a student is presenting experimental results through several sources:
• Graduate School Governance Association, up to $400.00 per trip.
• The MCP departmental Kline Endowment Funds award to SBP students who travel to scientific meetings.
• Additional funds may be available through individual fellowships and professional societies, such as the American Physiological Society.

Recreation Center Membership Support
Membership to the university recreation centers is included in the university campus life fee assessed each semester for full-time (10 credit hours or more) graduate students. Graduate students who are registered for fewer than 10 credit hours in a semester may receive a reimbursement of the recreational center fee upon request from the department through their 5th year of study (i.e. 5th year students and below). Graduate students must pay the fee upfront and submit their receipt to the Graduate Program Manager for reimbursement.

Limitations
Students in good academic standing receive tuition, health insurance, and stipend for up to five years of full-time study or until they accumulate a minimum of 90 graduate credit hours. After these limitations are reached, continued support is at the discretion of the student’s Dissertation Advisor and the Graduate Program Director. A student may not exceed 174 credit hours according to graduate school guidelines.

ALTERNATIVE FUNDING
The following is a partial list of potential funding sources. For more information on these and other awards, students are encouraged to contact the Office of Research and Advanced Studies (513 636-4816).

Albert J. Ryan Foundation Fellowship
The Albert J. Ryan Foundation was established in 1968 by Alice M. Ryan of Cincinnati in memory of her father. The purpose of the fellowship is to recognize and encourage the career development of students at Dartmouth College, Harvard University, and the University of Cincinnati who "show promise of becoming research scholars and who show a capacity to contribute to the advancement of knowledge of medical science". This is a very prestigious (and hence competitive) two-year award given to a select number of students in the second or third year of graduate school. Students who are chosen as Albert J. Ryan Foundation Fellows attend an annual three-day meeting which brings together current fellows from the three institutions. Since a limited number of applicants can be submitted per graduate program, the Graduate Program committee nominates the top candidates for this award, based upon their academic and research performance. The criteria listed below will be used by the college committee to select the Albert J. Ryan Fellows. First year students should consider these criteria as personal targets for the first two years of the program so that they can maximize their chances for competing for the Ryan award in their third year. The deadline for applications is usually in March/April. Criteria include:
• Grades
• Publications (particularly for students in their third year)
• Presentations at local and national scientific meetings
• Long-term career goals of the student (personal statement)
• A description of the proposed research

University Research Council (URC) Graduate Student Summer Research Fellowships
This annual program provides partial support for the summer semester. There is a limit on the number of applicants per program, so the Graduate Program Committee is responsible for selecting the top three candidates to apply for the award.

University Distinguished Graduate Assistantships
The UDGAs are highly competitive three-year awards with 12-month stipends. The purpose of these awards is to attract the best students to our institution; awards are therefore intended for incoming students with strong academic records.

University Dean’s Distinguished Dissertation Fellowship Program
The Division of Research and Advanced Studies sponsors a fellowship program that recognizes outstanding senior graduate students (students who are close to finishing their dissertation) whose "dissertations are likely to make significant contributions to their field of inquiry". This award includes a stipend of $24,000 per year. Students who receive this fellowship will also receive a University Graduate Scholarship to defray all tuition costs.

Predoctoral Awards from Professional Societies
All students should consult the websites of their professional societies for information regarding external predoctoral awards for which they may be eligible, such as the American Physiological Society, American Heart Association, etc.

Albert C. Yates Fellows and Scholars Program
This program is designed to help underrepresented minority students pursue graduate degrees. Yates Graduate Fellowships provide a stipend for the academic year, a full-tuition scholarship for the academic year, and a waiver of general fees.

GENERAL PROGRAM POLICIES

Supplementary Information Form
The Supplementary Information Form must be completed prior to registration. These are available from the Graduate Program Manager.

Transfer of Credits
Limits are set on the amount of work completed at other institutions that can be included as fulfilling degree requirements. The minimum requirement for the Ph.D. degrees is three years of full-time graduate study, or its equivalent, of which the last year must be in residence in the University of Cincinnati or under the University's direction. Eligibility for graduation requires a minimum of 90 graduate credits, the last 30 of which, exclusive of research credits, must be completed at the University of Cincinnati. For transfer students, the curriculum will be evaluated on a case-by-case basis.
Credit Hours
The degree will be granted for no less than the equivalent of three years of full-time graduate study, i.e. a minimum of 90 graduate credits. The last 30 credits, exclusive of research credits, must be completed at the University of Cincinnati or under its direction. In no case, however, will a degree be granted solely on the basis of the accumulation of the required number of credits. The Department of Molecular and Cellular Physiology will recommend students for degrees only after they have developed the necessary intellectual maturity and have fulfilled all other requirements of the department and the Graduate Division.

Good Standing
Students must maintain a 3.0 cumulative grade point average and pass each of their core classes with a grade of B or above to remain in good standing. Failure to do so results in a probationary status. Students will be notified in writing of this change in their graduate standing by the Graduate Program Director. Students on probation have a fixed time period (defined in the letter) in which to remedy their status. Students who do not raise their GPA to 3.0 in the allotted time, or students who have a GPA so low that it is mathematically impossible to raise their GPA to 3.0, will be dismissed from the program.

Program Time Limitations
It is expected that students will complete their training in 5 years or less. The Graduate School no longer tracks time to candidacy. All requirements for the doctoral degree must be completed within nine consecutive academic years of the date of matriculation into the program. If approved by the Chair of the Department of Molecular and Cellular Physiology, Graduate Program Director of the SBP Program, and Dissertation Advisor, a student whose candidacy is due to expire may petition the Senior Assistant University Dean of the Graduate School for an extension of time to attain his or her degree. Similarly, with these approvals, a student whose candidacy has expired (and who, therefore, has moved to inactive status) may petition the Senior Assistant University Dean for a reinstatement into his or her program and extension of time to degree. (See Maintaining Graduate Status, Extension of Time to Degree and Reinstatements.) After 5 years in the SBP program, the stipend may be terminated at the discretion of the Dissertation Advisor.

Residency
In order to ensure adequate opportunity for informal learning and engagement in scholarly activities, all doctoral students must meet a residency requirement. A minimum requirement consists of enrolling in ten graduate credit hours (12 if funded by a Graduate Assistantship) per semester for four out of five consecutive semesters of study (including summer) or three consecutive summer semesters. Exceptions to this policy must be submitted for approval to the Graduate Council.

Collateral Employment
All students are expected to devote full time to their academic and research activities. In the event that additional part-time employment may be necessary, or desirable, the student must receive the permission of the Dissertation Advisor and Graduate Program Director prior to the beginning of his or her employment. Consideration for permission will require
that the student is in good academic standing, and evidence must be given that the employment will contribute positively to the student’s education.

**Ethics**

Students are expected to adhere to the highest levels of academic and scientific conduct with respect to courses and examinations, data acquisition, analysis, and representation, as well as publication and acknowledgement of sources. All students are required to read “On Being a Scientist” and the “University of Cincinnati Student Code of Conduct” upon entering the graduate program. A signature of agreement to follow and uphold the ethics established in both publications is kept in each student’s personal file. All students accepted into the program are required to take *Ethics in Research*, which is offered by the Graduate Medicine Interdepartmental Department during the Fall semester. During the lecture series students will develop an understanding of ethical decisions and issues such as research integrity, authorship and conflict of interest.

**Academic Honesty**

Academic dishonesty in any form is a serious offense and will not be tolerated in our academic community. Dishonesty in any form, including cheating, plagiarism, deception of effort, or unauthorized assistance, may result in a failing grade in a course and/or suspension of laboratory privileges, and/or suspension or dismissal from the Graduate Program.

**Vacations and Holidays**

Students continue to receive stipends for up to 10 days of vacation per academic year. At academic institutions, the time between semesters is generally considered an active part of the training period. Exceptions must be approved by the Graduate Program Director and the student’s Dissertation Advisor.

**Sick Leave and Other Leave**

Students continue to receive stipends for up to 15 calendar days of sick leave per academic year. Under exceptional circumstances, this period may be extended by the Graduate Program Director or the student’s Dissertation Advisor in response to a written request from the student. Sick leave may be used for the medical conditions including pregnancy and childbirth. Any sick time greater than 15 days requires that vacation time be used. Unused sick or vacation time does not accrue.

**Parental Leave**

Students also may receive stipends for up to 30 calendar days of parental leave per year for the adoption or the birth of a child. Either parent is eligible for parental leave. The use of parental leave must be approved by the Graduate Program Director.

**Unpaid Leave**

Under special circumstances, graduate students may apply for a leave of absence from full-time study at the University for a specific period lasting up to one year. The circumstances justifying a leave include personal or family medical conditions or call to active military duty. The rationale must be independently documented by the applicant. Students are eligible for a leave of absence during their first three years of graduate study.
Individuals requiring extended periods of time away from their research training experience, which could include more than 15 calendar days of sick leave or more than 30 calendar days of parental leave, must seek approval from the Graduate Program Director for an unpaid leave of absence.

An approved leave of absence preserves the student’s status in his or her degree program and the time off will not be counted against the time limits for awarding degrees. A leave may be renewed for up to one additional year if the student applies for a leave extension at least four months prior to the end of his or her initial leave. Renewal of a leave is subject to the approval of the program and College of Medicine Research and Advanced Studies. In no case may any student be granted more than a total leave of two years.

If granted, the conditions of leave will be determined on a case by case basis through discussion between the student, the faculty or Dissertation Advisor, and the Graduate Program Director.

**Reinstatement Policy**

Students must register for at least one graduate credit hour at UC that contributes to degree requirements (as determined by the graduate program) in an academic year to maintain their graduate student status. Individuals who have not been registered for at least one credit hour in a period of three consecutive semesters are required to submit a completed Petition for Reinstatement Form if they wish to continue in the program. Students who have not registered for up to three years may apply to the Graduate Program Director for reinstatement. If reinstatement is approved, the student must pay a reinstatement fee equal to the current tuition for one graduate credit for each of the unregistered years up to a maximum of three credits.

Upon application, the program will review the student’s past performance and approve or deny the application. If the program approves the reinstatement, the form will be forwarded to the college dean for approval. Upon approval of the dean, the dean forwards the application to the Assistant University Dean for Advanced Studies for approval and processing.

