

The Michigan Chemistry-Biology Interface Training Program

General Information

And

Guidelines

DRAFT

A Handbook for Trainees

October 2004

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The Michigan Chemistry-Biology Interface Training Program

General Information and Guidelines for Students

October 2004

DRAFT

1. *Program Overview*

The Chemistry Biology Interface (CBI) Training Program is a unique multidisciplinary Ph.D. training program that focuses on the fundamental underlying chemical principles that govern all biological processes. This dynamic program help students obtain expertise in disciplines related to, but traditionally outside of the student's normal academic and research experience. All students will experience intensive laboratory research training with the aim of fostering the development of the students into independent, innovative scientists in academic or industrial settings.

Research opportunities for the trainees are varied and involve faculty with a wide range of expertise in research at the interface of chemistry and biology. The trainees have access to the most sophisticated techniques and instrumentation in modern research at this interface. Distinguished faculty members from the Department of Chemistry (College of Literature, Science, and the Arts), the Departments of Biological Chemistry and Pharmacology (Medical School), the Biophysics Research Division (BRD), and the Department of Medicinal Chemistry (College of Pharmacy) have combined strengths to create this challenging new program. The Ph.D. degrees will be awarded in Chemistry, Biological Chemistry, Pharmacology, Medicinal Chemistry, and Chemical Biology beginning in their second year of their Ph.D. program.

The curriculum of the Training Program includes a novel student sabbatical to be completed while the trainee is support by the training grant. Core courses in Chemical Biology and regularly scheduled opportunities for the trainees to present their research results to the Training Program Faculty and fellow trainees, as well as annual progress reports on February 15th of each year, are also integral to the program.

2. *Program Directors*

- Program Director is Vincent L. Pecoraro, Ph.D., Professor of Chemistry.
- Program Co-Directors are:
 - Gary Glick, Ph.D., Professor of Chemistry and Biological Chemistry and
 - David Ballou, Ph.D., Professor of Biological Chemistry

3. *Administrative Structure / Academic Counseling*

The administration of the program will be primarily the responsibility of the Chemistry-Biology Interface Training Program Committee. This committee operates on a three-year term, and oversees the ongoing operation of the program, and supervises academic affairs such as counseling and assessment of students' progress. The committee currently includes the director, Professors Pecoraro (Chemistry), and two Co-Directors, Professor Glick (Chemistry), and Ballou (Biological Chemistry), in addition to Professors Coward (Past Program Chair, Medicinal Chemistry), Mapp (Chemistry), Marsh (Chemistry), Osawa (Pharmacology) and Woodard (Medicinal Chemistry). This year (2004), their will be an additional student representative on the Program Committee, to chair adhoc student committees for a one year term. The Program Committee advises the directors on all aspects of the training program, the most critical being the recommendations for appointment of trainees, preceptor assignments, approval of student "sabbaticals" (vide infra) and evaluation of the dissertation prospectus of each trainee. Many of the program functions such as recruiting and admissions, seminars, counseling, development of core courses, and evaluation of trainee progress, will be carried out by sub-committees and appointed individuals.

4. *Trainee Selection Sub-Committee*

All CBI Training Program faculty advisors will be alerted to trainee vacancies and will subsequently nominate students in their laboratories to participate in the training program. The nomination packet will include the nomination letter, the student's undergraduate and graduate transcripts, their GRE scores, letter(s) of recommendation, evidence of research productivity such as manuscripts or scientific presentations and other information that the advisor and student feel are relevant in the decision making process. The Trainee Selection sub-committee will evaluate the supplied information and select a subset of candidates that will be interviewed by three of the program committee faculty to ensure that the student has a strong commitment to training at the Chemical Biology Interface. The program committee will select trainees in an effort to obtain maximum intellectual capacity, commitment to interfacial chemical biology research and the range of scientific interest of all units in our program. The committee will also attempt to identify and appoint students to ensure that diversity of our trainees is irrespective of gender and is representative of all races and ethnicities of our student pool.

