INTRODUCTION

The Biophysics graduate program at Michigan is interdisciplinary and consists of multidisciplinary research, distinct from the Ph.D. Programs in Physics, Chemistry, Biological Chemistry, or Biology. It encompasses fields as different as structural biology (X-ray and NMR structure determinations), biomolecular spectroscopy (NMR, IR, UV, EPR), computational biophysics (protein structure prediction, ab initio forcefield calculations), cellular biophysics (biomolecular mechanics, manipulation of single protein molecules, receptor diffusion in membranes) and biophysical chemistry (peptide design, protein folding, thermodynamics). The degree in Biophysics is conferred in recognition of independent, insightful and physically-oriented investigations of biological processes, matter or theories as demonstrated in a thesis based upon original research and creative scholarship.

This handbook is to be used as a guide to the rules and regulations that govern the graduate program both here in the Biophysics program as well as the University of Michigan. As a student you must familiarize yourself with requirements of the Department and the Rackham graduate school.

Throughout the Handbook references are made to Rackham rules and regulations which can be found in their entirety in The University of Michigan Bulletin, Rackham Graduate Student Handbook on their website: http://www.rackham.umich.edu/policies/academic_policies/
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BIOPHYSICS GRADUATE PROGRAM REQUIREMENTS

TYPICAL CHRONOLOGY OF PH.D. DEGREE

Year 1
Complete Placement Exams.
Complete at least 4 courses, including research ethics requirement.
Two research rotations (Biophysics 890 – Fall and Winter terms).
Select thesis advisor by May 1 deadline
Start thesis research.

Year 2
Complete remaining courses.
Continue thesis research (Biophysics 990).
Assemble Dissertation Committee (by mid-Feb.).
Complete preliminary exam.
Achieve Candidacy status by May 1 (see page 10 for details)

Year 3
Continue thesis research (Biophysics 995).
Present research prospectus (if required by committee).
Present individual seminar (if ready).

Year 4-5
Continue thesis research (Biophysics 995).
Data Meeting (report to committee).
Present individual seminar.
Dissertation defense.
A NOTE ABOUT PLACEMENT EXAMS

Upon entering the program, first-year students are required to take two subject placement exams during the first week of classes in their first term. These exams are only used to measure the student's knowledge of a particular subject (Biological Chemistry/Cell Biology and Physics). The outcome of these exams will determine future coursework needed for the degree.

The goal of the Biophysics Placement Exams is to evaluate the student’s knowledge of basic physical and biochemical principles in order to determine areas that require further study. Successful completion of the Biophysics Ph.D. requires the ability to synthesize information from a variety of sources.

The first exam covers Biochemistry and Cell Biology and the second exam covers Physics and Physical Chemistry. The Biochemistry/Cell Biology part will be at the level of Voet & Voet’s *Biochemistry*. The Physics/Physical Chemistry part will cover Quantum Mechanics/Quantum Chemistry and Thermodynamics/Statistical Mechanics at the advanced undergraduate level, combined with Electricity, Magnetism and Optics at a General Physics (with calculus) level.

**The exams are given prior to the student’s first Fall term, usually in late August/early September.** If the student doesn’t pass a particular exam, they will be advised to enroll in specific courses and pass those courses with a B- or better grade.

A preliminary list of topics can be found in the back of this handbook.

REGISTRATION POLICY

Ph.D. students are expected to register during each fall and winter semester from matriculation to degree completion, unless on an approved leave of absence or on Extramural Study status. If a student does not register for a term, he or she will be considered to have withdrawn and therefore, discontinued from the Ph.D. program. Please see Rackham’s website for more details: [http://www.rackham.umich.edu/current-students/policies/doctoral/phd-students/understanding-registration](http://www.rackham.umich.edu/current-students/policies/doctoral/phd-students/understanding-registration).
GOOD STANDING POLICY

A graduate student in the Biophysics program at the University of Michigan will be considered in “good standing” if he/she complies with all rules and regulations of the University, the College and the Biophysics program; and performs the duties of his/her GSI, GSRA or Fellow appointment in a professional timely manner and if the following conditions are also met:

1. The student must maintain an overall GPA of greater than or equal to 3.00 (B or better) for all academic courses taken, including cognate courses, throughout their residence in the program. *A student whose cumulative grade point average falls below a “B” in a given term or half-term will be placed on probation for the following term or half-term, or may be denied permission to register. See the Rackham Handbook for more details.*

2. The student must take two terms of the Graduate Research rotation course (890) and receive a satisfactory grade (S) in both terms.

3. The student must find a mentor who will agree to oversee their Ph.D. research by the beginning of the spring term (May 1) of their first year in residence.

4. The student must achieve Ph.D. candidacy by May 31 of his/her second year in residence. This will involve the following sequence of events:
   a. The student must assemble a suitable dissertation committee (faculty will sign a form agreeing to serve on said committee) *by mid-February of the second year.* Please note that those students who are doing early candidacy (during the Fall term of their second year) must assemble their committee by Mid-October.
   b. All minimum course requirements for the Ph.D. degree must be fulfilled before the effective term of candidacy (students may finish up coursework in the same term they are taking their prelims).
   c. The student must prepare a written proposal for his/her Ph.D. research and disseminate to his/her dissertation committee by the end of the Winter term of his/her second year. The student will meet with his/her dissertation committee and perform the required Oral Prelim Exam no later than May 31 of the second year in residence. In the event that the student does not pass the Oral Prelim on his/her first attempt, they will then not be in good standing. The student will have until August 31 of that year to re-take the exam, pass and regain good standing status.