Students who have not been enrolled in classes for more than three years are not eligible for reinstatement and must reapply for admission to the University.

**Physiology Student Organization (PSO)**

The Systems Biology and Physiology Ph.D. students are members of the Physiology Student Organization (PSO). Each academic year, the students elect a President, Vice-President, and Social Chair. This organization is student-driven and is encouraged to conduct meetings each semester (Fall, Spring, and Summer). Lunch will be provided by the department.

Some functions of the PSO are as follows:
• One student representative, at the department chair’s discretion, may attend the monthly departmental faculty meetings. The program manager will send a meeting reminder to the PSO president and a reply indicating attendance is required.
• Current SBP Ph.D. students may volunteer to be a student mentor for an incoming first-year student. The mentor must have passed PART 1 of their qualifying exam to be eligible.
• The PSO hosts the Department of Molecular and Cellular Physiology’s annual picnic. The department provides financial support.

SPECIAL RULES AND PROVISIONS

Non-Discrimination Policy
The University of Cincinnati reaffirms its policy that discrimination on the basis of race, color, religion, national origin, sex, sexual orientation, handicap, or age will not be practiced in any of its activities. Complaints involving the abridgement of this policy should be addressed to the Affirmative Action Coordinator.

Right to Review Records
Students, once enrolled, have the right to review their educational records, except for those excluded by law, such as records maintained by a physician or psychiatrist, or parents' financial statement. Educational records are maintained in such offices as Student Records, the different College Deans' Offices, department offices, Student Financial Aid, Career Development and Placement, and Educational Advising.

In order to gain a review of such records, along with any appropriate explanation or interpretation, the student should first address the proper university, collegiate, or departmental office. Should the student encounter any difficulty in obtaining the kind of review requested the question should be referred to the Office of the Registrar. An individual may challenge the content or the right to review a student record by appealing to the Family Educational Rights and Privacy Act Committee. It is the policy of the University of Cincinnati that the kinds of student records referred to in this statement will be reviewable by any qualified student at any reasonable time. Copies of any portion of the record will be provided at cost, except transcripts of students' permanent academic records for which the University's transcript policy will apply.

It is the policy of this institution that all student records, other than "Directory Information," are to be treated with confidentiality so that the only access afforded University faculty or staff is on a "need-to-know" basis. The office responsible for the maintenance of any particular student record will be responsible for seeing to it that such confidentiality is maintained.

The University considers the following information as Directory Information:

The student's name, address, telephone number, college, class, major field of study, dates of attendance, registration status, and degrees and awards received.
**Grievance Procedures**

It is the policy of the University, the College, and the Graduate Program to provide an opportunity for the resolution of disputes involving graduate students in a fair and collegial manner (within the Graduate Program if possible). If the parties are unable to come to a resolution, the student should prepare a written statement of the grievance setting forth the specific allegations with reasonable particularity and submit it as follows:

- To the Graduate Program Director or administering department chair for grievances against a faculty member or an agency associated only with that department with a copy simultaneously sent to the University Dean.
- To the College Dean for grievances against faculty members in two or more departments of that college or a college-wide agency with a copy simultaneously sent to the University Dean.
- To the University Graduate Dean for grievances against faculty members in two or more colleges or a university-wide agency.
- The grievance process initiated is fully described in the Graduate School Handbook.

**Semester Activity Report**

*Each semester,* a short report of the student’s activity will be requested by the Graduate Program Manager. These activity reports will be kept in the student’s department file for review by the Graduate Program Director and Thesis Committee Members as necessary.
## CURRICULUM – SYSTEMS BIOLOGY AND PHYSIOLOGY

### Ph.D. Track

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<th>Fall Semester</th>
<th>Spring Semester</th>
<th>Summer Semester</th>
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| YR 1 | • Introduction to Research (Lab Rotations)  
• Seminar/Journal Club (1)  
• Human Physiology (4)  
• Molecular and Cellular Biology (3)  
• Introduction to Functional Genomics (3) | • Introduction to Research (Lab Rotations)  
• Seminar/Journal Club (1)  
• Statistics and Experimental Design for Biomedical Sciences (3)  
• Ethics in Research (1)  
• Elective (Graduate Level 6000+) | • Introduction to Research (Lab Rotations)  
• FORM DISSERTATION COMMITTEE  
• QUALIFYING EXAM – PART I |
| YR 2 | • Introduction to Research or Research Dissertation (mentored training)  
• Seminar/Journal Club (1)  
• Professional Development in Biomedical Research (1)  
• Career Opportunities in Biomedical Sciences (2)  
• Electives (Advanced Courses in Physiology) | • Introduction to Research or Research Dissertation (mentored training)  
• Seminar/Journal Club (1)  
• Data Science for Biomedical Research (3)  
• Electives (Advanced Courses in Physiology) | • Research Dissertation (mentored training)  
• QUALIFYING EXAM – PART II |
| YR 3, 4, 5 | • Research Dissertation (mentored training)  
• Seminar/Journal Club (1) | • Research Dissertation (mentored training)  
• Seminar/Journal Club (1) | • Research Dissertation (mentored training) – by the end of YR 5  
• DEFEND DISSERTATION  
• PUBLIC DEFENSE  
• SUBMIT DISSERTATION TO GRADUATE SCHOOL |

( ) – number of graduate credits
# CURRICULUM – SYSTEMS BIOLOGY AND PHYSIOLOGY

## MSTP Track

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<td>YR 1</td>
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<td>• Research Dissertation (mentored training)</td>
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<td>• FORM DISSERTATION COMMITTEE</td>
<td>• Seminar/Journal Club (1)</td>
<td>• QUALIFYING EXAM – PART I AND II</td>
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<td></td>
<td>• Seminar/Journal Club (1)</td>
<td>• Intro to Bioinformatics (3)</td>
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</tr>
<tr>
<td></td>
<td>• Introduction to Functional Genomics (3)</td>
<td>• Statistics and Experimental Design for Biomedical Sciences (3)</td>
<td></td>
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<tr>
<td></td>
<td>• Professional Development in Biomedical Research (1)</td>
<td>• Ethics in Research</td>
<td></td>
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<tr>
<td>YR 2</td>
<td>• Research Dissertation (mentored training)</td>
<td>• Research Dissertation (mentored training)</td>
<td>• Research Dissertation (mentored training)</td>
</tr>
<tr>
<td></td>
<td>• Seminar/Journal Club (1)</td>
<td>• Seminar/Journal Club (1)</td>
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<td></td>
<td>• Electives (optional)</td>
<td>• Electives (optional)</td>
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<tr>
<td>YR 3, 4, 5</td>
<td>• Research Dissertation (mentored training)</td>
<td>• Research Dissertation (mentored training)</td>
<td>• Research Dissertation (mentored training) – by the end of YR 3</td>
</tr>
<tr>
<td></td>
<td>• Seminar/Journal Club (1)</td>
<td>• Seminar/Journal Club (1)</td>
<td>• DEFEND DISSERTATION</td>
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<td>• PUBLIC DEFENSE</td>
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<td></td>
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<td></td>
<td>• SUBMIT DISSERTATION TO GRADUATE SCHOOL</td>
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</tbody>
</table>

( ) – number of graduate credits
The curriculum described here is based on that taken by the majority of SBP students. Our curriculum is tailored to the background and needs of the individual. Changes from the standard curriculum need be approved by the Pre-Qualifying Advisor or Dissertation Advisor, and the Graduate Program Director.

During the first year of the graduate program, the majority of the student’s time is spent on coursework. Summer semester research, Introduction to Research, and lab rotations provide a growing involvement in basic research to first-year students. During the Summer/Fall semester of year 1 and as part of the Introduction to Research Techniques course, faculty members are invited to discuss their research, describing methodologies utilized in their labs. After these presentations, each student will select three laboratories through which he or she would like to rotate during the Fall and Spring semesters. The Graduate Program Director and Graduate Program Manager will arrange these rotations. The lab rotations are intended to expose the student to different research areas and techniques. Students will be graded (pass or fail) for credit hours of research for each lab rotation. The Faculty member in whose laboratory the student rotates will assign the grade.

Students should spend a minimum of 12 hours per week in the lab, for the semester, to gain direct exposure to basic laboratory principles and procedures, as well to advance the primary goal of selecting a Dissertation Advisor.

The student should select a Dissertation Advisor as soon as possible but at least by the end of Summer semester of year 1. The choice of Dissertation Advisor needs be approved by the Graduate Program Director. Failure to secure a Dissertation Advisor may result in a letter of advisement, academic probation, or dismissal from the program, based on the determination of the Graduate Committee.

Journal Club meets for one hour per week to discuss the papers of the weekly seminar speaker. Attendance is required at the weekly research seminars, the related journal clubs, and the meetings scheduled with outside seminar speakers. Absences from Seminar/Journal Club meetings will need to be made up by attendance at another COM seminar and a one-page written summary submitted to the Graduate Program Director and the graduate Program Manager. Absences excused by the Graduate Program Director or Graduate Program Manager, or approved conflicts, such as PFF, will be exceptions. A pass/fail grade is given for this required course.

During the second year, the student will initiate thesis research and take elective courses to complete course requirements. Electives will be decided by the student and his or her Dissertation Advisor to best prepare the student for the chosen field of research.

During the Summer semester of year 1, the student will prepare for and take Part I of the qualifying exam, demonstrating preparedness to pursue the Ph.D. degree. Prior to taking the comprehensive exam (Part I), the student will form a dissertation committee. This committee approves the dissertation proposal, and the student will then submit a formal application to Graduate School for admission to Doctoral Candidacy. Parts I and II of the qualifying exam must be completed before the Fall semester of the third year, but can be taken earlier if the Dissertation Advisor and student agree that the student is adequately
prepared, and this is approved by the Graduate Program Director (see section on Doctoral Candidacy).

Attendance at the weekly seminars, the related journal clubs, and the meetings scheduled with outside seminar speakers is required of all students.

Typically electives are chosen to provide advanced knowledge in the areas associated with the dissertation topic and to provide expanded knowledge in areas outside the dissertation topic.