5. *Recruitment of Faculty*

There exists an excellent research environment at the University of Michigan. Strong faculties in the colleges of LSA, Medicine and Pharmacy and the Departments of Chemistry, Biological Chemistry, Medicinal Chemistry, and Biophysics Research Division make the institution one of the most foremost in the

United States. There exists a high degree of interdisciplinary collaboration and this is an extremely strong attraction in the recruiting of new faculty to the University of Michigan. The CBI Program Committee's goal is to have a full rotation of faculty over the next three years to enhance and strengthen their interdisciplinary collaboration.

Criteria for Appointment of Faculty:

Research interest at the interface of Chemistry and Biology related areas.
Quality of research
Peer-reviewed funding
Willingness to participate in all aspects of the program

Mechanisms for Appointment:

Letter expressing interest to Program Committee
Review of letter and C.V. by Program Committee
Present seminar in Pharmacology, Medicinal Chemistry, Chemistry, Biological Chemistry or other appropriate seminar series
Appointment by Parent Committee

In the past five years several new faculty members with strong ties to the CBI Training Program have been recruited to Michigan. Present faculty participants to the Training Program are:

- Pecoraro, Vincent, Ph.D. (Professor, Chemistry)
- Ballou, David, Ph.D. (Professor, Biological Chemistry)
- Carlson, Heather, Ph.D. (John Gideon Searle Assistant Professor, Medicinal Chemistry & Assistant Professor, Chemistry)
- Coward, James K., Ph.D. (Professor, Medicinal Chemistry & Professor, Chemistry)
- Crippen, Gordon, Ph.D. (Professor, Pharmaceutical Chemistry)
- Engelke, David, Ph.D. (Professor, Biological Chemistry & Director, PIBS)
- Fierke, Carol, Ph.D. (Professor, Chemistry & Professor, Biological Chemistry)
- Fuller, Robert, Ph.D. (Professor & Associate Chair, Biological Chemistry)
- Garcia, George, Ph.D. (Associate Professor, Medicinal Chemistry)
- Glick, Gary, Ph.D. (Werner E. Bachmann Professor, Chemistry & (Professor, Biological Chemistry)
- Hollenberg, Paul, Ph.D. (Professor & Chair, Pharmacology)
- Kennedy, Robert, Ph.D. (Professor, Chemistry & (Professor, Pharmacology)
- Kerppola, Tom, Ph.D. (Associate Professor, Biological Chemistry & Associate Professor, Biophysics)
- Kopelman, Raoul, Ph.D. (Professor, Chemistry, Physics & Applied Physics)
- Ludwig, Martha, Ph.D. (Professor, Biological Chemistry & Research Scientist, Biophysics Research Division)

- Mapp, Anna, Ph.D. (Assistant Professor, Chemistry & Assistant Professor, Medicinal Chemistry)
- Marsh, Neil, Ph.D. (Associate Professor, Chemistry)
- Meyerhoff, Mark, Ph.D. (Professor, Chemistry)
- Morris, Michael, Ph.D. (Professor, Chemistry)
- Mosberg, Henry, Ph.D. (Professor, Medicinal Chemistry)
- Neubig, Richard, M.D., Ph.D. (Professor, Pharmacology & Associate Professor, Internal Medicine)
- Osawa, Yoichi, Ph.D. (Associate Professor, Pharmacology)
- Palfey, Bruce, Ph.D., (Assistant Professor, Biological Chemistry)
- Penner-Hahn, James E., Ph.D. (Professor, Chemistry & Research Scientist, Biophysics Research Division)
- Roush, William, Ph.D. (Professor & Chair, Chemistry)
- Sanford, Melanie, Ph.D. (Assistant Professor, Chemistry)
- Sherman, David, Ph.D. (Professor, Medicinal Chemistry & (Professor, Chemistry)
- Smith, William, Ph.D. (Professor & Chair, Biological Chemistry)
- Sunahara, Roger, Ph.D. (Assistant Professor, Pharmacology)
- Vedejs, Edwin, Ph.D. (Professor, Chemistry)
- Walter, Nils, Ph.D. (Assistant Professor, Chemistry & Associate Research Scientist, Biophysics Research Division)
- Wolfe, John, Ph.D. (Assistant Professor, Chemistry)
- Woodard, Ronald, Ph.D. (Professor and Assoc. Chair, Medicinal Chemistry & Professor, Chemistry)
- Yocum, Charles, Ph.D. (Professor, Biology)
- Zuiderweg, Erik, Ph.D. (Professor, Biological Chemistry)

6. *Trainee Candidates*

Students are usually supported for two years (4 new students are appointed each year). They are typically appointed in the second or third years. Rotations and preliminary coursework should be satisfied appropriate prerequisites in chemistry and biology prior to joining the training program. Advanced requirements include a mandatory student sabbatical which requires an 8-10 week visitation by the student in a collaborator's laboratory at an advanced stage of the student's career and two term enrollment in a one unit advanced seminar course. Qualification via PEERS and a course in research responsibilities is also required.