   *See page 10 for more details regarding candidacy.*

5. The student must receive satisfactory (S) grades for all terms enrolled in Biophysics 990 or 995. In addition, the student must receive a “satisfactory” or “marginal” assessment of progress by their faculty mentor on their annual progress report that is to be prepared by the Student/Mentor each Spring term. If a student receives an unsatisfactory grade (U) in Biophysics 995 and/or on the yearly progress report, this will trigger an immediate meeting of the student’s dissertation committee to review the student’s progress, and report back to the Graduate Chair. Based on this report, the Graduate Chair and Graduate Committee may determine that the student is not in “good standing” and may recommend that the student find a new mentor, or they will recommend dismissal from the program.

6. In addition to the general requirements explained above, the student must also fulfill all requirements (e.g. seminars, research proposals, etc.) set forth by the program.

*It is critical to maintain a record of Good Standing within the Biophysics Graduate Program. Only students who are in Good Standing are considered for financial support. Failure to maintain/remain in Good Standing can result in dismissal from the program.*
DEGREE REQUIREMENTS

The basic requirements for a Biophysics Ph.D. degree include:

- Completion of required coursework (at least 18 hours graded graduate coursework on the Ann Arbor campus), including:
  - Completion of the RCRS (Responsible Conduct of Research & Scholarship) requirement
  - Completion of a minimum of 4 credits hours of cognate/elective coursework
- Good standing
- Attainment of Candidacy (passing of the Candidacy Exam)
- Completion of a public seminar in the third or fourth year of graduate study
- Approval of the written dissertation by the Thesis Committee and Rackham, and a final oral examination by the Thesis Committee

The minimum requirement for the Ph.D. degree is seven (eight including the Final Term – six with a relevant Masters) full time terms of study (min. 8 credit hrs) and research beyond the bachelor’s degree. A graduate student research or teaching assistant must be a full-time student.

COURSE REQUIREMENTS

It is the goal of the Program to make sure the student acquires a solid background in biology, biochemistry, chemistry, physics, and biophysics, by including a selection of courses on the graduate or senior undergraduate level. Establishing a solid academic foundation is especially important in a rapidly changing interdisciplinary field such as Biophysics.

Because of the interdisciplinary nature of Biophysics, students enter the program from a variety of undergraduate backgrounds. All students must complete the required courses, along with any necessary additional coursework (determined by the outcome of their placement exams). Most students, unless they have an unusually strong background in biology, will be expected to complete one course in cell biology and one course in biochemistry. Students that lack a strong foundation in the physical sciences should take appropriate advanced undergraduate courses or introductory graduate courses in quantum mechanics or quantum chemistry and in thermodynamics or statistical physics. Pre-candidates must be registered for a minimum of 9 credit hours.

Courses are counted towards the Biophysics Requirements only when they are passed; for undergraduate courses (400-level) passing grade is “B” or above, in graduate courses (500-level and above), passing grade is “B” or above. Be aware that failed courses keep counting towards your cumulative grade-point-average (GPA), which has to remain “B” or above at all times. (See Good Standing Policy)

Students who are Doctoral Candidates (i.e. who have passed their preliminary exams) can take one additional course for credit. Follow the rules given in the Rackham Handbook. Other classes may be audited (contact the instructors). Visit is the Graduate version of audit (VI). Taking extra courses before and after Candidacy must be discussed with the Thesis advisor or with the Graduate Chair when the student has not chosen a home lab.

Grades in research courses accepted by the Graduate School are “S” (satisfactory) and “U” (unsatisfactory). No credit is given for a “U” but RFT’s are earned if applicable. An “I” grade may be given in any lecture or laboratory course when a minor part of the course work remains undone at the end of the term. If the work is made up within two complete semesters, a supplementary report of the appropriate letter grade may be filed; after the second semester the supplementary report will not be accepted and the “I” remains permanently on your record. Check in the Rackham Handbook for specific information on the Incomplete Policy. An “I” always remains on the record.
A minimum of 18 credits must be accumulated prior to achieving Candidacy. These hours include all regular required program courses, any courses in which the student registers and pays fees as a visitor but exclude Biophysics 890 (Rotation Research) and 990 (Pre-Candidate Research). A minimum of 6 credits of 890 must also be completed in order to achieve candidacy.

After achieving Candidacy, Candidates must register for a total of 8 hours of 995/term. Students are allowed one extra course on top of the 995 research credits, per Rackham guidelines.

All students must take the four core courses [Biophys 520 (Fall), Biophys 550 (Fall), Biophys 521 (Winter) and Biophysics 595 (Fall)]; and if needed, 2 electives and 2 courses in Biochemistry and Cell Biology. These courses can be decided in consultation with your advisor. Individual requirements may be waived based on prior coursework.

Students must enroll in one Research Ethics Course: PIBS 503 or UC 415 (offered by LSA, either the Chemistry or Physics sections depending on the nature of your interests/research). Note: this requirement must be fulfilled prior to achieving candidacy.

Cognate/Elective requirement: at least 4 credits of cognate/elective courses must be completed prior to achieving candidacy. Note: not all electives count as cognates, but all cognates can count as electives. Cognate courses are non-Biophysics courses OR Biophysics courses that are cross-listed with other programs (provided the courses are not one of the 4 core courses). The research ethics course does not count towards this requirement.

In the first year, students will also need to register for two (2) research rotations: Biophys 890 (Fall and Winter). In the second year, when a research advisor has been chosen, they will register for Biophys 990.