**Potential Electives**

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>COURSE NAME</th>
<th>COURSE NUMBER</th>
<th>CREDIT HOURS</th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Introduction to Developmental Biology</td>
<td>DB9085C</td>
<td>3</td>
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<tr>
<td></td>
<td>Foundations of Immunology I</td>
<td>IMMU8088</td>
<td>3</td>
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<tr>
<td></td>
<td>Pharmacological Principles and Receptors</td>
<td>MCBP8031</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fundamentals of Neuroscience I: Molecular and Cellular Neuroscience</td>
<td>NS7078</td>
<td>4</td>
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<tr>
<td>Spring</td>
<td>Cancer Biology and Therapeutics</td>
<td>CB8080</td>
<td>4</td>
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<tr>
<td></td>
<td>Grant Writing</td>
<td>CB9025</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Advanced Developmental Biology</td>
<td>DB9086C</td>
<td>3</td>
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<tr>
<td></td>
<td>Systems Pharmacology</td>
<td>MCBP8027</td>
<td>3</td>
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<tr>
<td></td>
<td>Advanced Topics in Renal Physiology</td>
<td>MCP6022</td>
<td>3</td>
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<tr>
<td></td>
<td>Fundamentals of Neuroscience II</td>
<td>NS7079C</td>
<td>5</td>
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<tr>
<td></td>
<td>Immunology of Disease</td>
<td>PMM8099</td>
<td>2</td>
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</tbody>
</table>

**Grading Procedures**

At the end of each registered semester, a student will receive an official transcript. The grades are as follows:
- **A**: excellent work that exceeds expectations
- **B+**: good work that exceeds expectations
- **B**: good work that meets expectations
- **C+**: fair work of acceptable quality
- **C**: fair work but not of acceptable quality
- **F**: unsatisfactory
- **P**: satisfactory (passing, pass/fail courses only)
- **I**: incomplete
- **W**: official withdrawal from a registered course
- **T**: audit (no grade reported - see instructor)

Once a student has advanced to candidacy and is working full-time in a dissertation laboratory, the student’s performance is assessed by the Dissertation Advisor each semester. A failing grade must be followed by a written statement sent to the Graduate Program Director signed by the Dissertation Advisor and the student, stating why the student is not performing adequately. This statement must also indicate how the student must address the concerns to remain in good standing.
Work-in-Progress Presentations
We encourage all students to present their work as part of their professional development. Beginning in year 3, each student will make a 30-minute annual work-in-progress presentation in the departmental seminar series. Required presentations for students beginning in year 2 are The Annual College of Medicine Graduate Student Research Forum and the SBP Retreat.

PROGRAM FACULTY AND RESEARCH FOCUS

The Systems Biology and Physiology Ph.D. Program require that a minimum of five faculty members serve on the thesis committee. At least two of the members must be from inside the Department of Molecular and Cellular Physiology, and at least one additional member must be a member from the SBP program. The Dissertation Advisor, who is chair of the committee, must be a member of the SBP program. Students who are part of the MSTP track are encouraged to include faculty with an M.D. or M.D./Ph.D. degree as members of their thesis committee.

Descriptions of the research focus of the mentors in the graduate program are found below in following table.

<table>
<thead>
<tr>
<th>PROGRAM FACULTY/DEGREE(S)</th>
<th>RESEARCH FOCUS</th>
</tr>
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<tbody>
<tr>
<td>Zalfa Abdel-Malek, Ph.D.</td>
<td>My research is focused on elucidating how skin cells, particularly melanocytes, the pigment cells, respond to the DNA damaging effects of ultraviolet radiation, the main causative factor for skin cancers, including the very deadly melanoma. I focus primarily on understanding the role of melanoma susceptibility genes, such as the melanocortin 1 receptor, in order to design effective preventive strategies for melanoma and non-melanoma skin cancers.</td>
</tr>
<tr>
<td>Bruce Aronow, Ph.D.</td>
<td>The Aronow / Jegga lab focuses on collaborative research projects and the development of informatics systems that leverage multiple disciplines of knowledge, expertise, and diverse data. The goal is to improve our collective ability to formulate high-impact inferences, hypotheses, and next-stage experiments that could have the highest overall impact for biomedical research. We currently focus on finding or supporting efforts to solve problems relevant to genomic medicine by developing, both independently and collaboratively, new algorithms, tools, and methodologies in translational bioinformatics. To this effect, we deal with several aspects of bioinformatics, ranging from gene regulatory networks to systems biology of normal and perturbed states.</td>
</tr>
<tr>
<td>El Mustapha Bahassi, Ph.D.</td>
<td>Research projects in Dr. Bahassi’s laboratory include: 1. Investigate the role of IDH1 and EGFR mutations in genomic instability and gliomagenesis. 2. Develop novel non-invasive biomarkers for brain tumors using</td>
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</table>
circulating tumor DNA and circulating tumor cells. We use both whole genome sequencing and long range PCR amplification to detect tumor-associated mutations. Quantification of these mutations in the bloodstream will allow monitoring of disease status in the patient under treatment.

3. Develop novel targeted therapies for chemotherapy-resistant brain tumors. We are specifically targeting deficiencies in DNA damage repair mechanisms using the concept of synthetic lethality.

<table>
<thead>
<tr>
<th>Thomas Beck, Ph.D.</th>
<th>Tom Beck is a physical chemist with research interests in theoretical and computational chemistry. His research has included further work on atomic clusters and quantum dynamics, computer simulations of liquid chromatographic interfaces, simulations of phase equilibria in liquids, development of new numerical methods for quantum chemistry, fundamental studies of ions in solutions, and modeling studies of biological ion channels.</th>
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<tbody>
<tr>
<td>Joshua Benoit, Ph.D.</td>
<td>Mechanisms underlying insect stress tolerance, reproductive physiology, regulation of metabolism, and aging are the encompassing themes of my research, with the goal of integrating these topics under systems biology studies that use molecular-, organismal- and population-based approaches. The emphasis of my lab is on producing broadly trained biologists who have knowledge and experience in a variety of techniques, allowing proficiency in bioinformatics, laboratory techniques, and field research. Although individuals within my lab are not limited to a specific insect system, there is a slant toward medically important insects/arthropods such as cockroaches, mosquitoes, tsetse flies, and ticks. Current projects include the utilization of insects as a model for lactation, mechanisms underlying the transition from oviparity to viviparity in insects, and dynamics between mosquito overwintering and their microbiome.</td>
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<tr>
<td>Joseph Broderick, M.D.</td>
<td>My career goals are 1) To determine the demographic, environmental, and genetic causes of stroke in the population; 2) To examine temporal trends in stroke occurrence and management and how they vary with race, age, and gender; 3) To develop and test new treatments for acute stroke, and 4) To educate and mentor the next generation of physician researchers in cerebrovascular disease and stroke. To these ends, I developed the largest biracial population-based study of stroke in the U.S. (The Greater Cincinnati-Northern Kentucky Stroke Study – funded by NINDS since 1993), which has provided a subsequent platform to study temporal trends in incidence rates, management patterns, and study of the environmental and genetic causes of stroke in whites and blacks. The population laboratory led to subsequent NINDS-funded studies including a population-based study of the genetic and environmental causes of hemorrhagic stroke in the same region (ongoing since 1997) and a large international study of the genetics of intracranial aneurysms (Familial Intracranial Aneurysm Study I)</td>
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</table>
and II). Along with my colleagues, I helped to develop a unique, regional, hyperacute response team for acute stroke in the late 1980s that was tested in the NINDS t-PA Stroke Trials and modeled throughout the world. These trials led to the first scientifically proven treatment for acute ischemic stroke. Subsequently, as overall P.I., I have led several large NINDS-funded clinical trials focused on acute stroke therapy including intracerebral hemorrhage.

<table>
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<tr>
<th>Joseph Clark, Ph.D.</th>
<th>Dr. Clark is responsible for discovering novel bioactive markers in human spinal fluid called BOXes and has characterized them and correlated their activity to post-stroke complications and traumatic brain injury. The Clark laboratory is proficient at chemical purification from biological materials as well as characterization of actions of novel molecules including binding and enzyme kinetics. His research has been very technology- and engineering-oriented including study and manufacture of diagnostic and micro devices. These have been developed and tested using human as well as animal model systems. Therefore Dr. Clark has extensive experience in performing translational research and expertise in biomarker studies, genomics, and diagnostics.</th>
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<tr>
<td>Mitchell Cohen, M.D.</td>
<td>My research initially focused on the mechanism of action of <em>E. coli</em> heat-stable enterotoxin, a worldwide cause of infant and travelers’ diarrhea. My laboratory identified that increased guanylyl cyclase (GC-C) receptors for this toxin contributed to the increased susceptibility and severity of diarrhea seen in infants. Identification of the endogenous ligands for GC-C, guanylin and uroguanylin, led to development of knockout mice and an evolving understanding of the relationship between intestinal secretion and inflammation through this ligand-receptor family. I have had a longstanding NIH-supported program of vaccine trials for enteric infection, including a validated human cholera challenge model which has been used to study the safety, immunogenicity, and protective efficacy of candidate vaccines. We have also led human safety and immunogenicity studies on candidate typhoid fever and enterotoxigenic <em>E. coli</em> vaccines.</td>
</tr>
</tbody>
</table>
| Laura Conforti, Ph.D. | My laboratory is interested in ion channels and the membrane mechanisms that regulate the activation and function of T lymphocytes. Ion channels, located on the membrane of T cells, are the effectors which link antigen recognition to T cell function and gene regulation by controlling calcium homeostasis. Our main focus areas are: Role of ion channels in T cell response and adaptation to hypoxia. Hypoxia (low oxygen availability) can occur in pathological conditions such as solid tumors. T lymphocytes encounter hypoxic environments at these pathological sites where they are expected to fight the cancer cells. Our group is interested in studying how hypoxia blocks T cell activation; i.e. T cells are no longer able to
combat the disease at hand. We have found that hypoxia inhibits the activity of ion channels in T cells thus contributing to the failure of the immune system to fight cancer cells. Our studies focus on the mechanisms mediating the effects of hypoxia on ion channels. Role of ion channels in the development and persistence of chronic autoimmune diseases such as systemic lupus erythematosus (SLE). SLE affects about 1.5 million Americans, predominantly women, and is characterized by a broad variety of clinical symptoms such as glomerulonephritis and central nervous system impairment. We have shown that T lymphocytes from SLE patients present with a characteristic defect in potassium channel behavior: alterations in membrane localization during the activation process. This defect contributes to the hyperactivity of T cells in SLE. We are interested in studying the processes by which ion channels localize into specific membrane compartments while T cells migrate and make contact with antigen-presenting cells. Our laboratory is working, in collaboration with biomedical engineers, on the fabrication of nanoparticles for targeted knockdown of ion channels in selective immune cell subsets. These nanoparticles could represent a novel therapy for SLE and other autoimmune diseases. The techniques used in the laboratory include, but are not limited to, electrophysiology (patch-clamp) and fluorescence and confocal microscopy. Furthermore, nanotechnology methods are currently applied.