Students are nominated by faculty or the program committee. Students undergo interviews by a Trainee Selection Subcommittee consisting of three CBI faculty members (chaired by Professor Woodard) and are ultimately selected by the Program committee.

Requirements for Appointment

- Interest in studies at the interface of chemistry and biology
- Willingness to complete course work required for the Program
- Strong letter of recommendation by present mentor and other U of M faculty
- Strong Undergraduate and Graduate Achievement
- Interviews by Trainee Selection Sub-committee
- Balance will be maintained within the Program so that all different disciplines have reasonable representation

7. *Grant Award and Eligibility*

The CBI Training Program is committed to providing all Ph.D. candidates with twelve months of financial support for the four-to-five years of their graduate program tenure. In order to continue to receive this support, students must make satisfactory progress toward the Ph.D. degree. Following completion of the first two years in resident with support from the CBI Training Grant, students receive aid through a combination of teaching and research assistantships, and fellowships. Support includes a generous stipend, full tuition and excellent health care benefits. Eligibility is based upon U.S. citizenship, Permanent Resident status, and underrepresented minority status.

8. *Rackham Graduate School Student Handbook*

Graduate students are responsible for knowing the information in this handbook which is related to their conduct, degree requirements, graduate record, etc. The handbook also provides useful information about the University's student services. The handbook's www address is:
<http://www.rackham.umich.edu/StudentInfo/Publications/GSH/contents.html> .

9. *Preliminary Examination(s)*

Each of the five participating units have individual requirements for advancing to candidacy for the Ph.D. These are appropriately administered by the degree-granting units and are designed to assure competence in each of the three basic fields. Currently, there are written proposals followed by oral examinations in Chemistry, Medicinal Chemistry, Pharmacology and Biological Chemistry. A similar system is proposed for the interdepartmental program in Chemical Biology. In addition, each department has some form of written examination as part of the candidacy requirements. The CBI Training Program does not involve any additional examinations, but the progress of the trainees is closely monitored by the Program Committee via regularly scheduled platform and poster presentations of their research.

10. *Proposed Training*

Students will typically be appointed to the training grant at the beginning of their second year of study. Students enrolled in the CBI Training Program will be required to enroll in the new seminar-based core course, Chemistry 751. Students will also be expected to complete their “student sabbatical” prior to rotating off of the training grant. We envision that this sabbatical period will typically be completed during their third year in residence at the University.

11. *Core Requirements*

The CBI Training Program curriculum adopted a new core course, “New Frontier at the Chemistry/Biology Interface.

New Frontiers at the Chemistry/Biology Interface

As part of the evolving curriculum of the CBI training program, we have developed a new course required for all participating students entitled ‘New Frontiers at the Chemistry/Biology Interface’. The goals of the class are three-fold: to promote interdisciplinary learning through seminar attendance in departments across the campus, to hone critical thinking skills through analysis of the current primary literature, and to increase knowledge breadth of participating students in both the chemical and biological sciences. This is a two-semester course that will culminate with a special seminar from a speaker selected and invited by the CBI trainees, assisted by the course coordinator. This seminar will be part of a ‘mini-symposium’ and will be followed by a poster session in which all CBI trainees (those currently funded and those no longer funded) present the results of their thesis research projects. This mini-symposium will take place at the end of the winter (second) term. The goal is to foster scientific and social interactions between not only the registered course participants, but also all CBI-associated students and faculty. This course has been approved by the Department of Chemistry (the home department) for Fall 2005.

Provided below is a mock syllabus for the class, with seminars selected from the Fall 2004 seminar series in departments across campus.

A more detailed description of the course organization is also included. Note that because the syllabus covers the Fall term only, the mini-symposium is not included.