Students with a background in Physics will probably need to take:

- **Biochemistry**: Biolchem 550 (Fall)
- **Additional courses could be**:
  - **Cell Biology**: MCDB 428 (Winter, Biological focus) or BiomedE 418 (Winter, Quantitative/Engineering focus)
  - **Macromolecular Structure/Function**: Chembio 501 (Fall) / Chembio 502 (Winter) or BiolChem 515 (Fall)
  - **Dynamical Processes in Biophysics**: Physics 417 (Winter)

Students with a background in Biology will need to obtain a solid background in Mechanics, Electricity and Magnetism, Statistical/Thermal Physics, and Quantum Mechanics. Choose courses in your weakest area(s):

- **Mechanics**: Physics 401 (Fall or Winter – Intermediate Mechanics)
- **E&M**: Physics 405 (Fall or Winter – Intermediate Electricity and Magnetism)
- **Statistical/Thermal**: Chem 463/575 (Fall – Thermodynamics), or Chem 576 (Winter – Statistical Mechanics), or Physics 406 (Fall or Winter – Statistical and Thermal Physics)
- **Quantum**: Chem 461/570 (Fall or Winter – Physical Chemistry) or Physics 453 (Fall or Winter – Quantum Mechanics)

Once you’ve passed the prelims/chosen a lab, there are a number of courses related to specific areas of research, which should probably be chosen after discussion with your advisor/thesis committee, for example:

- **X-ray Crystallography**: Biophys 602
- **NMR**: Biophys 503
- **Kinetics**: Chem 673
- **Spectroscopy**: Chem 580

And other courses in Math (463), Statistics (401), Bioinformatics, Applied Physics, etc.
COURSE DESCRIPTIONS

More detailed information about courses can be found online via the websites of departments offering said courses, or via online college course guides (i.e. LSA, Engineering).

Biophysics Courses: http://lsa.umich.edu/biophysics/graduate/courses

Biological Chemistry Courses: http://medicine.umich.edu/dept/biochem/course-descriptions

LSA Course Guide: http://www.lsa.umich.edu/cg/

Engineering Course Guide: http://www.engin.umich.edu/college/academics/bulletin/courses
CANDIDACY PROGRESSION CHECKLIST

☐ COURSE WORK: Complete all required coursework.

   I. Core: 12 hours of Biophysics core courses with a B or better:
      ☐ 520 [Theory & Methods of Biophysical Chemistry] 3 credits
      ☐ 521 [Techniques in Biophysical Chemistry] 3 credits
      ☐ 550 [Lab Techniques in Biophysics] 3 credits
      ☐ 595 [Professional Development in Biophysics] 3 credits

   II. 6 credits of Biophysics 890 (Intro to Research): Students are required to register for this class in the fall and winter terms of their first year.
      ☐ Fall  ☐ Winter

☐ COGNATE and/or ELECTIVES: Take and pass at least 4 credit hours of cognate/elective coursework with a B or better. NOTE: cognates can count as electives, but not all electives are cognates! Please contact the Student Services Office for more information.

   ☐ ___ credit(s) of ______  ☐ ___ credit(s) of ______
   ☐ ___ credit(s) of ______  ☐ ___ credit(s) of ______

☐ ETHICS REQUIREMENT: Take and pass 1 credit hour of RCRS/Ethics requirement with a B or better

   ☐ ___ credit of PIBS 503  ☐ ___ credit of UC 415

☐ PRELIM: Take and pass your Preliminary Exam

   • Form a Prelim Exam Committee, comprised of at least 4 professors, including your research advisor as Chair. Complete the Oral Prelim/Dissertation Committee Selection form and hand it in to the Student Services Office.
   • Write a Research Proposal (expected length is around 10 pages) and distribute to members of your Prelim Exam Committee well in advance of the Prelim Exam (two weeks prior).
   • Just prior to your prelim, pick up a Candidacy Exam Report form from the Student Services Office. Take the form to your Prelim Exam, obtain signatures from your committee, have your committee chair complete the form and return the form to the Student Services Office.

☐ CANDIDACY: Upon receipt of the Biophysics Candidacy Exam Report form—if you have completed all of the above requirements—the Student Services office will complete your online Recommendation form for Candidacy form with Rackham. Students are expected to achieve candidacy by the end of their second year.

   • View the Candidacy Deadline list from the Rackham website and know your deadlines!
     http://www.rackham.umich.edu/current-students/policies/doctoral/phd-students/candidacy-deadlines
**RESEARCH**

The Ph.D. signifies the completion of a significant body of original publishable research, performed under the supervision of a research advisor. The choice of a research advisor and thesis project is a major decision. This choice is facilitated by our rotation program, which allows students to explore various research laboratories and areas of Biophysics research during their first year. Students must register for two terms of Biophysics 890 (Introduction to Research), each consisting of a laboratory rotation in the laboratory of any Program faculty member upon mutual agreement. Students must enroll for at least 3 credits. *Even if students are sure of their choice of thesis advisor, they must take advantage of this opportunity to broaden their exposure to different research efforts.*

**ROTATIONS**

Only two lab rotations are required before joining a lab. If a student wants to do a third lab rotation, they must first seek approval of both the Graduate Chair and the Program Chair. **NOTE: funding isn’t always available for third rotations.**

**BEFORE Deciding on a Lab Rotation:**

1. Research your potential faculty mentor’s research interests (whether online or via research papers, etc.).
2. Interview at least 4 faculty members whom you are interested in rotating with, keeping in mind the following things:
   a. How closely do their research interests match yours?
   b. Personality (can you work with this person)?
   c. Publication record (do students in the lab have a history of productivity?)
   d. Try to gain an idea of how welcome you’ll be in the lab and how much guidance you’ll get.
3. Speak with students currently in the lab, or those who have done rotations in the lab before.