Maria Czyzyk-Krzeska, M.D., Ph.D.  My laboratory is interested in molecular mechanisms involved in renal cancer oncogenesis. I particular, we study functions of two major tumor suppressors, von Hippel-Lindau tumor suppressor (VHL, lost in the majority of clear cell renal carcinoma) and Folliculin (FLCN, lost in renal cancer associated with Birt-Hogg-Dube syndrome). We investigate the molecular mechanisms by which these two tumor suppressors regulate autophagy, microRNAs, and angiogenesis.

David D’Alessio, M.D.  Dr. D’Alessio studies the regulation of glucose homeostasis and the abnormalities that lead to diabetes. The focus is on factors controlling insulin secretion, including GI hormones and central and peripheral neural circuits.

Hamid Eghbalnia, Ph.D.  The research at the Eghbalnia laboratory is focused on the investigation of biomolecular processes using multiple experimental modalities, and a combination of computational and statistical models. Of key interest to our lab are models of inflammatory mechanisms, both chronic and acute, as well as their links to complex diseases such as cancer and obesity. We use analytical methods (NMR, MS, CRDS) to obtain the time course of stable isotope fractionation, for example in PCOS patients (chronic inflammation) or septic patients (acute inflammation). We use RT-PCR data to capture the wiring in the inflammatory circuit.
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<tr>
<th>Name</th>
<th>Research Focus</th>
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<tbody>
<tr>
<td>Guo-Chang Fan, Ph.D.</td>
<td>The research focuses in the Fan laboratory include: 1) microRNA regulation and response to heart attack and septic shock, 2) intracellular and extracellular Hsp20 in cardiovascular disease, 3) cell-to-cell communication in the heart under disease conditions (i.e. diabetes, severe sepsis, and infarction); and 4) autophagy and exosomes in cardiovascular disease. The long-term goal of their study is to develop the therapeutic targets/reagents for the treatment of cardiovascular disease. Research approaches employed in the Fan lab are utilizing transgenic/knockout animal models and gene-engineered cardiomyocytes/stem cells to dissect the contribution of miRNAs/Hsp20/autophagy/exosomes to cardiac pathophysiology.</td>
</tr>
<tr>
<td>Fred Finkelman, M.D.</td>
<td>My lab uses <em>in vivo</em> mouse models to study the roles of antibodies and Th2 cytokines in host defense, immunopathology and lymphocyte homeostasis.</td>
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<tr>
<td>Rafeeq Habeebahmed, Ph.D.</td>
<td>The goal of our current research is to regenerate the ischemic myocardium and towards this we employ three different approaches, namely stem cell transplantation, mobilization of endogenous bone marrow stem cells, and promoting proliferation of host cardiomyocytes. We are also investigating the regulation of microRNA by hypoxia inducible factor (HIF-1α) in stem cells, and we aim to identify the role of HIF-1α dependent miRNAs in cell proliferation, angiogenesis, and cardiac regeneration. Our other area of interest is cellular reprogramming; we were one of the first groups to reprogram skeletal myoblasts into induced pluripotent stem cells (IPS) and to identify tumorigenic risks associated with IPSC transplantation even in an immunocompetent host.</td>
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<tr>
<td>Stuart Handwerger, M.D.</td>
<td>Regulation of gene expression in human placenta and uterine decidua during differentiation.</td>
</tr>
<tr>
<td>Daniel Hassett, Ph.D.</td>
<td>The research of the Hassett laboratory is fundamental research involving bacterial pathogenesis. The laboratory studies primarily CF and COPD airway disease with a primary focus on the role(s) of <em>Pseudomonas aeruginosa</em> and <em>Staphylococcus aureus</em> biofilms in the progression and development of the chronic states of both diseases. The second major interest is in the mechanisms by which category A (bioweapons) Select Agent bacteria (e.g. <em>Bacillus anthracis</em>) survive within alveolar macrophages. We are using robotic, high-throughput screening methods with 300,000 member chemical libraries that could inhibit growth of the pathogen within macrophages.</td>
</tr>
<tr>
<td>Judith Heiny, Ph.D.</td>
<td>Our research focuses on the physiological roles and regulation of the Na,K-ATPase alpha isoforms in skeletal muscle excitation, contraction, and fatigue.</td>
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<tr>
<td>James Herman Ph.D.</td>
<td>Understanding neural mechanisms underlying stress and stress...</td>
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<tr>
<td>Name</td>
<td>Research Summary</td>
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<tr>
<td>Andrew Herr, Ph.D.</td>
<td>The Herr laboratory uses tools from biophysical chemistry and X-ray crystallography to study protein aggregation phenomena in human health and disease. We are particularly interested in the role of immune complexes in autoimmune disease, the recognition of collagen by immune-type receptors, and the self-assembly of surface proteins during the formation of bacterial biofilms.</td>
</tr>
<tr>
<td>Robert Highsmith, Ph.D.</td>
<td>My research interests have focused on mechanisms of blood coagulation / fibrinolysis and vessel wall biology. My major contributions have been in the area of vascular smooth muscle-endothelial cell coupling in the control of coronary blood flow. My laboratory is generally credited with the discovery of endothelin, produced by endothelial cells and one of the most potent endogenous vasoconstrictors yet described, and its mechanism of action in vascular smooth muscle.</td>
</tr>
<tr>
<td>Simon Hogan, Ph.D.</td>
<td>The goal of the Hogan laboratory is to understand the immune-intestinal epithelial interactions under homeostasis and how alterations in these pathways predispose to the development and maintenance of chronic inflammatory diseases such as food allergy and inflammatory bowel disease (IBD). In parallel with these mouse studies, we define the roles of leukocytes (monocyte / macrophages, mast cells, and eosinophils) in intestinal inflammatory diseases by conducting studies of human monocyte / macrophages, or by evaluating specimens derived from patients with food allergy and IBD.</td>
</tr>
<tr>
<td>John Hogenesch, Ph.D.</td>
<td>Our laboratory studies the mammalian circadian clock using genomic and computational tools. We use these tools to discover new clock genes and to learn how the clock keeps time and how it coordinates rhythms in physiology and behavior. This clock research drives development of genomic and computational methods that we apply to other areas of biology. Finally, we recognize biological complexity and conduct this research at the network level rather than the single gene level.</td>
</tr>
<tr>
<td>Christy Holland, Ph.D.</td>
<td>Dr. Holland is actively involved in teaching biomedical engineering (BME) and medical imaging in the BME undergraduate and graduate curriculum and served as the Director of Graduate Studies 2008-2009. She mentors and advises students within and outside of BME educational programs. Christy Holland's research interests include ultrasound-enhanced thrombolysis for stroke therapy, ultrasound-mediated drug delivery, bioeffects of diagnostic and therapeutic ultrasound, and acoustic cavitation. As a result of her research, Dr. Holland has gained wide recognition at UC, nationally and internationally for her excellence and contributions in ultrasound research. See <a href="http://www.ultrasound.uc.edu/research.html">http://www.ultrasound.uc.edu/research.html</a></td>
</tr>
<tr>
<td>Christian Hong, Ph.D.</td>
<td>The Hong laboratory’s vision is to understand molecular mechanisms of circadian rhythms and their interconnected network</td>
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</table>
with other cellular processes such as cell cycle, DNA damage response, and metabolism. These complex biological modules are intertwined by molecular components that communicate and adapt to various external environments to optimize the survival of an organism. We employ mathematical modeling to navigate complex dynamics of molecular networks, and use genetics and molecular biology to validate mathematical models.

**David Hui, Ph.D.**

Dr. Hui utilizes cell and molecular biology approaches to study cholesterol transport and signal transduction mechanisms that impact on susceptibility to metabolic diseases including coronary heart disease, obesity, diabetes, and cancer. One major focus of the laboratory is to define the mechanism underlying the influence of apolipoprotein E gene polymorphism and the apoE receptors in the LDL receptor family in modulating sensitivity to atherosclerosis and diabetes. Both lipid transport-dependent and lipid transport-independent cell signaling mechanisms are emphasized in these studies. A second area of research is focused on the roles of lipolytic enzymes secreted by the pancreas in modulating dietary lipid absorption, with the goal of discovering novel targets to reduce dietary lipid absorption in decreasing the risk of cardiometabolic diseases.

**Sohaib Khan, Ph.D.**

We are exploring the mechanisms involved in estrogen-induced tissue remodeling and cancer of the endometrium and breast. We have previously shown that estrogen induces the homodimerization of its receptor (ER-alpha), which initiates the transcription of the immediate early genes to amplify the hormonal signals. More recently, we have developed conditional knockout mouse models for estrogen receptor and, contrary to the existing dogma, established that epithelial ER-alpha expression is essential for the development and function of the mammary gland. Currently we are utilizing our mouse models to investigate the role of ER-alpha in mammary gland differentiation. Towards uncovering the role of ER-alpha in various brain regions, we have deleted ER-alpha in specific neurons and observed physiological consequences, such as obesity, binge eating and reproductive disorders.