Mock Syllabus for 'New Frontiers at the Chemistry/Biology Interface'

Instructor: Dr. Anna Mapp
3809 Chemistry
5-6862
amapp@umich.edu

Office hours: Mondays, 4-5 pm
Lecture days: TTh, 12 – 1 pm (as needed, * indicates alternate dates)

Overview

CBI Frontiers is a one-credit course designed to introduce participating students to cutting edge research at the interface of chemistry and biology. Throughout the course of the semester, you will attend eight seminars in the Departments of Chemistry, Medicinal Chemistry, Biological Chemistry, the Biophysics program, and the Life Sciences Institute. You will be given 1-3 key references related to the topic of each speaker's seminar one month prior to the seminar date. Each enrolled student will be assigned as the discussion leader for one of the seminars. The discussion leader is responsible for preparing a 30 minute presentation to be given during the class period one week prior to the seminar critically evaluating the published work, and for subsequently leading a classroom discussion. The critical evaluation should include at least 3 key questions not yet addressed in the publications. On the day of the seminar, an informal meeting with the speaker and all enrolled students will enable a continuation of the discussion. Each student will also be assigned 4 seminars for which they will write a brief (1-2 page) summary analyzing one of the key questions raised by classroom discussion leader, including how this was addressed in the seminar. These assignments will be due one week after the seminar date. The grade for this course will be based upon the oral presentation (40%) and the written summaries (40%), and class participation (20%).

Seminar speakers & class meeting times

- 9/7/04 Introduction to the Chemistry/Biology Interface
- discussion of course organization & goals
 - current challenges in research at the chemistry/biology interface, part I
- 9/9/04 Classroom discussion of papers from Prof. Tadhg Begley
- 9/13/04 Life Sciences Institute Seminar, 10 am Palmer Commons
Dr. Tadhg P. Begley
Professor of Chemistry
Cornell University
"Comparative Genomics: Applications to Thiamin, Cysteine, NAD⁺ and CoA Biosynthesis"
- 9/16/04 Classroom discussion of papers from Prof. Jon Thorson
- 9/23/04 Medicinal Chemistry seminar, 4 pm, C.C. Little
Dr. Jon S. Thorson
Professor of Pharmaceutical Sciences
University of Wisconsin - Madison
"Natural Product Glycorandomization."
- 9/30/04 Classroom discussion of papers from Prof. Jennifer Doudna
- 10/7/04 Biological Chemistry seminar, 12 pm, 5330 Medical Science I
Dr. Jennifer Doudna
Investigator, Howard Hughes Medical Institute,
Professor, Department of Molecular Cell Biology and Chemistry,
University of California, Berkeley.
"Hijacking the Ribosome: Translation Initiation by a Hepatitis C Viral RNA"
- 10/8/04* Classroom discussion of papers from Prof. Michael Hall
- 10/12/04 Chemistry seminar, 4 pm, 1706 Chemistry
Dr. Michael Hall
Professor of Chemistry
Texas A&M University
"Modelling Metalloenzymes"
- 10/21/04 Classroom discussion of papers from Prof. Stephen Withers

- 10/26/04 Biological Chemistry seminar, 12 pm, 6311 Medical Science I
 Dr. Stephen Withers
 Professor, Departments of Chemistry and Biochemistry, University of
 British Columbia.
 "Nature's Many Mechanisms for Oligosaccharide Degradation"
- 10/28/04 Classroom discussion of papers from Prof. Paul Wiseman
- 11/5/04 Biophysics seminar, 4 pm, 1300 Chemistry
 Dr. Paul Wiseman
 McGill University
 "Membrane Protein Clustering and Dynamics"
- 11/11/04 Discussion of papers from Prof. Christian Whitman
- 11/18/04 Medicinal Chemistry seminar, 4 pm, C.C. Little
 Dr. Christian P. Whitman
 Jacques P. Servier Regents Professor of Medicinal Chemistry and Division
 Head
 University of Texas - Austin
 "Catalytic Promiscuity & the Rational Design of New Enzymatic
 Activities."
- 11/19/04* Discussion of papers from Prof. Dirk Trauner
- 11/23/04 Chemistry seminar, 4 pm, 1706 Chemistry
 Dr. Dirk Trauner
 Assistant Professor of Chemistry
 University of California at Berkeley
 "Chemical Synthesis and Synthetic Biology"
- 11/30/04 Challenges at the chemistry/biology interface II
- 12/7/04 Challenges at the chemistry/biology interface III