**BEFORE Joining a Lab:**

1. Interview other lab members and post-doctoral fellows to get a “first-hand” account of the conditions and expectations of the lab
2. Attend at least 1 group meeting prior to the deadline for joining a lab (April 30).
3. Make sure the PI is capable of providing funding support for new students.

**Direct-admit students must choose their home lab by May 1 during their first year.** You may join in the laboratory of any of the regular or associated faculty. Since the thesis advisor will be responsible for the majority of stipend, tuition and fringe benefits expenditures, it behooves the student to consider the financial position as well as the scientific interest when choosing a lab. You should register for Biophysics 990 (Pre-Candidate Research) during each semester of dissertation work as long as you are a pre-Candidate. **It is recommended that you choose a lab within 2 weeks of the May 1st deadline to avoid gaps in pay or benefit coverage.**

In rare cases it is sometimes permissible to rotate with a non-Biophysics affiliated faculty member, and should a student choose a non-Biophysics affiliated faculty as their thesis advisor; **the student must also choose a co-advisor who is affiliated with Biophysics (who will also serve on their Committee).**
Some students may decide at some point that they want to switch thesis labs; this is permissible, pending approval of the Graduate Chair. The decision is consequential because the choice of a lab amounts to the choice of a research field that will affect much of their future career. **Students are encouraged to switch only after serious reconsideration.**

The student and the thesis advisor are jointly responsible for following the Program and Graduate School requirements for the Ph.D. The mentor’s responsibilities begin at the time of his/her agreement to accept the student for research. In addition to supervising the research, the thesis advisor is expected to advise the student on course elections, examinations, independent study pertinent to his/her general development as a scientist and any other matters affecting his/her general progress toward a degree.

**THESIS RESEARCH**

Once you have obtained Candidacy, your main activity in Biophysics will be thesis research. **Every semester you should register for Biophysics 995 for 8 credit hours.** You will also want to attend many of the numerous specialized lectures and seminars at Michigan, and you may also want to take or audit additional courses of interest to you.

The thesis research should involve original and significant advances of our understanding of an important area in Biophysics. It is expected that your work will result in papers published in peer-reviewed scientific journals. In fact, the experiencing of presenting your work in written and oral form is an important part of the graduate experience.
PRELIM/CANDIDACY EXAM & COMMITTEE

Biophysics graduate students must achieve Ph.D. candidacy by successfully passing an oral candidacy examination by his/her Dissertation Committee. This examination is held in the second year of enrollment and can be completed either by the end of the Fall term (end of December) or by the end of the spring term (end of May). The timing of the exam should be decided by a discussion between the graduate student and his/her Ph.D. advisor.

In preparation for the candidacy exam, each student should assemble a suitable Dissertation Committee (faculty will sign a form agreeing to serve on said committee) by mid-February of the second year. Please note that those students who are doing early candidacy (during the Fall term of their second year) should assemble their committee by mid-October. The Dissertation Committee of at least three Biophysics faculty members (at least one must be core) and one cognate (non-Biophysics) faculty member will review the proposal. **This committee should include the candidate’s thesis advisor.** With the addition of the thesis advisor, the prelim exam committee will often be identical to the candidate’s Ph.D. committee (although this is not required). The Preliminary Exam Committee must be approved by the Graduate Chair.

*Note: if the student chooses a thesis advisor who is not affiliated with Biophysics, they must choose one Biophysics core faculty member to serve as their co-thesis advisor. Please refer to the faculty listing at the back of this handbook.*

As part of the candidacy exam, each student must submit a written proposal to his/her Dissertation Committee. The proposal should be sufficiently detailed so that the nature of the chosen research problem and the direction of the effort is clearly defined. The expected length is around **ten double-spaced typed pages** (including all text and graphics [sections a-d]). Literature references are then added at the end (not included in the page limit).

The proposal should contain:

a) Background and Significance  
b) Project Goals  
c) Research Plans  
d) Preliminary Data  
e) Literature References

**The proposal should be distributed to the student’s Dissertation Committee at least two weeks prior to the candidacy exam.**

In the candidacy exam, students should present a brief summary of their research proposal. The presentation may include an introduction to the chosen research problem, goals, hypotheses and preliminary results; but it should not be a seminar style presentation. Students will be examined on knowledge of the background subject areas and on their research plans. Students are expected to have a good understanding of the goals, directions, importance, potential pitfalls and potential pathways of the proposed research. Students should be prepared to propose alternatives and discuss background material concerned with that proposal. Students should also show that they are making reasonable progress towards their doctoral research. The Dissertation Committee will determine a Chair (other than the research advisor) for the meeting and that Chair will be responsible for the conduct of the exam. The research advisor will be present, but will not participate in the examination except in limited consultation.

The Dissertation Committee also reviews the student’s coursework and any progress reports. The Committee determines what additional courses, reports or other study are required if, for any reason, the examination is not satisfactory. The Committee may decide to re-examine the student at a later time or recommend dismissal from the program. A subsequent review by the student’s research advisor as to whether any additional requirements have been met does not necessarily require another meeting of the Dissertation Committee with the student. Students should inform the Biophysics Graduate Coordinator when their candidacy exams are scheduled. A report to the Dissertation Committee will be prepared and given to the research advisor before the exam takes place.
ANNUAL EVALUATION

All students from the second year to the completion of the Ph.D. degree requirements participates in an annual evaluation of their progress towards the degree with their dissertation advisor. In the spring of each year, students and faculty will receive via email the evaluation form, instructions for completing the form and a deadline by which it must be submitted to the Student Services Administrator. The form is completed jointly by the student and advisor and reviewed by the Graduate Chair. The goal of this process is to assist students and advisors in overcoming any barriers to success and to facilitate open communication about degree and research requirements. If the student receives an unsatisfactory evaluation, this will trigger an immediate meeting of their dissertation committee to review the student’s progress, and report back to the Graduate Chair.