**Steven Kleene, Ph.D.**

We study signaling in primary cilia as it relates to kidney disease. Primary cilia are present on many mammalian cells. They influence fundamental cellular processes, and defects in primary cilia contribute to kidney disease, cancer, and obesity. Our work focuses on polycystic kidney disease (PKD), a renal disease that is often caused by defects in ion-conducting channels in the primary cilia. To that end, we have developed a novel method of stably recording the channel activities and calcium signals in the cilia of live renal cells. We are determining the functional consequences of mutations in ciliary channels known to cause kidney disease in humans. The central methods we use are patch-clamp electrophysiology, cell culture, and molecular biology.
<table>
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<tr>
<th>Name</th>
<th>Research Focus</th>
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<tbody>
<tr>
<td>Rohit Kohli, M.D.</td>
<td>Dr. Kohli’s research work has focused on the pathogenesis of obesity-related fatty liver disease (NAFLD). In particular, he has focused upon the role of reactive oxygen stress in the generation and regulation of the extreme stage of this disease; nonalcoholic steatohepatitis (NASH). Dr. Kohli's laboratory currently focuses on the role of fructose in triggering the above-mentioned oxidative injury and fibrosis within the liver. He also works with the Metabolic Diseases Institute at the University of Cincinnati to understand the mechanism and impact of bariatric surgical procedures on NASH and other co-morbidities of obesity. His focus is on the role of bile acids in the metabolic improvements seen after bariatric surgery.</td>
</tr>
<tr>
<td>Kakajan Komurov, Ph.D.</td>
<td>The Komurov lab uses computational and experimental approaches to analyze regulatory organization of molecular networks and their alterations in cancer. To this end, we develop novel computational approaches and software for network-based analyses of genomic data. We combine our computational platform with experimental analyses to study drug resistance to targeted therapy against EGFR-family receptors in breast and lung cancers.</td>
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<tr>
<td>Evangelia Kranias, Ph.D.</td>
<td>The overall goal of our research program is to elucidate the regulatory mechanisms and signaling pathways underlying calcium homeostasis in cardiac muscle and the alterations in these pathways associated with heart failure. These basic studies are extended to the clinic and we have identified several human mutations in the major calcium cycling genes, which are associated with cardiac arrhythmias and heart failure. These genetic variants may be used as prognostic or diagnostic markers in personalized medicine. Our aim is to identify novel targets for the treatment of heart failure and cardiac arrhythmias.</td>
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<tr>
<td>Sookkyung Lim, Ph.D.</td>
<td>Mathematical modeling in the life sciences has become crucial for the study of complex system of biological processes. There is a significant demand for mathematics, modeling, and scientific computation in the biosciences. My current research activities are directed toward, for example, the study of network dynamics of coupled biological systems (circadian clock, cell cycle, DNA damage response, and metabolism), tumor growth and invasion in brain and breast, DNA supercoiling dynamics with thermal fluctuation, and swimming mechanism of bacteria such as <em>E. coli</em> and <em>Spiroplasma</em> in aqueous environment. These biological problems may be modeled by using, for instance, ordinary differential equations (ODEs), partial differential equations (PDEs), elastic theory, fluid mechanics, and nonlinear dynamics.</td>
</tr>
<tr>
<td>John Lorenz, Ph.D.</td>
<td>The Lorenz lab is specifically engaged in research designed to evaluate the role of various ion transporters in the control of blood pressure and renal function. Using molecular techniques to produce mice lacking various kidney-specific transporters, we are studying the contribution of these transporters to overall fluid and electrolyte...</td>
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<tr>
<td>Name</td>
<td>Research Focus</td>
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<tr>
<td>Bryan Mackenzie, Ph.D.</td>
<td>Research in the Mackenzie laboratory is aimed at understanding the molecular physiology of membrane transport, particularly of metal ions, ascorbate, and amino acids. A major focus is iron transport, absorption, and metabolism, with the goals of improving iron nutrition and treating or preventing iron overload that is characteristic of hereditary hemochromatosis and thalassemia. Approaches used in the Mackenzie laboratory include the voltage clamp, radiotracer assays and fluorescence-based assays in RNA-injected <em>Xenopus</em> oocytes, together with the use of genetically modified animal models.</td>
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<tr>
<td>John A. MacLennan, Ph.D.</td>
<td>Our research focuses primarily on ciliary neurotrophic factor (CNTF) receptor signaling and the roles it plays in the development and maintenance of the nervous system. In order to directly study these functions in living mammals (mice), we use a wide variety of techniques including conditional genomic knockouts, behavioral tests, stereotaxic surgery, multi-labeling immunohistochemistry, confocal microscopy and computer-based image analysis. Evidence indicates that CNTF receptor signaling can promote the survival and regeneration of motor neurons as well as regulate the activity of neural stem cells.</td>
</tr>
<tr>
<td>Mario Medvedovic, Ph.D.</td>
<td>I am developing and applying new statistical and computational methods for the analysis of &quot;big data&quot; in the context of biomedical research. My recent work is focused on the reconstruction of regulatory networks using libraries of genome-scale signatures of cellular perturbations. I am also developing protocols for analyzing next-generation sequencing data, and working on development and application of unsupervised statistical learning approaches based on the non-parametric Bayesian models.</td>
</tr>
<tr>
<td>Jaroslaw Meller, Ph.D.</td>
<td>Our research is focused on developing and applying computational approaches for data mining, analysis, and knowledge extraction from biomedical data. In particular, we are active in the fields of structural bioinformatics, computational genomics, and systems biology. For example, we have recently developed a number of novel methods for analysis and predictions of protein interactions, including those for membrane proteins, and for model quality assessment. Based on these methodological advancements, we are also developing bioinformatics tools, e.g. for functional and structural annotation of proteins and their complexes, including SABLE, SPPIDER, and POLYVIEW-3D.</td>
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<td>Anil Menon, Ph.D.</td>
<td>We develop novel <em>in vitro</em> and <em>in vivo</em> models to study disorders of metabolism in the cardiovascular system at the molecular level. Specifically, we study those involved in epigenetic “programming” events in the developing fetus that affect metabolic and cardiovascular functions during adult life.</td>
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<tr>
<td>Tesfaye Mersha, Ph.D.</td>
<td>Dr. Mersha’s overall research interest and goal includes the use of population genomics, and quantitative and statistical genetics.</td>
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methods to understand human genome variation and utilize this
information to dissect complex diseases, particularly lung and lung
related disorders such as asthma, through approaches and methods
including association analysis admixture mapping and
transcriptional profiling analysis.

Jeffery Molkentin, Ph.D.
The Molkentin laboratory has a number of diverse foci of
investigation, although they remain fundamentally interested in
understanding the molecular mechanisms of heart and skeletal
muscle disease. Toward this end the laboratory investigates the
basic machinery that underlies cell death, with a special interest in
mitochondrial-dependent mechanisms of non-apoptotic death, such
as cellular necrosis. Prominent diseases of both heart and skeletal
muscle are affected by cellular necrosis. Identifying the genes that
control this process should have substantial impact on human
health. The laboratory is also interested in characterizing the
intracellular signaling pathways that control cellular growth,
differentiation, and replication in cardiac and skeletal muscle. Once
again, a better understanding of signaling pathways that control
such processes coupled with an identification of novel genes could
suggest new treatment strategies for human diseases. For example,
the laboratory has a strong track record of publications detailing the
intracellular signaling effectors (kinases and phosphatases) that
underlie the cardiac hypertrophic response or the transition of the
heart into dilated failure. Similarly, they are also examining the
transcriptional regulatory factors and epigenetic mechanisms that
regulate cardiac and skeletal muscle differentiation, growth, death,
and replication to suggest additional targets for treating human
disease. The laboratory is also actively engaged in identifying
novel secreted protein factors (cytokines, growth factors,
chemokines, etc.) from the heart that might control disease
responsiveness. The laboratory is also actively engaged in studying
the cardiac fibroblast and how it functions during disease to alter
the extracellular matrix, which impacts heart remodeling. Finally,
we are also investigating the basic mechanisms of intracellular
calcium handling in cardiac and skeletal muscle to further explore
the paradigms of excitation-transcription coupling and excitation-
signaling coupling.

Marshall Montrose, Ph.D.
The Montrose laboratory explores the physical and molecular basis
for epithelial defense in the gastrointestinal tract. They develop and
apply intravital confocal imaging to mutant mouse models,
allowing real-time monitoring of epithelial repair from imposed
damage. They are exploring the basis for tight-junctional
rearrangements during intestinal cell shedding and epithelial
renewal, the role of both intracellular and extracellular ion-
signaling in mediating the gastric repair stimulated by trefoil factors
and prostaglandins, and whether bacterial chemosensing is the basis
for Helicobacter pylori being rapidly attracted to (and preferentially
colonizing) areas of gastric damage. Training in the laboratory includes approaches that span biological sciences to imaging computational sciences.

Sean R. Moore, M.D., M.S.  The long-term goal of our laboratory is to discover mechanisms underlying child undernutrition and diarrhea in developing countries and to improve therapies to break this vicious cycle. Current areas of emphasis include 1) mechanisms of glutamine-based therapies for tropical/environmental enteropathy in children, 2) novel mouse models of tropical/environmental enteropathy to understand the reduced efficacy of live oral vaccines in the developing world, and 3) elucidating network dynamics of circadian rhythms, cell cycle, metabolism, and DNA damage response in intestinal epithelial cells.

Anjaparavanda Naren, Ph.D.  Cystic fibrosis transmembrane conductance regulator (CFTR) is a cAMP-regulated chloride channel located primarily on the apical surface of epithelial cells that line various organs, including the airways and the gut. CFTR dysfunction is detrimental and may result in life-threatening medical disorders. My laboratory studies two such disorders: (1) Cystic fibrosis, a lethal genetic disease that affects mostly the Caucasian population (>30,000 in USA), in which the CFTR chloride channel is HYPO-functional and (2) Secretory diarrhea, a disease affecting millions of children worldwide, in which HYPER-function of the CFTR chloride channel can occur due to infectious toxins, such as cholera toxin and E. coli enterotoxin. My lab is interested in identifying interactions between CFTR and its binding partners and defining how spatiotemporal regulation of CFTR-containing macromolecular complexes in the apical compartment of polarized epithelial cells lining the secretory epithelia regulates overall fluid secretion. Our studies will identify new drug targets for cystic fibrosis, secretory diarrhea, and other diseases resulting from CFTR dysfunction and provide insights into the etiology of diseases associated with CFTR-interacting molecules.

