THE UNIVERSITY OF CHICAGO

COMMITTEE ON MICROBIOLOGY

Student Handbook
2017-2018

Revised: August 2017

TABLE OF CONTENTS

DIVISIONAL ADDRESS LIST

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2017-2018 ACADEMIC CALENDAR

Autumn Quarter 2017

September 25	Quarter Begins
November 23-24	Thanksgiving Day Holiday
December 9	Autumn Quarter Ends

Winter Quarter 2018

January 3	Quarter Begins
January 15	Martin Luther King, Jr. Day
March 17	Winter Quarter Ends

Spring Quarter 2018

March 26	Quarter Begins
May 28	Memorial Day
June 9	Convocation
June 9	Spring Quarter Ends

COMMITTEE ON MICROBIOLOGY ADMINISTRATION

Chairperson and Graduate Advisor	Sean Crosson
COM Graduate Administrator	Noreen Bentley
Biomedical Sciences Cluster Administrator	Lisa Abston-Leftridge

STEERING COMMITTEE

Name	Location	Phone
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Bergelson, Joy	EBC 102A	2-3855
Roizman, Bernard	CLSC 607A	2-1899
Haselkorn, Robert	CLSC 1039A	2-1069
Rothman-Denes, Lucia	CLSC 829A	2-1083

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Roos, Raymond	Ab 616	2-5659

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COMMITTEE ON MICROBIOLOGY
Current Graduate Students

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PROGRAM OF STUDY

Year One:

- Students must complete the majority of course work, including an ethics course.
    - 9 credits must be earned, 7 of which come from classroom work.
- Students are required to complete 10 week rotations in at least two laboratories.
    - These rotations should be performed in the Autumn, Winter, or Spring quarters.
- There are three weekly seminars at which attendance is mandatory.
    - Microbiology Seminar Series (Wednesdays at 12:00pm)
    - Microbiology Research Forum (Fridays at 12:00pm)
    - BMSC All-Stars (T Th at 12:00, Autumn and Winter quarters only)
- The students will complete the preliminary examination by the beginning of the second year.
- Preferably by the end of the Spring quarter, but no later than the end of Summer quarter, students must have chosen a lab and research advisor to begin their thesis research.

Year Two:

- Students must form a Doctoral Thesis Committee consisting of their research advisor and three to four additional faculty members.
    - This committee must be formed before the beginning of the third year.
    - The thesis committee is allowed to have a maximum of one faculty member not a part of the Committee of Microbiology
- Students will present their research at the Microbiology Research Forum.
- If the required course work has not been completed in year one, any remaining courses must be completed by the Spring quarter of year two.
- Students should fulfill at least one of the two required TA-ships during the second year.
- The Doctoral Thesis Committee should administer the Qualifying Exam by the end of the Summer Quarter of the second year. This exam must be passed by no later than the Autumn quarter of the third year. Passing the Qualifying Exam permits the student to enter into candidacy for the PhD.

Advanced Years:

- Years three and above consist mostly of thesis research.
- Students are required to present annually at the Microbiology Research forum
- Students are required to meet with their thesis committee once a year through year 4. After year 4, students must meet with their committees at least twice a year.
- The TA-ship requirement ideally should be completed by the end of year 3, but must be completed by the end of the Spring Quarter of year four.
- Each graduating student must write a dissertation describing their research, present the work, and defend it before their Doctoral Thesis Committee.
- The dissertation research period should take 12-16 quarters with the total duration (including course work) not to exceed 26 quarters.

REQUIREMENTS FOR THE Ph.D. DEGREE

A Ph.D. candidate must fulfill certain formal coursework requirements, pass the preliminary and qualifying examinations, present a satisfactory dissertation describing the results of original research, and have submitted a first author paper.

The Committee expects a knowledge of and proficiency in Microbiology. This requirement will normally be met by fulfilling the formal coursework listed below, but detailed degree programs are flexible. Courses taken at other institutions, in other departments, or as part of the Medical School curriculum may substitute for Microbiology courses with approval of the Chair of the COM.