SEMINAR REQUIREMENT

Students are required to present a seminar to faculty and fellow students during their fourth year. The seminars are given as part of a Graduate Student Symposium during the Fall or Winter term. The student must present their own research. They may be invited to give yet another seminar in the regular Biophysics Seminar Series or other departments in the later stages of their career. Students are encouraged to accept these invitations as they help develop good communication skills.

In addition to presenting a seminar, all students are required to attend the Biophysics Seminar Series. The serious student will take advantage of all learning opportunities, and the Seminar Series represents excellent sources of up-to-date results and ideas.

DATA MEETING (8th/9th Semester Meeting)

All Biophysics graduate students will be required to have a meeting with their Dissertation Committee in the winter of their 4th year or fall of their 5th year*. The timing of this meeting will be determined for each student based on discussion with their faculty advisor, but it must be completed by December 31 of their 9th semester. In rare exceptions (where students make exceptionally fast progress in their Ph.D. studies), this meeting may occur even earlier (6th or 7th semester, for example). At this meeting, the student must present a detailed discussion of his/her data in a clear and logical fashion, including major findings and a detailed outline of the thesis. PowerPoint presentations are preferred at the meeting. Please notify the Biophysics Graduate Coordinator once the date for the data meeting is determined such that the appropriate paperwork can be prepared.

*Additional data meetings may be required by the student’s Committee depending upon the outcome of their Annual Evaluation.
THESIS PREPARATION AND DEFENSE

Detailed instructions about the preparation and defense of the Dissertation are in the Dissertation Handbook, available online at Rackham’s website. In general, the Dissertation is a comprehensive treatment of the Thesis Research performed by the student. It is possible for the Dissertation to include material from journal articles previously published by the student, however the Dissertation should also include contextual information regarding the significance of the question being addressed, a discussion of other approaches used by previous researchers, and the importance of the Thesis research.

Following the submission of the Dissertation to the Thesis Committee, the student must defend the Dissertation in an oral presentation. The student must have a pre-defense meeting with the Office of Academic Records and Dissertations at least 10 working days before the defense. The student can register online for this, and must be registered to Defend and finish all requirements. The oral defense generally consists of an open presentation of the thesis research to the University Community followed by a closed session with the Thesis Committee. At least four members of the Thesis Committee must be present at the oral defense. Including the Chair or one Co-Chair and Cognate Member. All members are required to read and comment on the submitted Dissertation before the Defense.

MASTERS DEGREE

There is no terminal Master of Science (M.S.) program in the Biophysics Graduate Program and the Program will not admit students intending to obtain a terminal Master of Science Degree. However, the degree can be granted in the extenuating cases of students who have unsuccessfully attempted to pass the preliminary examination requirements. It can also be conferred as a non-terminal degree to students who are working to complete the Ph.D. degree.

The Master of Science Degree in Biophysics, when granted by Biophysics Graduate Program, requires successful completion of a minimum of 28 credit hours of course work (average “B”), and 4 credit hours of cognate studies (“C-” or better). 990, 995 or “VI” courses do not count towards this total – student should also see the Rackham Handbook section on Masters Degrees.
FINANCIAL SUPPORT & BENEFITS

The Biophysics Graduate Program is committed to seek continued support for your stipend, tuition, and health insurance throughout your graduate training. To be eligible for such financial support, students must be in “Good Standing” (see above). Students are expected to continue to make progress in their thesis research independent of the source of their funding.

Fellowship Funding & Support Beyond the First Year

First-year students entering the Biophysics program directly can expect financial support for full coverage of stipend, tuition, and healthcare during their first two terms (fall and winter, 8 months). After their first winter term, following the choice of a thesis advisor, support will be provided by some mix of the following funding mechanisms: (1) a Research Assistantship (GSRA) supported by an individual grant of their thesis advisor; (2) a Teaching Assistantship (GSI) in a relevant academic department; or (3) an extramural fellowship. Fellowship students can expect their paychecks to be deposited some time during the middle of each month. Students on training grants and other types of scholarships, such as Rackham Merit Fellowships and NSF awards, are also paid from fellowships.

Graduate Student Research Assistants (GSRAs)

Students who are not on fellowships are generally paid as Graduate Student Research Assistants (GSRAs) or, if helping to teach a course, as Graduate Student Instructors (GSIs). The source of funding for all GSRA appointments is via their thesis advisor. GSRAs and GSIs are considered “employees” of the university and as such, will have taxes deducted from their paychecks, and they will receive a W-2 form. GSRAs and GSIs are not eligible for UM employee parking.

Taxes

All stipends are taxable so many students will need to pay estimated income taxes quarterly. Students are also required to report their stipends as income on their income tax returns (although they do not receive a W-2 form). More information can be found on Rackham’s website: http://www.rackham.umich.edu/help/funding_and_awards/tax_information/.

There are also instructions and forms online at (www.irs.ustreas.gov), Publication 970 or you can call the IRS at 800/829-1040 and the Michigan Treasury Department at 517/373-3200.

May through August, when students are not enrolled, social security and Medicare are deducted from paychecks. Social security and Medicare will not be deducted September through April, the months in which students are enrolled.

Tuition

Graduate students holding at least a 25% appointment as a Graduate Student Instructor (GSI) or Research Assistant (GSRA) will have the full tuition waived. However, you will be liable for the various mandatory (and registration) fees. Students in the Molecular Biophysics Training Grant Program will have these fees waived.