Daria Narmoneva, Ph.D.  This laboratory is focused on vascular tissue regeneration and creating the microenvironment that would promote capillary formation and cell-cell interactions similar to those in native tissues. Particular areas include development of angiogenic microenvironment to enhance healing of chronic diabetic ulcers, reducing fibrosis in diabetic myocardium, and the role of mechanical environment in vascular cell interactions and tissue remodeling. Our approach involves using a novel biomaterial – self-assembling peptide nanofibers – to support spontaneous angiogenesis in vitro and capillary growth, with advantages including control of chemical and biomechanical extracellular microenvironment and customization for a specific application.

Santa Ono, Ph.D.  Experimental medicine, immunology, allergy research, transcriptional regulation in the human immune system,
mechanisms of mast cell dependent inflammation on the ocular surface and the immune component of age-related macular degeneration, ocular research.

| Sarah Pixley, Ph.D. | Research in the Pixley lab has moved from a past emphasis on the neurogenesis and neuropharmacology of the olfactory system into more applied neural tissue repair work. Our current focus is on using **novel biomaterials to promote neural tissue repair and regeneration**. In the recent past, we were working with carbon nanomaterials. However, one of the most promising biomaterials is magnesium, in both metal and ionic form. Magnesium metal has attracted more attention recently because it is potentially a safe biodegradable implant material. The most obvious uses are as bone fixation or substitution devices. It is also being considered as a good material for making cardiovascular stents. Magnesium metal implants so far appear to degrade safely in the body, but the FDA has not yet been convinced of its safety, so more information is needed to convince them. Our lab is very interested in using magnesium for nervous tissue repair because, in ionic form, it is well known to be a neuroprotectant, alleviating the effects of damage to nervous tissue. To best harness that neuroprotection we are looking at two applications. First, we propose that a thin magnesium filament might guide regenerating nerves to find their way across an injury gap. So far, we have shown that magnesium metal implants into regenerating nerves are very well tolerated and appear to be serving the appropriate guidance function. We are also exploring novel methods of delivering ionic magnesium into the brain to improve the effectiveness of neuroprotection. Our collaborative group includes surgeons, neurobiologists, neuropathologists, and engineers. We are currently funded by an NSF grant that funds an Engineering Research Center dedicated to Revolutionizing Metallic Biomaterials (http://erc.ncat.edu/). |

| David Plas, Ph.D. | Our group investigates signal transduction control of cancer cell metabolism and its effects on apoptosis control. We have found that the protein kinase S6K1 is required to mediate cancer cell glycolysis, but that inhibiting S6K1 can result in increased fatty acid oxidation, which can substitute for glycolysis to prevent cancer cell death. We are now pursuing coordinated suppression of S6K1 together with inhibition of fatty acid oxidation as a new approach for cancer chemotherapy. |

| Timothy Pritts, M.D., Ph.D. | My interest is the inflammatory response to trauma and hemorrhage, with a focus on the use of resuscitation strategies to modify this response. We are currently utilizing a murine model of hemorrhage and blood banking to examine the role of the red blood cell storage lesion in the systemic inflammatory response to hemorrhage and resuscitation. |

| **Jeffrey Robbins, Ph.D.** | The laboratory has a number of foci, but all are directed toward understanding the mechanistic bases for heart disease and cardiac failure. The first focus concerns the general cellular processes that are involved in proteotoxicity, which appears to be a general common pathway involved in the development of cardiac disease. When proteins are mutated or folded incorrectly, they can become toxic to the cell and particularly to the cardiomyocyte. We are exploring how this occurs and developing therapeutic windows to interfere with the pathogenic processes. The second focus deals with mutations in the cardiac muscle proteins that lead to hypertrophic cardiomyopathy. We are exploring the cause and effect relationships of mutations in these proteins and the mechanisms underlying the development of disease as a result of altered contractile behavior. The third focus involves cardiac scaffold engineering, using a combination of porcine-derived patch material and seeded stem cells, in an effort to discover how to replace diseased cardiac tissue with material that will be healthy and functional, and remain so for many years after surgical implantation of the patch. |
| **Nathan Salomonis, Ph.D.** | Our understanding of human health and ability to treat disease is being radically transformed by new technologies to read genomes and transcriptomes at an unprecedented resolution. To capitalize on these technologies, it is essential that we develop holistic models of gene biology that will best inform clinicians of disease risk. We use computational approaches to examine the interplay between diverse modes of gene regulation, including transcription, alternative splicing, and microRNA regulation that underlie important cellular interaction networks. By applying such techniques to human disease and cellular dysfunction paradigms, we strive to shed new light on existing problems. To achieve these goals, we develop community-available tools, such as AltAnalyze and GO-Elite, to analyze and interpret genome-level data that is accessible by both untrained and skilled computational biologists. To identify global trends from complex data sets, we take advantage of pathway-driven approaches and aggregate large amounts of publicly available data from a broad range of developmental and disease datasets available in the public domain. With these tools in hand, we strive to validate predicted functional effects in the laboratory with a diverse team of collaborative scientists. |
| **Jo El Schultz, Ph.D.** | The overall directions of Dr. Schultz’s research program are two-fold: 1) identify and characterize signaling events involved in protecting the myocardium from ischemic injury and cell death following myocardial infarction (i.e. heart attack) and 2) determine the mechanisms by which cardiac hypertrophy and heart failure occur following myocardial infarction or hemodynamic load (high |
blood pressure or volume overload). The Schultz lab employs \textit{in vivo} and \textit{in vitro} approaches to elucidate the contribution of the opioid and growth factor receptor systems to cardiac pathophysiology. \textit{In vivo} echocardiography, \textit{ex vivo} working and Langendorff whole-heart preparations, \textit{in vivo} hemodynamic measurements, and biomechanics and intracellular calcium dynamics of individual isolated cardiomyocytes are routine procedures. In addition, a number of surgical techniques (aortic banding, coronary artery ligation, catheterizations) are used. In this research, pharmacological, histological, biochemical, and state-of-the-art molecular biology assays are employed, and include Northern blot and quantitative real-time PCR analysis for mRNA expression, and protein analysis via Western blot, ELISA and immuno-staining. Genomic and proteomic tools, including DNA microarrays, are used to further characterize or identify known and novel mechanism(s) of opioid- and growth factor-mediated cardiovascular physiology and pathology.

Kim Seroogy, Ph.D.  
Dr. Seroogy's primary research interests focus on the neuroprotective and neurorestorative roles of select growth factors in the injured nigrostriatal system, in animal models of Parkinson's disease. Non-motor symptoms of the disease are also being studied in a novel model of comorbid depression and Parkinson's. The overall goal of this research is to develop disease-modifying therapies that alleviate affective as well as motor symptoms of Parkinson's.

Gary Shull, Ph.D.  
The focus and objective of research in the Shull laboratory is to determine the ion transport mechanisms responsible for absorption and secretion of ions in the gastrointestinal tract and kidney. To accomplish this, the genes for a large number of ion transporters, pumps, and channels have been disrupted by gene targeting and the resultant phenotypes analyzed. These studies have revealed important secretory and absorptive functions for various proton pumps, anion exchangers, and Na-coupled ion transporters.

Manoocher Soleimani, M.D.  
Research in my lab focuses on epithelial transport and biology with emphasis on cloning and expression of acid-base and electrolyte transporters, generation and examination of mouse models with genetic deletion of acid-base or electrolyte transporters in the gastrointestinal tract or kidney, and determining the pathways that are important to ischemic reperfusion injury in the kidney and liver.

Seongho Song, Ph.D.  
The research focus is in the general area of developing Bayesian statistical models including hierarchical Bayesian inference with MCMC methods. The particular areas of interest are related to population genetics, lifetime data analysis with various types of censoring methods, longitudinal data analysis, and microarray data analysis. Recently I have started working on uncertainty quantification for climate control data.

Peter Stambrook, Ph.D.  
Mechanisms by which embryonic stem cells preserve genomic
Saulius Sumanas, Ph.D. | The Sumanas lab utilizes zebrafish as a model to study molecular mechanisms of vasculature formation as well as the mechanisms that regulate the fate choices between the vascular endothelial, cardiac, and hematopoietic cell lineages. We are investigating mechanisms of endothelial cell specification and arterial-venous differentiation and identifying new genes participating in these processes. We are also dissecting the transcriptional cascade which controls vasculature formation by utilizing microarray / next-generation sequencing analysis combined with overexpression and gene knockdown studies. And finally we are performing screens for novel potential regulators of vasculature formation followed by their characterization and functional studies.

Lubov Timchenko, Ph.D. | Dr. Timchenko’s laboratory investigates molecular mechanisms by which non-coding RNA CUG, CCUG, and CGG repeats cause neurological and neuromuscular diseases, myotonic dystrophy type 1 (DM1); myotonic dystrophy type 2 (DM2) and fragile X-associated tremor/ataxia syndrome (FXTAS). A primary focus of the studies in the lab is to determine mechanisms of these diseases and to translate this knowledge into development of therapeutic treatments.

There are four main projects in the lab.
(1) The first project investigates the role of GSK3 beta-cyclin D3 signaling in development of pathology in patients with DM1. This project is focused on the development of therapeutic approaches for DM1 using the inhibitors of GSK3 beta.
(2) The second project investigates molecular mechanisms of neurodegeneration in FXTAS.
(3) The third project examines the role of RNA-binding proteins in the reduction of global protein synthesis in DM2. The main subject of this project is ZNF9 and ZNF9-interacting proteins, involved in muscle atrophy in DM2 and in other muscular dystrophies.
(4) The fourth project investigates molecular mechanisms regulating decay of the mutant DMPK mRNA and ZNF9 pre-mRNA in patients with DM1 and DM2. The project is focused on the development of therapy for DM1 and DM2 on the level of degradation of the mutant RNAs.

Patrick Tso, Ph.D. | The main focus of my research is in diet-induced obesity with particular emphasis on the role of apolipoprotein AIV in insulin secretion by the pancreas. We use both in vivo animal models as well as islets isolated from the pancreas. The other research area is the activation of mucosal mast cells by intestinal fat absorption. We found that the activation of mucosal mast cells by fat absorption is specific, since neither protein nor carbohydrate absorption activates the mast cells. Lastly, I am also responsible for the NIH funded Mouse Metabolic Phenotype Center.