Formal Coursework
To obtain a Ph.D. in the Division of Biological Sciences, nine graded courses are required. The Divisional requirement of nine course credits is maintained by the Committee on Microbiology. **Bold indicates required courses.** See Appendix 1 for course descriptions. The Curriculum is as follows:

Required for Autumn, Winter, and Spring of the First Year:
MICR 39000 **Introduction to Experimental Microbiology**
MICR 40000 **Microbiology Research Forum**
IMMU 31000 **BMSC All-Stars, Autumn and Winter quarters only**

Autumn
IMMU/MICR 31200 **Host Pathogen Interactions**
BCMB/MGCB 30400 Protein Fundamentals
BCMB 30600 Nucleic Acid Structure and Function
BCMB/MGCB 31400 Genetic Analysis of Model Organisms
BCMB/MGCB 31600 Cell Biology I
GEOS 36650 Environmental Microbiology
MICR 30600 Fundamentals of Bacterial Physiology

Winter
BCMB/MGCB 31200 Molecular Biology I
BCMB/ECEV 31100 Evolution of Biological Molecules
BCMB/MGCB 31700 Cell Biology II
ECEV 32000 Introduction to Scientific Computing for Biologists
ECEV 33365 Evolutionary and Genomic Medicine: Dynamics at the Host-Microbe Interface
ECEV 35600 Population Genetics
GEOS 33800 Global Biogeochemical Cycles
IMMU 31500 Advanced Immunology I
MICR 31600 Molecular Basis of Bacterial Disease

Spring
MICR 33000 **Bacteria/Bacteriophage Genetics and Cell Biology**
MICR 35000 **Advanced Virology**
BSDG 55000 **Scientific Integrity/Ethical Conduct**
BCMB 30800 Single Molecule Biochemistry
BCMB/MGCB 31300 Molecular Biology II
BCMB/BPHS 32200 Biophysics of Biomolecules
GEOS 36600 Geobiology
IMMU 37000 Mucosal Immunology
IMMU 32000 Advanced Immunology II
MGCB 32000 - Quantitative Analysis of Biological Dynamics
MICR 34600 Introduction to Virology

Microbiology Research Courses
MICR 47000: Thesis Research
MICR 47100: Non-Thesis Research (Rotation)

Students are expected to maintain a grade average of "B" or higher. Students who fail to do so will be placed on academic probation with continuation in the program dependent upon improved performance. Students concluding their first year without a "B" average will be terminated from the program after Spring Quarter.

Scientific Ethics Courses (Year 1: BSDG 55000, Year 4: ECEV 40200, IMMU31100 or MGCB 32100)

1) All first-year students are required to attend a scientific ethics class organized by the Dean of Students Office. This course is offered during the Spring quarter only. These sessions on scientific ethics often involve examining a set of case studies. All first year graduate students must register for this course. The Dean's Office will distribute announcements with the title of each talk and the name of the faculty members who will be giving presentations.

2) In their 4th year, all graduate students are required to attend an additional Responsible Conduct of Research course organized as a series of 10 case studies led by students and faculty, focusing on concrete situations in different fields of specialization. This is a required course taken for credit on a pass/fail basis. This refresher course is offered at the level of each graduate program cluster rather than at the level of the entire Biological Sciences Division. A winter course (ECEV/ORGB 40200) is directed by faculty and instructors associated with the Committee on Evolutionary Biology (Darwinian Cluster), but open to all graduate students in the BSD. Another winter course option is IMMU 31100, directed by faculty and instructors associated with the Committee on Immunology. A third upper-level ethical training course (MGCB 32100), offered in the spring of odd-numbered years, explores ethical case studies that might arise in laboratory settings.

Seminars (MICR 39000, 40000 and IMMU 31000)

In addition to formal courses and seminars, there are many regularly scheduled research seminars that will help keep students updated on new developments in microbiology and related disciplines. Students are expected to attend weekly Committee on Microbiology Seminars and the Microbiology Research Forums throughout the course of their matriculation. Attendance at BMSC All Stars (IMMU 31000) is required for all first year students in Autumn and Winter quarter.

The Committee on Microbiology Seminar, given by invited speakers, is held on Wednesdays from 12:00-1:00 p.m. in CLSC 119. The Committee on Microbiology Research Forum meets Fridays during the academic year from 12:00-1:00 pm in CLSC 119. At each Research Forum meeting, one student, postdoctoral scholar or faculty member will present the research they are working on. IMMU 31000, known as All-Stars, meets on Tuesdays and Thursdays and consists of faculty members from the Biomedical Sciences Cluster presenting a brief explanation of the work being done in their labs.