Graduate Student Instructors (Teaching)

Although there are no formal teaching requirements, as part of their training students are strongly encouraged to teach at least one semester as a Graduate Student Instructor (GSI) in Biophysics, Chemistry, Biology, Biochemistry, or Physics. This experience is especially important for those interested in a future career in academia, although all students can gain from the opportunity for presenting technical material in a pedagogical context. It may happen that you are asked to teach in later stages of your study as well, depending on financial resources of your thesis advisor. Students are strongly encouraged to serve as teaching assistants in a form that includes direct contact hours with a class (rather than grading). It is mandatory for students assigned teaching positions for the first time to attend the GSI Training Orientation offered by the Center for Research on Learning & Teaching. This course is usually offered the last week in August or in early January.
**GradCare (Health) and Dental Insurance**

All graduate students, regardless of their funding source, are entitled to GradCare health and Dental option 1. You will receive an email telling you to select benefits on Wolverine Access. Students are responsible for selecting benefits within 30 days of their appointment.

If you plan to leave the State of Michigan for any length of time, please contact the Benefits Office (615-2000) or visit the benefits office website at [http://benefits.umich.edu/benefitgroups/grads.html](http://benefits.umich.edu/benefitgroups/grads.html) to inquire about off-site or emergency coverage.

Please see the Student Services Administrator if you have ANY questions or problems.

**STUDENT REPRESENTATION**

The Biophysics program has annual elections in which they elect a candidate to represent the graduate students on the Curriculum Committee and at the Biophysics faculty meetings (One year term).

**Biophysics Graduate Student Council**

The Biophysics Graduate Student Council (GSC) deals with academic and other issues of concern to graduate students in the Program. It serves as a tie between the faculty, graduate students, and staff. The GSC also sponsors social events for faculty, graduate students, staff and their families from time to time. Any student interested in being on the GSC should contact the present members for further information at Biophysics.gsc@umich.edu.
PROGRAM INFORMATION

Copy Room
The copy room (#4029) is located on the 4th floor directly across from the Biophysics administrative office (#4028). If you need to make copies that are course or lab related, stop in the Administrative Office and you will be given a code for the copy machine. Once you join a lab, you will be given a lab-specific copy code to use.

Graduate Student Mailboxes
Every graduate student has their own mailbox located in the Biophysics lounge on the 4th floor (room 4041). Any mail addressed to you here in Biophysics will be put there, as well as any messages from faculty, Academic Services staff, Technical staff or Rackham will be put in your mailbox. Please check your mailbox regularly. First-year PIBS student’s mailboxes are located in the PIBS office.

Building Access
The Chemistry Building is normally open during business hours Monday through Friday. Graduate students who are working (or rotating) in Chemistry Building labs will have access to the building during the following hours with their current MCard:

- M-TH: 7AM – 10PM
- Fri: 7AM – 6PM
- Sat: 11:30AM – 6PM
- Sun: 11:30AM – 10PM

Biophysics Library
Our library contains various Biophysics and related texts for student use. Please see someone in the Administrative Office for a key. The usual loan period is for 1 week. If you need more time, please contact Sara in the Biophysics main office.

DEPARTMENTAL ADMINISTRATION

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Room</th>
<th>Telephone*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Chair</td>
<td>Charles L. Brooks, III</td>
<td>4028C or 2006a</td>
<td>4-1146</td>
</tr>
<tr>
<td>Graduate Chair:</td>
<td>Michal Zochowski</td>
<td>259 W. Hall</td>
<td>7-5552</td>
</tr>
<tr>
<td>Administrative Manager</td>
<td>Chris Betz Bolang (interim)</td>
<td>4040</td>
<td>5-7056</td>
</tr>
<tr>
<td>Executive Secretary</td>
<td>TBD</td>
<td>4028b</td>
<td>4-1146</td>
</tr>
<tr>
<td>Student Services Manager</td>
<td>Sara Grosky</td>
<td>4028</td>
<td>3-6722</td>
</tr>
<tr>
<td>IT</td>
<td>NuIT Group</td>
<td>4732</td>
<td>7-2846</td>
</tr>
<tr>
<td>Laboratories &amp; Facilities</td>
<td>Tracy Stevenson</td>
<td>1500c</td>
<td>5-2724</td>
</tr>
</tbody>
</table>

* When dialing from a campus phone, only the last five digits are used
### FACULTY AND INTERDISCIPLINARY PROGRAM FACULTY MEMBERS

(* indicates core faculty member)  