Susan Waltz, Ph.D. | The focus of my lab is on the role of growth factor and receptor
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<th>Name</th>
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<td>Alison Weiss, Ph.D.</td>
<td>Whooping cough remains an unconquered disease, worldwide. Developing nations simply do not have the resources to vaccinate their children. Very little disease is seen in the United States, and this is entirely due to the use of the whole-cell vaccine. However, this situation could change rapidly if the population refused to accept the current whole cell vaccine, a situation which occurred in Great Britain and Sweden, where concern about the safety of this vaccine has led to a decline of its use, and a subsequent rise in disease. The current whole cell vaccine contains only whole killed bacteria. A component vaccine of known composition would be desirable. The problem in developing a new component vaccine is to define what is necessary and sufficient to induce a protective immune response. We have focused our efforts on trying to understand the disease, hoping to develop a theoretical basis for vaccine development.</td>
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<td>Jeffrey Whitsett, M.D.</td>
<td>Jeffrey Whitsett’s laboratory makes extensive use of conditional gene targeting in transgenic mice, bioinformatics, physiology, and biochemistry in the study of lung formation and function. Transgenic mice models are utilized to understand the pathogenesis of genetic and inflammatory lung disorders and to develop new therapies for respiratory disease. Conditional systems for gene targeting have been developed for study of lung formation and function, as well as for identifying lung progenitor cells and their fates in the mouse.</td>
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<td>David Wieczorek, Ph.D.</td>
<td>Our laboratory research is on cardiac and skeletal muscle diseases using transgenic and knockout mouse model systems. More specifically, we focus on tropomyosin and how mutations in this sarcomeric protein lead to hypertrophic and dilated cardiomyopathies.</td>
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<td>Roger Worrell, Ph.D.</td>
<td>The overall focus and objective of research in the Worrell laboratory is to determine the mechanisms of ion transport and regulation in epithelia. Current emphasis is to determine the mechanisms and regulation of intestinal ammonium transport with a focus towards better treatment of hepatic encephalopathy. Currently the laboratory is also determining the effect of intestinal ion transport on modulating the intestinal microbiome with a focus on developing means to regionally modify the intestinal microbiome via targeting ion transport. The laboratory uses both in vitro cell culture models and transgenic mouse models.</td>
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<td>Yan Xu, Ph.D.</td>
<td>Dr. Xu’s main research interests are bioinformatics applications and systems biology. She is currently focusing on the identification of gene signatures, regulatory networks, and biological pathways controlling 1) perinatal lung maturation, 2) surfactant homeostasis, and 3) airway mucus production and goblet cell differentiation. Her</td>
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research goal is to integrate data from new computational methods and experimental approaches in a synergistic way to gain better understanding of molecular mechanisms underlying lung development and pathogenesis.

Yana Zavros, Ph.D.
The overall focus and objective of research in the Zavros laboratory is to define the mechanism by which Hedgehog signaling acts as a constituent of gastric epithelial homeostasis, repair, and cancer. Through the development and use of unique transgenic mouse models and in vitro cultures, the laboratory is actively identifying the mechanisms by which Sonic Hedgehog, a morphogen originally identified for its role in embryogenesis, regulates adult epithelial cell homeostasis and the development of *Helicobacter pylori*-induced diseases.

Tongli Zhang, Ph.D.
Cells, working machines in our body, respond to environmental signals (e.g. food, hormone, infection, etc.) and make critical decisions such as proliferation, differentiation, defense, or even death. The decision makings of cells are carried out by their molecular control networks. Although no single molecule is directing the cellular behaviors by itself, the dynamical properties emerging from the interaction between the control molecules serve as clear commands to the cells. As we know more about the molecular control networks, they are getting more complex. These networks often include feedbacks, crosstalk, context-dependent changes, and time-dependent changes. Mathematical modeling is a powerful tool to handle such complexities. In my research, I combine biological intuition with mathematical modeling to make clear the seemingly confusing networks. My biological intuition is on cell cycle, apoptosis, p53 pathway, and NF-κB pathway. My modeling expertise is on positive feedbacks, negative feedbacks, switches, and oscillations.

EMERITUS FACULTY
Emeritus Faculty may contribute to contribute to the graduate program but no longer serve as primary dissertation advisors for graduate students.

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<th>EMERITUS FACULTY/DEGREE(S)</th>
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<td>Robert Banks, Ph.D.</td>
<td>I continue to have an interest in the physiological factors that regulate the excretion of sodium by the kidney. My laboratory had focused on determining to what extent and in what fashion a number of vasoactive factors including histamine, atrial natriuretic factor, endothelin, nitric oxide, and angiotensin II were involved in the regulation of renal hemodynamics in normal and disease states. A second major goal of our research program was to further elucidate the renal complications associated with non-insulin-</td>
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dependent diabetes (NIDDM) and insulin-dependent diabetes (IDDM). A focus of these studies was to determine to what extent changes in both the expression and message for renal glucose transporters correlates with an important functional variable of glucose transport within the kidney, namely the renal transport maximum (the TmG), in animals with IDDM and with NIDDM.

Michael Behbehani, Ph.D. My research focused on three areas:
1. Pain physiology and pharmacology with emphasis on descending pain inhibitory pathways and migraine. In particular I have studied the mechanism by which pain processing is inhibited by activation of the limbic system.
2. Neurodegenerative disease with emphasis on Parkinson’s disease. In particular I have focused on the role of trophic factors in the progression of this disease.
3. Theoretical modeling of the components of the pain pathway and basal ganglia. I use NEURON and Matlab for modeling of these systems.

John Cuppoletti, Ph.D. Danuta Malinowska, Ph.D. The Cuppoletti-Malinowska laboratory is focused on the study ion channels in physiology, disease, and therapeutics. Our work includes studies of large conductance (Big) potassium channels (BK channels) as well as ClC-2 channels. The latter channels are widely expressed in non-epithelial tissues and epithelial tissues. Drugs have been developed to activate these channels. BK channel activators are currently used as therapy in diseases of the eye, and ClC-2 channels are currently used in treatment of disorders of the intestine. The availability of these drugs thus has large implications in human health and disease and has allowed investigation of the roles of these ion channels in physiological and pathological processes. The lab uses electrophysiological methods as well as cell and molecular biology.

Nelson Horseman, Ph.D. Our laboratory contributed many papers during the `80s and `90s to the discovery and refinement of the prolactin signaling pathway and the whole animal biology of prolactin. A few years ago we discovered that breast tissue expresses a complex serotonin signaling system. That discovery has led us into several new aspects of physiology. One of the most important findings has been the new discovery that serotonin drives the expression and secretion of parathyroid-hormone-related peptide.

John Hutton, M.D. Biomedical informatics; molecular genetics.

James Lessard, Ph.D. Gene regulation and gene targeting.


Janusz Suszkiw, Ph.D. Role of environmental-endogenous neurotoxin/neuroprotectant interactions in etiology and progression of aging-related neurodegenerative disorders such as Parkinson's and Alzheimer's disease. Development of microglia-targeted therapeutic approaches
to slowing the neurodegenerative processes. Cholinergic systems: role of nicotinic acetylcholine receptors in learning/memory and in neuroprotection.

| Stephen Woods, Ph.D. | Stephen Woods is currently Professor and Director of the Obesity Research Center at the University of Cincinnati. He researches the neurobiology of energy homeostasis, using techniques from the molecular to the behavioral. His current research is focused on how hormones secreted in proportion to body fat such as insulin and leptin enter the brain and influence neural circuits controlling appetite. He has been continuously funded by NIH since the 1970s including a MERIT Award and has authored over 500 scholarly publications and has nearly 25,000 citations to his work on food intake and obesity. Professor Woods has mentored over 30 Ph.D. students and over 25 postdoctoral fellows. Most of his trainees have positions in academia or industry, and many have enjoyed successful academic careers. He is a Fellow of AAAS and the American Psychological Society. |

### DOCTORAL CANDIDACY

#### Criteria

To become a candidate for the Doctor of Philosophy degree, students must fulfill the following specific and discrete criteria that will allow them to continue their education in the laboratory environment under the direct guidance of a Dissertation Advisor:

1. Students must demonstrate a broad working knowledge of the principles of cell and organ system physiology, with particular depth of understanding in their chosen field of research and related area.
2. Students must be able to identify research problems, formulate hypotheses to interrogate these problems, and design experiments to test these hypotheses.
3. Students must be able to analyze and interpret experimental data and draw conclusions based on these results.
4. Students must demonstrate working knowledge of principles used to analyze biological systems as static networks, networks in quasi-equilibrium, and dynamic networks.
5. Students must be able to adequately present experimental data in a public forum and reasonably field questions regarding their meaning and interpretation.

#### Process

**QUALIFYING EXAM – Ph.D. Track**

**Qualifying Exam – Part I: Comprehensive Exam**

After their first year in the program, students will sit for a comprehensive examination that will take place in two parts, as follows:

A. By the end of the Summer Semester of their first year, a written exam will be given covering broad aspects of their first year of coursework. All students in a given year shall sit for the same written exam, and the exam shall be of a consistent format from
year to year. The bulk of this exam will be a closed-book essay-questions format, but there may also be questions that are best delivered in an open-book format (i.e. problem solving).

B. If the student is judged to have done well enough on the written exam to potentially pass, an oral exam to further review the student’s knowledge will be scheduled. The goal of the oral exam is to have students discuss the scientific areas covered by the written exam in more detail by discussion of their answers to the questions. A separate exam shall be scheduled for each student and shall be administered by the Examining Committee. This oral exam must take place within two weeks of passing the written exam.

Students must pass the comprehensive exam as a prerequisite to writing the Candidacy. A passing grade must be agreed upon by a three-quarter majority of the Examining Committee.

**Appeal:** Should the student fail the comprehensive examination at the written exam stage or following the oral exam, he or she may petition the Graduate Education Executive Committee for consideration of a re-examination. Second examinations for candidacy must be taken within six months of the original exam and the results of such exams will be final (i.e. there will be no appeals considered for a third exam).

**Qualifying Exam Part II: Candidacy Proposal**
By the end of the summer of the first year, the candidate will form his or her dissertation committee.