Course Selection Guide

**** Elective Courses in Italics satisfy NIGMS training grant Quantitative Training requirement***

Autumn	Winter	Spring
Basic Science Core (pick at least 2) • Cell Biology I • Genetic Analysis • Protein Fundamentals	*Basic Science Core (pick at least 1)* • Molecular Biology I • Cell Biology II	*Basic Science Core (optional)* • Molecular Biology II • Quantitative Analysis of Biological Dynamics
Program Core • Host-Pathogen Interactions • Intro to Exper Microbiology • Microbiology Research Forum	*Program Core* *Optional* a) Molecular Basis of Bacterial Disease b) Global Biogeochemical cycles c) Evolutionary and Genomic Medicine • Intro to Exper Microbiology • Microbiology Research Forum	*Program Core* *Both:* a) Advanced Virology and b) Bacteria/Phage Genetics & Cell Biology • Intro to Exper Microbiology • Microbiology Research Forum • Scientific Ethics and Integrity
	**Elective (optional pick 1-2)* • Rotation • Advanced Immunology I • Theoretical Ecology • Dynamics at the Host-Microbe Interface • *Evolution of Biological Molecules* • *Introduction to Scientific Computing for Biologists* • Bacterial Pathogenesis (not offered 2018)	**Elective (optional pick 1)* • Rotation • *Biophysics of Biomolecules* • Advanced Immunology II • Single Molecule Biochemistry • Geobiology • Population Genetics • Musocal Immunology • Topics in Microbial Biogeochemistry • *Quantitative Analysis of Biological Dynamics*

Laboratory Rotations

The purpose of laboratory rotations is to expose the student to different research environments, to broaden his or her acquaintance with useful laboratory techniques, and to introduce him or her to the conceptual framework of experimental design. Students undertake short, ten-week research projects in at least two different laboratories before beginning their dissertation research. With permission from the COM Chair, two full-time rotations, each lasting 5-7 weeks, can be performed during the summer. Students arrange their own rotations by contacting faculty members directly. Students who would like to rotate with faculty not a member of the Committee on Microbiology should petition the Graduate Advisor for approval. The student should inform the Graduate Advisor and the Microbiology Graduate Administrator of his or her rotation choice.

Teaching Assistantships

The ability to communicate verbally and teach is an important skill for a successful research career. All students are required to serve as teaching assistants (TAs) for two quarters. A course designed to train graduate students to be effective TAs can be taken in lieu of one of the two TAships. The student must receive approval from the Graduate Advisor prior to accepting a TAship. Responsibilities include, but are not limited to, leading discussion groups, writing problem sets, and running laboratories. At the end of each course, the TA is required to complete a self-evaluation and submit it to the Biological Sciences Division Graduate Student Administrator. The faculty member and students will also evaluate the TA's performance. These evaluations will become a part of the student's record.

BSDG 50000 Teaching Assistantship Training Course (Autumn quarter only)
BSDG 50600 Teaching Assistantship

Preliminary and Qualifying Examinations

The Biological Sciences Division requires that "a general oral or written preliminary examination, separate from course examinations, must be passed by the student upon the major subject offered and such subordinate subjects as may be required by the Department concerned."

Preliminary Examination

The objective of the Preliminary Examination is to determine the strength of a student's general knowledge of microbiology as well as his or her ability to synthesize an overview of research problems of active interest, based on the literature. Students must have at least a "B" average or permission from the Graduate Advisor to take this exam.

The student will be given a set of four questions in the following areas of microbiology: Bacteriology, Virology, Molecular Genetics, Cell Biology, Immunology and/or Biochemistry. The student is expected to prepare a written response to one of the four questions and verbally answer the other three within a two-week time span to the Preliminary Examining Committee. The student is asked to do the reading and thinking for the examination solely on his or her own.
The written response is due one week after receiving the questions and may not exceed five double-spaced pages, not including references.