12. *Pharmacology Student Course Schedule*

**Representative Course Schedule for a
Pharmacology Student**

| <u>Course Title</u> | <u>Course #</u> |
|--|------------------------------|
| <u>YEAR 1</u> | |
| Fall | |
| Physiology | Phys 510 |
| Protein Structure Function | Biol Chem 550 |
| Lab Survival Skills and Ethics | PIBS 501 |
| Lab rotation | PIBS 600 |
| Winter | |
| Principles of Pharmacology-Module | Pharm 611 |
| Receptor Pharmacology-Module | Pharm 610 |
| Autonomic Pharmacology-Module | Pharm 614 |
| Lab Rotation | PIBS 600 |
| <u>YEAR 2</u> | |
| Fall | |
| Antimicrobial and Cancer Pharmacology-Module | Pharm 612 |
| Molecular and Neuropharmacology-Module | Pharm 615 |
| Seminar | Pharm 646 |
| Research | Pharm 990 |
| Chemical Biology | Chem Biol 501 (fka Chem 525) |
| CBI Seminar Core Course | |
| Winter | |
| Cardiovascular Pharmacology | Pharm 616 |
| Endocrine Pharmacology | Pharm 617 |
| Seminar | Pharm 646 |
| Research | Pharm 990 |
| Chemical Biology | Chem Biol 502 (fka Chem 526) |
| CBI Seminar Core Course | |

13. *Medicinal Chemistry Student Course Schedule*

**Representative Course Schedule for a
Medicinal Chemistry Student**

Course Title **Course #**

ORGANIC TRACK

YEAR 1

Fall

| | |
|--------------------------------|---------------|
| Medicinal Chemistry | Med Chem 532 |
| Research Rotation | Med Chem 573 |
| Protein Structure and Function | Biol Chem 550 |
| Organic Principles | Chem 540 |

Winter

| | |
|-------------------------------|------------------------------|
| Survey of Medicinal Chemistry | Med Chem 533 or Med Chem 534 |
| Research Rotation | Med Chem 573 |
| Basic Pharmacology | Pharm 611 |
| Organic Synthesis | Chem 541 |

BIOLOGICAL TRACK

YEAR 1

Fall

| | |
|--------------------------------|--------------|
| Medicinal Chemistry | Med Chem 532 |
| Research Rotation | Med Chem 573 |
| Protein Structure and Function | Biolchem 550 |
| Organic Principles | Chem 540 |

Winter

| | |
|-------------------------------|------------------------------|
| Survey of Medicinal Chemistry | Med Chem 533 or Med Chem 534 |
| Research Rotation | Med chem 573 |
| Basic Pharmacology | Pharm 611 |
| Chemical Biology | Chem Biol 502 (fka Chem 526) |

BIOPHYSICAL TRACK

YEAR 1

Fall

| | |
|---|---------------|
| Medicinal Chemistry | Med Chem 532 |
| Research Rotation | Med Chem 573 |
| Protein Structure and Function | Biol Chem 550 |
| Energetics, Interactions and Dynamics of Biomacromolecules | Bio Phys 520 |

Winter

| | |
|---|-----------------------------|
| Survey of Medicinal Chemistry | Medchem 533 or Med Chem 534 |
| Research Rotation | Med Chem 573 |
| Basic Pharmacology | Pharm 611 |
| Physical Methods for the Study of Biomacromolecules | Bio Phys 521 |

* Medchem 533 and 534 are offered in the winter term, alternate years

Course Title**Course #*****ALL TRACKS*****YEAR 2****Fall**

| | |
|--|-----------------------------|
| Elective (Chemical Biology for Biol Track) | Chem Biol 501(fka Chem 525) |
| Elective | |
| Elective | |
| Research | Med Chem 990 |
| CBI Seminar Core Course | |

Winter

| | |
|-------------------------------|-------------------------------|
| Survey of medicinal chemistry | Med Chem 533 or Med Chem 534 |
| Elective | |
| Research | Med Chem 990 |
| Literature Research Seminar | Med Chem 740 (fall or winter) |
| CBI Seminar Core Course | |