**Dissertation Advisor and Committee**
The Systems Biology and Physiology Ph.D. Program require that a minimum of five faculty members serve on the Ph.D. research committee. At least two of the members must be from inside the Department of Molecular and Cellular Physiology, and at least one additional member must be a member from the SBP program. The Dissertation Advisor, who is chair of the committee, must be a member of the SBP Program. The committee must be approved by the Graduate Program Director and the Graduate School. The student should select his or her Dissertation Advisor by the end of the Summer semester of year 1.

By the end of the second year (Summer Semester) the candidate will prepare, in cooperation with their Dissertation Advisor and committee, an NIH (or other) style proposal and submit to the dissertation committee for review. This proposal will include preliminary data generated by the candidate and will describe a research project that the candidate proposes to complete for the Ph.D. degree. The candidate will then sit for an oral defense of this proposal in front of the dissertation committee, during which he or she will present a summary of the intended research and answer questions regarding the research design, research tools proposed, data interpretation, and underlying scientific principles. The dissertation committee will assign a grade of pass or fail based on the candidate’s responses to all the examination questions and not just on the feasibility of the research proposal. As with the comprehensive exam described above, a maximum of one appeal will be allowed if the candidate fails the exam.
After completing parts I and II of the qualifying exam, the candidate is eligible for candidacy.

By the beginning of the third year the candidate and Dissertation Advisor should begin the process of planning for graduation and post-graduation.

**Retaking the Candidacy Exam**
Should the student fail the candidacy examination, he or she may petition the Graduate Education Executive Committee for consideration of a re-examination. Second examinations for candidacy must be taken within six months of the original exam.

**QUALIFYING EXAM – MSTP Track**

**Qualifying Exam – Part I: Comprehensive Exam**
After the first year in the program, students will sit for a comprehensive examination that will take place in two parts, as follows:

A. By the end of the Summer Semester of the first year, a written exam will be given covering broad aspects of the first-year coursework. All students in a given year shall sit for the same written exam, and the exam shall be of a consistent format from year to year. The bulk of this exam will be a closed-book essay-questions format, but there may also be questions that are best delivered in an open-book format (i.e. problem solving).

B. If the student is judged to have done well enough on the written exam to potentially pass, an oral exam to further review the student’s knowledge will be scheduled. The goal of the oral exam is to have students discuss the scientific areas covered by the written exam in more detail by discussion of their answers to the questions. A separate exam shall be scheduled for each student and shall be administered by the Examining Committee. This oral exam must take place within two weeks of passing the written exam.

Students must pass the comprehensive exam as a prerequisite to writing the Candidacy. A passing grade must be agreed upon by a three-quarter majority of the Examining Committee.

**Appeal:** Should the student fail the comprehensive examination at the written exam stage or following the oral exam, he or she may petition the Graduate Education Executive Committee for consideration of a re-examination. Second examinations for candidacy must be taken within six months of the original exam, and the results of such exams will be final (i.e. there will be no appeals considered for a third exam).

**Qualifying Exam Part II: Candidacy Proposal**
Students on the MSTP track are expected to have already chosen their dissertation mentor upon admission into the program. Therefore, by the beginning of the Fall Semester of the first year, the candidate will form his or her dissertation committee.
Dissertation Advisor and Committee
The Systems Biology and Physiology Ph.D. Program require that a minimum of five faculty members serve on the Ph.D. research committee. At least two of the members must be from inside the Department of Molecular and Cellular Physiology, and at least one additional member must be a member from the SBP program. The Dissertation Advisor, who is chair of the committee, must be a member of the SBP Program.. The committee must be approved by the Graduate Program Director. The student should select his or her Dissertation Advisor by the end of the Summer semester of year 1.

By the end of the first year (Summer Semester) the candidate will prepare, in cooperation with their Dissertation Advisor and committee, an NIH (or other) style proposal and submit to the dissertation committee for review. This proposal will include preliminary data generated by the candidate and will describe a research project that the candidate proposes to complete for the Ph.D. degree. The candidate will then sit for an oral defense of this proposal in front of the dissertation committee, during which he or she will present a summary of the intended research and answer questions regarding the research design, research tools proposed, data interpretation, and underlying scientific principles. The dissertation committee will assign a grade of pass or fail based on the candidate’s responses to all the examination questions and not just on the feasibility of the research proposal. As with the comprehensive exam described above, a maximum of one appeal will be allowed if the candidate fails the exam.

After completing parts I and II of the qualifying exam, the candidate is eligible for candidacy.

Retaking the Candidacy Exam
Should the student fail the candidacy examination, he or she may petition the Graduate Education Executive Committee for consideration of a re-examination. Second examinations for candidacy must be taken within six months of the original exam.

ADMISSION TO CANDIDACY

With fulfillment of these requirements, the student is eligible to be considered for candidacy for the Ph.D. degree.

Exam
Doctoral students are required to pass a department certification process before advancing to candidacy. A student must have at least a 3.0 grade point average in doctoral coursework and fulfill all other pre-candidacy requirements specified by the doctoral program in which the student is enrolled.

When to File
The student should file for candidacy as soon as possible after receiving approval by the Graduate Education Executive Committee.
How to File for Candidacy
Once a student has been approved for candidacy by the Graduate Education Executive Committee, he or she should submit an official application for candidacy as soon as possible. Applications for candidacy can be obtained from the Graduate Program Manager.

Verification
The student’s program must promptly submit candidacy verification on behalf of the student to the Graduate School upon the student’s completion of the requirements noted above. The Graduate School will then send a formal letter to the student notifying him or her of admission to candidacy. Once admitted, the student must register for at least one graduate credit hour in each academic year in the program to maintain graduate student and candidacy status.

Other University Requirements
After admission into candidacy, registration and fee payment are required for at least one credit hour in each academic year in order for each student to maintain candidacy status. International students are also required to register for at least one credit hour in each academic year in order to fulfill proper university and immigration requirements. Such students must submit a Reduced Course Load Certification Form to UC International Services upon completion of all required course work.

Time to Degree
The Graduate School no longer tracks time to candidacy. However, students must complete the doctoral degree within nine consecutive academic years of the date of matriculation into the program.

DISserTATION RESEARCH

Dissertation Advisor and Committee
The Systems Biology and Physiology Ph.D. Program require that a minimum of five faculty members serve on the Ph.D. research committee. At least two of the members must be from inside the Department of Molecular and Cellular Physiology, and at least one additional member must be a member from the SBP program. The Dissertation Advisor, who is chair of the committee, must be a member of the SBP Program. The student should select his or her Dissertation Advisor by the end of the Summer semester of year 1. After the student has successfully passed the qualifying exam, the student should consult with the Dissertation Advisor and Graduate Program Director to select thesis committee members. The committee must be approved by the Graduate Program Director. The student must have a thesis proposal, generally based on the Qualifying Exam proposal, approved by their committee 60 days after passing the qualifying exam.

Since the thesis committee is an important and integral part of the graduate training program, the student is required to meet approximately every October and April to determine if the student is making adequate progress. Prior to the committee meeting, the student is required to submit to the Committee Members a summary statement of current progress that includes: research progress, publications, and honors or awards. Following
each thesis committee meeting, the Dissertation Advisor and student will complete and submit a Thesis Committee Meeting form to the Program Manager stating briefly the date of the meeting, the progress achieved and decisions made, and who was in attendance. If the meetings are not going to be held by the end of December and June, a written statement must be submitted by the Dissertation Advisor with the reason for the delay. One first author paper is required before the final defense can be scheduled.

**Final Defense of Dissertation**

The student must present the thesis committee and the Graduate Program Director with a written thesis two weeks prior to the final scheduled thesis committee meeting. Notification for the final meeting must be sent to the faculty of the Systems Biology and Physiology program by the Graduate Program Manager. A copy of the written thesis must also be made available to the faculty through the Graduate Program Manager. At this final committee meeting, the student will present a brief summary of the thesis to the committee and to the faculty and must answer all the questions regarding the thesis in front of the committee and the faculty at large. The student must demonstrate fluent knowledge of the field and convince the Committee and faculty that the thesis is worthy of defense to the public. The final thesis committee meeting is similar to the exam that takes place after the public defense. At the conclusion of the question period, the student will be dismissed for discussion of the thesis between the faculty and committee members. Following this discussion the committee members and Graduate Program Director will meet alone and/or with the student for further discussion if it is felt necessary, and the committee will decide whether permission to schedule a public defense will be granted. The student must announce the public defense via the Graduate School website (https://gradapps.uc.edu/roadmap) at least two weeks prior to the scheduled date of the public defense (per Carol Gundrum of the Graduate School) for the semester in which they will graduate.

The student’s dissertation defense will be open to the public and to all members of the academic community. For the public defense, the candidate will be given 45 minutes of uninterrupted time (except for questions involving clarification) to orally present the thesis work. The floor will then be opened to questions from the public. At the conclusion of the defense, the Committee will meet and make a final decision as to the acceptability of the overall thesis dissertation and its defense. At least 75% of the voting members of the Dissertation Committee must approve the dissertation, i.e. four out of five. If approved, all committee members must sign two originals of the University approval and Departmental Final Defense approval forms. Reasons for votes of disapproval must be stated in writing by individual members.

An outside moderator or referee is not required. However, such a person should be assigned by the University Dean upon the request of either the candidate or the Chairperson of the dissertation committee. The duties of such a person are limited to observing the oral defense of the dissertation and reporting in writing to the University Dean on the academic propriety of the proceedings.

**Submission of Dissertation**

After a dissertation has been approved, the candidate for the doctoral degree is required to follow the doctoral dissertation electronic submission procedures detailed on the Graduate

The student will arrange with the Graduate Program Manager for three bound thesis copies produced by a commercial bookbinder: one copy for the department, one for the Dissertation Advisor, and one for the student. The cost will be borne by the Department.

**Graduation**

In the semester prior to the one in which the student anticipates graduating, the student should consult the Program Manager to ensure all requirements (online certify) have been met. Also, the student should review all deadlines and procedures that are applicable to doctoral students posted on the Graduation link at the graduate website ([www.grad.uc.edu](http://www.grad.uc.edu)). These are listed in a step-by-step tutorial format.

Students are personally responsible for ensuring that all requirements are met. Failure to follow the instructions or meet a deadline may result in a delay in graduation.