The student will present his or her answers orally to the Preliminary Examining Committee two weeks after receiving the questions. The exam lasts for approximately two hours. The student is free to bring

a 5x8 index card into the exam for each question and two handwritten transparencies per question. In addition, a board will be present in which the student may write on during the examination. The format of the presentation should be that of a short lecture (approximately 10 minutes) designed to teach a generally knowledgeable group about the topic. The presentation should concisely review the pertinent background information, state the question being asked, and lay out an experimental plan (if applicable). Potential pitfalls and difficulties should be evaluated. The faculty will question the student further about the general subject of the presentation. Remember that the questions will serve as a focus for discussion; the discussion itself, however, may be quite broad.

The preliminary examination committee for each student shall consist of a minimum of three and up to five members; three committee members shall be members of the COM. The examining committee shall be appointed by the chairman of the Curriculum Sub-committee in consultation with members of the Curriculum Sub-committee. Based on his or her interests, the student may petition the Curriculum Sub-committee chairman to include a specific faculty member as an examiner.
Based upon the student's performance, the Preliminary Examining Committee recommends one of the following options to the Graduate Advisor:

A. Pass unconditionally

B. Pass conditionally, with written answers to a question(s) required. Answers should be submitted within two weeks. The student will then meet again with the Exam Committee to defend his/her answers.

C. Pass conditionally, with further course work required in one or two areas.

D. Fail, with the recommendation that the student retake the exam within two quarters.

E. Fail, with the recommendation that the student leave the program.

The Graduate Advisor then considers this recommendation, taking into account the student's overall academic performance as well as his performance on the examination. If a student who fails the exam is allowed to retake it, the committee for the re-take will be selected by the Research Advisor and the Chair of the Committee on Microbiology and will contain at least one member of the first Preliminary Examining Committee and at least one new member.

The Qualifying Examination

The Qualifying exam (thesis proposal) evaluates a student's ability to propose a research plan, presented on the format of a grant (NIH R21). Upon successful completion of the proposal, the Examining Committee becomes the student's Doctoral Advisory Committee. A student must have the endorsement of his/her Research Advisor in order to stand for the thesis proposal. In the event that a Research Advisor declines to endorse a student for the thesis proposal, the Graduate Advisor will review the student's record and determine if that student will be allowed to seek a new Research Advisor or be asked to leave the program.

Once the student chooses a Research Advisor, the student, in consultation with the Research Advisor, formulates a list of 4 of 5 prospective Thesis Committee members (including the student's advisor) and submits the list to the Chair for approval. The Graduate Advisor's review of proposed committees is designed to help ensure that the proposed committee members are qualified and appropriate and also that the expertise of the members is broad-based, in keeping with the interdisciplinary nature of the program. Final decisions on committee membership will be made by agreement between the Graduate Advisor, the Research Advisor and the student.

In addition to approving the initial thesis advisory committee, the Chair must also approve replacements when members of a doctoral committee resign. In the event that more than one member of a doctoral committee resigns, the Graduate Advisor and the Research Advisor will meet to consider the circumstances that led to the resignations and decide on an appropriate course of action. Possible courses of action include (but are not limited to) replacement of doctoral committee members, formation of a new doctoral committee or reconsideration of the student's qualifications for candidacy.

After the Qualifying exam the Thesis Exam Committee will continue to serve as an advisory committee throughout the student course of the student's doctoral research. This Doctoral Committee will be chaired by a member other than the student's Research Advisor. The function of the doctoral committee is to monitor the student's progress and to assist the student in the development of the dissertation research. For this reason, the choice of the members of the doctoral committee should be based on their knowledge and expertise in the area of the student's research. In the event the student chooses to work with a member of the faculty who does not have an appointment in the Committee on Microbiology, the student must petition the Chair for approval. At least three members of the Doctoral Committee, including the chair, must have appointments in the Committee on Microbiology.

It is important to note that the Qualifying exam is <u>not</u> a thesis defense. It does not require preliminary results although, if available, they can be used. The exam tests the student's ability to:

1. Choose a topic, that is, formulate an important biological question;

2. Propose a coherent set of avenues to answer the question;

3. Summarize critically the current literature on that topic; and

4. Describe a series of experiments taking into account possible pitfall and therefore alternative approaches.

The written proposal should be modeled after an NIH grant application which should consist of general and specific aims (no more than l page), background and significance (no more than 3 pages), methods of procedure and a description of the experimental approaches (no more than 6 pages). (This is not a place for trivial experimental details.) The proposal should be submitted to the thesis committee one week in advance of the qualifying exam. The written proposal should be submitted to the COM Administrator less than 6 months after the Qualifying exam. The Qualifying exam should be completed before the beginning of the student's third year. It is the student's responsibility to schedule this exam in a timely manner to ensure that the deadline is met. In the event that circumstances indicate a different schedule, or the student's Doctoral Committee is unable to meet prior to this time, the student must secure permission to postpone the exam from the Academic Advisor. In cases where a student's research advisor changes, or when the thesis research topic fundamentally changes, the student will defend a new written proposal within 6 months of the change.