14. *Chemistry Student Course Schedule*

**Representative Course Schedule for a
Chemistry Student**
(with a Concentration Focusing on Bio-Organic Chemistry)

| <u>Course Title</u> | <u>Course #</u> |
|--|-----------------------------|
| <u>YEAR 1</u> | |
| Fall | |
| Physical Organic Chemistry | Chem 540 |
| OR | |
| Mechanistic Organic Chemistry | Chem 543 |
| Chemical Biology | ChemBiol 501 (fka Chem 525) |
| Research Course | |
| Winter | |
| Synthetic Organic Chemistry | Chem 541 |
| Chemical Biology | ChemBiol 502 (fka Chem 526) |
| Research Course | |
| <u>YEAR 2</u> | |
| Fall | |
| Elective in Chemistry, Biophysical Chemical, Molecular Biology, Immunology or Cell Biology | |
| CBI Seminar Core Course | |
| Winter | |
| Elective in Chemistry, Biophysical Chemical, Molecular Biology, Immunology or Cell Biology | |
| CBI Seminar Core Course | |

**Representative Course Schedule for a
Chemistry Student**
(with a Concentration Focusing on Chemical Biology)

| <u>Course Title</u> | <u>Course #</u> |
|--------------------------------|-----------------------------|
| <u>YEAR 1</u> | |
| Fall | |
| Chemical Biology | ChemBiol 501 (fka Chem 525) |
| Protein structure and function | Biol Chem 550 |
| Research Course | |

Winter

Chemical Biology ChemBiol 502 (fka Chem 526)
Biol Chemistry (enzyme mechanisms, catalysis, kinetics) Biol Chem 573, 575
Research Course

YEAR 2

Fall

Elective in Chemistry, Biophysical Chemical, Molecular Biology, Immunology or
Cell Biology
CBI Seminar Core Course

Winter

Elective in Chemistry, Biophysical Chemical, Molecular Biology, Immunology or
Cell Biology
CBI Seminar Core Course

15. *Biological Chemistry Course Schedule*

**Representative Course Schedule for a
Biological Chemistry Student**

| <u>Course Title</u> | <u>Course #</u> |
|--|-----------------------------|
| <u>YEAR 1</u> | |
| Fall | |
| Lab Survival Skills and Ethics | PIBS 501 |
| Protein Structure & Function | Biol Chem 550 |
| Molecular Genetics OR CDB 530 – Cell Biology | Hum Gen 541 |
| Laboratory Rotation | PIBS 600 |
| Winter | |
| Critical Analysis | Biol Chem 597 |
| Laboratory Rotation | PIBS 600 |
| Electives | |
| <u>YEAR 2</u> | |
| Fall | |
| Graduate Seminar | Biol Chem 711 |
| Dissertation Research | Biol Chem 990 |
| Electives | |
| Chemical Biology | ChemBiol 501 (fka Chem 525) |
| Winter | |
| Graduate Seminar | Biol Chem 711 |
| Dissertation Research | Biol Chem 990 |
| Electives | |
| Chemical Biology | ChemBiol 502 (fka Chem 526) |

16. *CBI Training Program Course Electives*

CBI Training Program Course Electives

| | |
|---|---|
| Cell Biology | Anatomy & Cell Biology 530 |
| Critical Discussions in Bioinformatics | Biological Chemistry 511 |
| Survey in Bioinformatics | Biological Chemistry 501,502 (<i>aka 525,526</i>) |
| Biology & Chemistry of Protein Cofactors | Biological Chemistry 528 |
| Protein Structure and Function | Biological Chemistry 550 |
| Ligand Binding and Enzyme Kinetics | Biological Chemistry 570 |
| Signal Transduction | Biological Chemistry 576 |
| Cell Cycle Regulation | Biological Chemistry 585 |
| Special Topics in Signal Transduction | Biological Chemistry 590, 591 |
| Signal Transduction and Regulation of Gene Expression During Development | Biological Chemistry 645 |
| Prokaryotic Gene Expression | Biological Chemistry 651 |
| Eukaryotic Gene Expression | Biological Chemistry 652 |
| Kinetics and Mechanism | Biological Chemistry 673 |
| Enzyme Mechanism | Biological Chemistry 674 |
| Advanced Topics in the Secretary Endocytic Pathway | Biological Chemistry 675 |
| Inorganic Chemistry | Chemistry 507 |
| Biophysical Chemistry | Chemistry 520 |
| Synthetic Organic Chemistry | Chemistry 541 |
| Applied Physical Methods in Organic Chemistry | Chemistry 542 |
| Reaction Mechanisms | Chemistry 543 |
| Molecular Genetics | Human Genetics 541 |
| Gene Expression Modules III | Human Genetics 653 |
| Bioorganic Principles of Medicinal Chemistry | Medicinal Chemistry 532 |
| Survey of Medicinal Chemistry | Medicinal Chemistry 533 |
| Modern Tools of Drug Discovery | Medicinal Chemistry 534 |
| Gene Expression Modules I | Microbiology 651 |
| Principles of Pharmacology | Pharmacology 611 |