<table>
<thead>
<tr>
<th>Name</th>
<th>Department/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banaszak Holl, Mark</td>
<td>Chemistry, Macromolecular Science &amp; Engineering</td>
</tr>
<tr>
<td>Bardwell, James</td>
<td>Biology</td>
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<tr>
<td>Biteen, Julie</td>
<td>Chemistry</td>
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<tr>
<td>Brooks, Charles*</td>
<td>Chemistry, Biophysics</td>
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<tr>
<td>Cai, Dawen</td>
<td>Cellular &amp; Developmental Biology</td>
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<tr>
<td>Carlson, Heather A.</td>
<td>Medicinal Chemistry</td>
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<td>Chen, Zhan</td>
<td>Chemistry</td>
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<tr>
<td>Cheng, Wei</td>
<td>College of Pharmacy</td>
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<tr>
<td>Cho, Uhn-Soo</td>
<td>Biological Chemistry</td>
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<tr>
<td>Cierpicki, Tomasz</td>
<td>Pathology (Medical School)</td>
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<tr>
<td>Fierke, Carol</td>
<td>Chemistry, Biological Chemistry</td>
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<tr>
<td>Gafni, Ari*</td>
<td>Biophysics, Biological Chemistry</td>
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<tr>
<td>Joglekar, Ajit</td>
<td>Cellular &amp; Developmental Biology</td>
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<td>Kerppola, Tom</td>
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<td>Kubarych, Kevin</td>
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<td>Lehnert, Nicolai</td>
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<td>Liu, Allen</td>
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<td>Lubensky, David</td>
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<td>Marsh, E. Neil</td>
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<td>Mayer, Michael</td>
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<td>Meiners, Jens-Christian*</td>
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<td>Meyhöfer, Edgar</td>
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<td>Ogilvie, Jennifer</td>
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<td>Palfey, Bruce</td>
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<td>Pecoraro, Vincent</td>
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<td>Penner-Hahn, James*</td>
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<tr>
<td>Raghavan, Malini</td>
<td>Microbiology &amp; Immunology</td>
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<td>Ramamooorthy, Ayyalusamy*</td>
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<td>Saper, Mark</td>
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<td>Sension, Roseanne</td>
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<td>Skiniotis, Giorgios</td>
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<td>Smith, Janet</td>
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<td>Southworth, Daniel</td>
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<td>Steel, Duncan*</td>
<td>Biophysics, Physics, Engineering</td>
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<tr>
<td>Stockbridge, Randi*</td>
<td>Biophysics, MCDB (arriving W16)</td>
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<td>Tesmer, John</td>
<td>Pharmacology</td>
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<td>Trievel, Ray</td>
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<td>Veatch, Sarah*</td>
<td>Biophysics</td>
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<tr>
<td>Verhey, Kristen</td>
<td>Cellular &amp; Developmental Biology, Life Sciences Institute</td>
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<td>Violi, Angela</td>
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<td>Walter, Nils</td>
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<td>Wang, Shaomeng</td>
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<td>Wood, Kevin*</td>
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<td>Xu, Zhaohui</td>
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<td>Yang, Qiong*</td>
<td>Biophysics</td>
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<td>Zochowski, Michal R.*</td>
<td>Biophysics, Physics</td>
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</table>
PLACEMENT EXAM TOPICS

Biochemistry and Cell Biology

At the level of Voet & Voet’s Biochemistry

- Proteins
  - Amino acids
  - Peptide bond
  - Levels of protein structure
  - Sequencing of proteins
  - Characterization of proteins
  - Globular proteins – hemoglobin
  - Fibrous proteins – Collagen, silk, wool
  - Protein folding
  - Enzymes
  - Enzyme kinetics
    - Michaelis-Menten
    - Types of inhibition
    - Mechanisms
    - Regulation

- Lipids
  - Triglycerides
  - Phospholipids
  - Steroids
  - Membranes

- Nucleic Acids
  - Bases
  - DNA structure and replication
  - RNA structures, transcription, splicing
  - Protein synthesis

- Cell Biology
  - Cell architecture

- Nuclear structure
- Membrane structure

Physics and Physical Chemistry

- Electricity, Magnetism and Optics (at the level of General Physics (with calculus): Halliday and Resnick)
  - Electrostatics with dielectrics and multipoles
  - Maxwell’s equations in integral form
  - Electromagnetic waves
  - Polarization
  - Reflection and refraction
  - AC and DC circuits
  - Geometric Optics

- Quantum Mechanics (at the level of upper-class undergraduate physics or physical chemistry)
  - Uncertainty principle
  - DeBroglie wavelength
  - Schrödinger equation, expectation values, probability densities
  - Bound states in a square well, atom, and harmonic oscillator
  - Tunneling
  - First-order time-independent and time-dependent perturbation theory
  - Valence Bond theory and molecular orbitals
  - Delocalized orbitals

- Statistical Mechanics and Thermodynamics (at the level of upper-class undergraduate physics or physical chemistry)
  - First and second laws of thermodynamics and simple applications
  - Free energies, definitions and uses
  - Statistical definition of entropy
  - Ensembles
  - Partition functions
  - Kinetic theory of gases in equilibrium
  - Phase transitions
  - Boltzmann distribution
CAMPUS RESOURCES

In addition to your Advisor, the Student Services staff, the Graduate Chair and the Rackham Graduate School staff; there are many resources on campus to help you succeed in the Biophysics Ph.D. program.

Mentoring & Career Resources

- **Rackham Graduate Student Success**: http://www.rackham.umich.edu/current-students/graduate-student-success
- **How to Get the Mentoring You Want** http://www.rackham.umich.edu/downloads/publications/mentoring.pdf
  A general guide for graduate students about the importance of the student-mentor relationship.
- **Rackham-CRLT Graduate Student and Postdoc Mentorship Program**
  http://www.crlt.umich.edu/imp/overview
  Provides an opportunity to extend networks and mentoring opportunities by working with faculty at regional colleges and universities.