Annual Doctoral Committee Meetings

All students are required to meet at least once a year with their Doctoral Committee and present a brief written report of their research as a basis for discussion. This meeting ideally occurs directly after the student's presentation at the Microbiology Research Forum.

The report should be approximately 2-4 pages in length and contain a concise summary of progress, including previous aims and outcomes as well as future goals and a time line. This report must be provided to the committee one week before the meeting date.

After the fourth year, a minimum of two meetings per year are required. At least three members of the Doctoral Committee must be present. These meetings help to ensure that students are making adequate progress toward the completion of the dissertation and to provide the student with a broader base of expertise on which to draw for help and advice. They also strengthen the student's acquaintance with faculty other than the Research Advisor, providing a stronger basis for future letters of recommendation. Following each meeting the Chair of the Doctoral Committee will prepare a summary and send it to the student and the student's Research Advisor for their approval and signature. The Doctoral Committee should be convened six months before a student expects to receive his or her degree to indicate their agreement that the student is nearing completion of their work and to arrange for subsequent approval that the student may begin writing the dissertation.

Presentation of the Dissertation

Each student is responsible for the preparation of a written detailed discourse describing his/her thesis project in the form of a dissertation. The dissertation is written upon completion of the majority of the experimental work and approval by the Doctoral Committee. The preparation of the dissertation document should also be considered an educational experience in which the mentor and the student extensively discuss the format and contents of the document and the philosophy of the process, and review drafts of the document during its preparation. The format should follow the guidelines posted on the Ph.D. Dissertation Office Website. Once the mentor agrees that the document is well written and complete, the student can submit the dissertation to the other thesis committee members. The mentor should indicate his/her acceptance of the document by signing and dating the cover page or by sending an email. By signing the cover page or emailing, the mentor indicates that he/she and the student have reviewed the dissertation document and view it to be complete.

Once the dissertation has been submitted to the Doctoral Committee, each member has two weeks to review the document and transmit any comments concerning major deficiencies to the student. The student is expected to prepare a revised version of the dissertation addressing these deficiencies (usually within a two week period). The revised version of the dissertation document must be returned to the Doctoral Committee members no later than one week before the oral defense date. The revisions that have been made should be highlighted in some way, either by the use of a different font or type style, or with vertical lines in the page margins.

It is recognized that each thesis project, and therefore each dissertation, will be different. As such, no specific requirements should be instituted for its length or content. However, it is expected that the vast majority of dissertations should conform to the following guidelines. The student is encouraged to review selected dissertations in the program office for examples of format, content and quality.

a) The total length of the document should be 125 - 250 pages (including figures; excluding references), in order to provide the level of detail expected of a document of this nature.
b) Chapters of thesis submitted as published papers must specify, if authored by more than the graduate student, who did each experiment in the published paper.
c) The Introduction should be 20 - 40 pages long. It should contain a focused description of the background to the thesis problem, not a comprehensive review of microbiology.
d) The Materials and Methods section should be 20 - 60 pages long. It should describe the details of all experiments used, even those that have been published elsewhere. This section should be able to serve as a useful laboratory resource for future generations of investigators in the research group.
e) The Results section should be 60 - 100 pages long, including figures and tables. In general, the figures and tables should occupy 1/2 - one page each. Figures should be shown in the written thesis for all results mentioned as "data not shown" in publications by the student. Figures should be original or published by the author. Figures from review articles authored by others are not acceptable because of copyright restrictions, as the thesis dissertation is a public document. If published figures not generated by the student must be used, the student must obtain written permission from the publisher. The numbers of figures and tables relative to text in the Results section should be determined by the mentor and the student.
f) The Discussion section should be 25 - 50 pages long. This section should be a scholarly discourse that puts the thesis work in the context of the relevant fields of microbiology. Related work of others, and differences in experimental outcome or interpretation should be addressed. The student should clearly indicate what is new or unique about his/her work and how it contributes to the field. The quality of the Introduction and Discussion sections should be such that they could form the core of a review article good enough for publication in a peer-reviewed journal.