17. Research Opportunities

Rotations:

All departments and programs have in place mandatory rotations for first-year students. Therefore, all students who are likely to be appointed to the training grant will have completed a minimum of two rotations prior to selecting an advisor. The precise details of each rotation program are slightly different; however, all faculty members of the training program have embraced the core ideals of the rotation system as an integral part of their respective Ph.D. training. In addition to the sites at the University of Michigan, some programs allow students to complete rotations at Pfizer Pharmaceutical Company, which has a major research facility located in Ann Arbor.

Mentor Selection:

The choice of a laboratory for the Ph.D. dissertation research is usually made by the end of the first year of graduate study, following completion of the laboratory rotation system implemented by each department or program. Faculty research interests are made known to the new students by departmental seminars, web-based departmental and personal resources, informal faculty presentations, and individual discussions between the student and faculty member.

Dissertation Research:

Prior to joining the training grant, the trainee will have chosen a laboratory for the dissertation research. Prior to the end of the second year, a written summary of the proposed research is presented and defended in an oral examination. In most cases, the committee that examines the student for advancement to candidacy for the Ph.D. continues as the student's dissertation committee.

Dissertation Committee:

This committee consists of at least four members of the faculty and includes at least one member who is not in the student's home department. This committee meets with the student at regular intervals during the course of the dissertation research. Annual reports to the committee help to bring focus to the research and importantly, help to develop writing skills. It is expected that the annual report will be submitted to the CBI Program Committee to monitor progress towards the degree. It is also expected that at least two members of the dissertation committee (one from outside the home department) will be from the CBI Training Program faculty.

Student Sabbatical:

Students will write a proposal that outlines an “advanced rotation experience” preferably in a research collaborators laboratory. The site of the sabbatical may be in academe, industry or government laboratories. These laboratories may be physically located in Ann Arbor or other places in Michigan as well as in more distant sites, including overseas. The proposal should describe a self-contained project that is relevant to the student’s thesis work. Regardless of the site for the sabbatical, it is expected that the student will physically move to the laboratory of the collaborator for the period of the sabbatical. If necessary, the sabbatical may be done over more than one visit. Examples of topics might include a synthetic chemist bringing compounds that were prepared to a laboratory to carry out biological evaluation or an individual working on catalysis spending time in a computational laboratory to understand enzyme mechanism. When approved by the advisor and with a letter of agreement from the host scientist in hand, the trainee will submit the proposal to the Program Committee for approval. Student support during this period will be the responsibility of the training grant, the research mentor and institutional sources such as the Rackham Graduate School. At the end of the sabbatical, a short report of research experience will be submitted to the program committee.

18. Progress Reports / Ongoing Responsibilities

Following admission to candidacy, which normally occurs at the end of the second year, students are also monitored by thesis committees within their home departments; thesis committees must contain one faculty member from the CBI in addition to the mentor.

- Students will be expected to present results in poster format annually at the CBI Symposium that is associated with the last seminar of the year for students in the advanced seminar course.
- Students will be requested to provide a short summary of research progress toward the degree each winter term and either meet with a subset of the program committee or their thesis committee to ensure progress toward the degree is accomplished.

Students will also be required to fill out/ or update Biographical forms as part of their progress reporting process.

19. Contact Information

CBI Program Information – Vincent Pecoraro (734) 763-1519.

vlpec@umich.edu

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