Selected Campus Academic Resources

- **Center for Research on Learning and Teaching (CRLT)** http://www.crlt.umich.edu/index.php
  CRLT offers programs and services designed to support graduate students in all stages of their teaching careers from training for their first teaching experience through preparation for the academic job market.
  ✓ Preparing Future Faculty Conference
  ✓ U-M Graduate Teacher Certificate
  ✓ Seminars for Graduate Student Instructors
- **Sweetland Center for Writing** http://www.lsa.umich.edu/sweetland/
  The Sweetland Center for Writing supplements formal writing instruction by providing free programs that help students understand assignments, develop ideas, support arguments and claims, cite sources, and revise at the paragraph and sentence level.
  ✓ Writing workshops
  ✓ Writing references and resources
  ✓ Peer tutoring
  ✓ Dissertation Writing Institute
- **English Language Institute (ELI)** http://www.lsa.umich.edu/eli/
  The English Language Institute offers opportunities for students to participate in courses and workshops aimed at improving their language and communication skills.
  ✓ English for Academic Purposes Courses
  ✓ Workshops
  ✓ Writing Clinics
  ✓ English Learning Links
- **Center for Statistical Consultation and Research (CSCAR)** http://www.cscar.research.umich.edu/
  CSCAR emphasizes an integrated, comprehensive statistical consulting service, covering all aspects of a quantitative research project ranging from the initial study design through to the presentation of the final research conclusions.
  ✓ Workshops and seminars
  ✓ Software help
  ✓ Software access
  ✓ Spatial Analysis/GIS
- **Knowledge Navigation Center (KNC)** http://www.lib.umich.edu/knowledge-navigation-center
  The KNC teaches individuals how to use technology in coursework, teaching, or research.
  ✓ One-on-one technology consultations
  ✓ Workshops
  ✓ Digitalization of documents
- **University of Michigan Library** http://www.lib.umich.edu/
  MLibrary supports, enhances, and collaborates in the instructional, research, and service activities of the faculty, students, and staff, and contributes to the common good by collecting, organizing, preserving, communicating, and sharing the record of human knowledge.
  ✓ Borrowing and circulation
  ✓ Course reserves
  ✓ Instruction and workshops
Funding Resources
- Rackham & UM: http://www.rackham.umich.edu/prospective-students/funding
- NSF Graduate Fellowship Program: https://www.nsfgrfp.org/
- HHMI – Gilliam Fellowship Program: http://www.hhmi.org/programs/gilliam-fellowships-for-advanced-study
- HHMI – International Student Research Fellowships: http://www.hhmi.org/programs/international-student-research-fellowships

Mental Health & Wellness
- University Health Service (UHS) is a health care facility, located on central campus that offers many outpatient services in one building for U-M students, faculty, and staff. Many of UHS services provided to registered students are covered by the Health Service fee. http://www.uhs.umich.edu/
- Counseling and Psychological Services (CAPS) offers a variety of confidential services to help students resolve personal difficulties. Services include brief counseling for individuals, couples and groups. http://www.umich.edu/~caps/
- Psychological Clinic provides psychological care for students. Services include consultation, short-term and long-term therapy for individual adults and couples. http://www.psychclinic.org/
- Services for Students with Disabilities (SSWD) provides services to students with visual impairments, learning disabilities, mobility impairments, hearing impairments, chronic health problems and psychological disabilities, so they may enjoy a complete range of academic and non academic opportunities. http://ssd.umich.edu/
- Department of Recreational Sports is the place for fun and fitness on campus. Rec Sports offers both informal activities and structured programs: Club Sports, Challenge Program, Drop-in Program, Intramural Sports and/or Outdoor Adventures. http://www.recsports.umich.edu/

**For a more comprehensive list of ‘Mental Health and Wellness’ resources, please see: http://www.umich.edu/~mhealth/students.html

Selected Sources of Campus Support
- International Center provides a variety of services to assist international students, scholars, faculty and staff. http://internationalcenter.umich.edu/
- The Career Center is committed to preparing U-M students and alumni to be active, life-long learners in developing and implementing their career decisions. http://www.careercenter.umich.edu/
- Center for the Education of Women (CEW) offers support services to students, faculty, staff and community members. http://www.cew.umich.edu
- Department of Public Safety (DPS) provides information on crime prevention strategies, the law enforcement authority of the University police, and policies and statistics about crime on campus. http://police.umich.edu/
- Sexual Assault Prevention and Awareness Center (SAPAC) provides educational and supportive services for the University of Michigan community related to sexual assault, dating and domestic violence, sexual harassment, and stalking. http://www.umich.edu/~sapac/

Conflict Resolution
- Rackham: http://www.rackham.umich.edu/current-students/help/resolution
- Office of the Ombuds is a place where student questions, complaints and concerns about the functioning of the University can be discussed confidentially in a safe environment. 6015 Fleming, Phone: (734) 763-3545 http://www.ombuds.umich.edu
- Office of Student Conflict Resolution (OSCR) http://www.oscr.umich.edu/
  Promotes justice by facilitating conflict resolution for the Michigan community and creating a just and safe campus climate. 600 East Madison, Phone: (734) 936-6308
- Graduate Student Affairs, 1530 Rackham, Phone: (734) 647-7548
VACATION POLICY & HOLIDAYS

As a Biophysics student, you are allowed to take off on all official university holidays (defined below). Any additional vacation must be discussed with and approved by your thesis advisor. First year students would consult their current rotation mentor and the Biophysics Graduate Chair.

Holidays (University-wide):

- New Year’s Day
- Memorial Day
- Independence Day
- Labor Day
- Thanksgiving Day
- The day following Thanksgiving
- Christmas

University-designated holidays will be observed on the calendar day on which each falls except that holidays falling on Sunday will be observed on the following Monday and holidays falling on Saturday will be observed on the preceding Friday.

LEAVE OF ABSENCE POLICY

Ph.D. students may request a temporary leave of absence (of more than a month) when certain life events prevent continued active participation in their degree program. Rackham’s Leave of Absence Policy enables students to officially suspend work toward their degree for a limited time. Students may request a leave of absence as early as six months prior to the term the leave is to start. A leave will be granted to students for illness (either physical or mental) or injury, to enable them to provide care or assistance for family or dependents, to allow them to meet military service obligations, or for other personal reasons.

The Leave of Absence Policy, a checklist for Ph.D. students, and a checklist for faculty and staff are available at the following site: http://www.rackham.umich.edu/current_students/doctoral_students/phd_students/leave_of_absence/