Some students may elect to prepare the Results Section as chapters that are directly from their submitted or published manuscripts. These chapters may contain the submitted/published introduction, results, and discussion. However, the Materials and Methods for published papers are generally not sufficient for a thesis, and thus a more thorough version should be included in the overall Materials and Methods section (described in section c above) of the thesis instead of in the individual chapters. Furthermore, in addition to the Materials and Methods section, the student is still required to write an overall Introduction and Discussion as described in sections b and e above.

Thesis Defense

The thesis defense is composed of two parts. The first part is a public presentation of the thesis project in which the student presents his/her work orally before an audience of peers and answers questions relevant to the project. The seminar should be prepared and rehearsed with the mentor's guidance. The student should avoid complicated slides and focus the presentation on objectives, approaches and interpretation of results. Acknowledgments should be limited to less than five minutes at the end of the presentation. The second part is a private defense by the student of both the thesis project and the dissertation document in front of the ad hoc thesis committee. Since this is the last opportunity the committee has to ensure the quality of our graduates, the private defense will continue until each member is satisfied with the student's performance or until the committee decides that the student has failed the defense examination. Even though the committee may feel comfortable that the student has passed the examination and will complete an acceptable dissertation document, no committee member should sign the completion form until he/she is completely satisfied with the revised version of the thesis document in hand.

A student can schedule a date for the defense with the Graduate Student Administrator soon before or at the time that the initial version of the dissertation document is submitted to all Doctoral

Committee members, to be set no earlier than four weeks after the reception of the dissertation by the committee members. Doctoral Committee members will indicate their receipt of the dissertation by initialing and dating a copy that has been accepted by the mentor or by emailing the student.

As a courtesy, the student should provide members of his/her committee with the final bound copy of the thesis, unless the committee member indicates otherwise.

(The "Thesis Requirement" document was adapted from the University of Texas thesis guidelines 2004.)

The University web site has invaluable information regarding the preparation of the thesis and various deadlines. The link is https://www.lib.uchicago.edu/research/scholar/phd/students/.

A couple of deadlines to keep in mind:

a) You must apply to graduate by the end of the first week of the quarter that you plan to graduate.
b) The deadline for submission of the approved thesis and all necessary documents is the Wednesday, 3.5 weeks before convocation for that quarter. The exact dates can be found at the web site mentioned above.
c) Doctoral candidates who submit their approved dissertation to the Dissertation Office by Friday of the first week of a quarter and apply to graduate in that quarter will not have to register as students in that quarter and thus will not pay the associated fees.

Miscellaneous Information

Registration

General Information

About one week before the dates designated for registration, the Graduate Student Administrator will contact students informing them of the days and times when they should register. Students register online at: my.uchicago.edu. First year students will meet with the Committee Chair and the Graduate Student Administrator to discuss procedures during orientation week.

Leave of Absence

During Scholastic and Research Residence a student may, if necessary, apply for a Leave of Absence from the PhD program to be approved by the Committee Chair.

Pro-Forma Registration

Students in Advanced Residence, whose dissertation research requires residence away from Chicago, may register pro-forma. It provides registration as a full-time student without payment of tuition. A fee of $357 per quarter is assessed. Pro-forma status establishes a good faith relationship between the student and the University. The following regulations apply:

a) Pro-forma registration is approved for only one academic year at a time.

b) Applications for pro-forma registration must be approved in writing by the Program Chair. The Chair's signature confirms that the student will be working at another institution 100+ miles away from the University of Chicago and that the work is recognized as essential to the dissertation. Students applying for pro-forma status must have been admitted into candidacy and have had dissertation topics approved. For students on the Graduate Residence Track, pro-forma status will normally begin only after completion of Scholastic Residence.

c) An applicant for renewal of pro-forma status must show the Program Chair that good use has been made of the time already spent "on location" and that additional time is essential to completing the original task. Renewals of pro-forma status must be approved by the Dean of Students.

d) A student on pro-forma status may not be gainfully employed for more than 19 hours per week.

e) Pro-forma students may not use the facilities of the University or the time of its faculty, except for progress reports that may be required by the students' departments.

f) A copy of the approved applications must be filed with the Registrar.

g) The Registrar will certify that a pro-forma student is duly registered at the University to any agency requiring such certification.

h) The fact that a registration is pro-forma will be noted on the student's academic record.

i) Pro-forma registrations do not count toward satisfying a student's residence requirements toward a degree.

Students must have satisfied all course requirements, including Scientific Ethics and completed TAships.

Non-Degree Visiting Students
Graduate students who come to the UC with a newly recruited faculty member are allowed NDVS status until their thesis research is completed and they graduate with their Ph.D. from their home institution. Outside students who are not recruited with new UC faculty who want to do thesis research here will only be allowed NDVS status for a maximum of one year (12 months).

If a faculty member wishes to accept a graduate student into their lab from another graduate program/institution, and it is expected that the student would be working in the lab for longer than one year, they should be brought in with employee status (tech, or other appropriate title) through the faculty members' primary appointment department's HR office.

Non-Degree Visiting Students (NDVS) are bona fide graduate students enrolled in an accredited PhD program at an outside institution. These NDVS come to the University of Chicago to continue their bench research projects but will be obtaining their Ph.D. degree from an institution other than the UC. (This status does not apply to undergraduate students or students who are not enrolled in a Ph.D. graduate program elsewhere.)

More information on qualifying as a Non-Degree Visiting Student can be found at **http://bsdgrad.uchicago.edu/page/non-degree-visiting-students**.

FINANCIAL AID

All students registered in the PhD program are provided with adequate financial aid. **Financial aid is guaranteed to all incoming students, subject to satisfactory academic performance.** Support for subsequent years of study is subject to the student's satisfactory research progress, as determined by the faculty sponsor, the Committee, and the Division of Biological Sciences.

Sources of Support
Students receive tuition, payment of fees, plus a stipend. The various sources of support are:

- Training grants
- Departments
- External fellowships
- University fellowships
- Research assistantships

Payment of Stipend Checks
University fellowships and NIH checks are paid in equal quarterly installments at the beginning of each academic quarter. Taxes are owed on, but not deducted from, these stipend checks (see section on "Taxes" below).

Advanced students are often paid from NIH grants under the title "Research Assistant Type B" (RA-Type B). RA-Type B students are paid on a monthly basis. Taxes will be deducted from the RA-Type B checks.

University fellowships and NIH training grants pay for student health insurance, fees, and tuition without the student having to make separate payments.

Health Insurance and fees are included in RA-Type B stipends. Students should complete a payroll deduction form so their student health insurance and fees are automatically deducted from their check. Not completing a payroll deduction form will require the student to pay for these costs, upfront and in full, prior to the start of each quarter.

Important
A note regarding the transition from quarterly to monthly stipend payments: Quarterly stipends are paid on the first day of the academic quarter for that quarter. Monthly stipends are paid at the end of the month. When transitioning from quarterly to monthly, the last quarterly check (that one would be accustomed to budgeting for three months) must last an additional month. It is suggested that each month, while being paid quarterly, a small amount be set aside in a savings account to help during the transition from quarterly to monthly payroll.

Taxes
Graduate student stipends are taxable by the State of Illinois and the Federal governments. Students on fellowships and NIH training grant support must calculate and pay estimated quarterly taxes. IRS Federal Form 1040 ES and Illinois Form 1040 ES help you estimate your federal and state taxes. IRS publications 505 and 970 provide information on determining what portion of your stipend is taxable and how and when to pay taxes you owe. The forms are available from the IRS. Regenstein Library also carries tax forms (Reserve room, First Floor), particularly after January 1.

Travel to Scientific Meetings
Attendance at scientific meetings is an important part of the educational process. Travel funds are normally available on training grants, and are distributed by the Training Grant Administrator. In general, funds are only given to students scheduled to present a paper or a poster at the meeting.

Should you wish to apply for such support, you should submit a formal request (with your advisor's approval) in writing to the grant administrator supplying the following information: purpose of meeting and relevance to the research; title, place and time of the meeting; (if applicable) title and authors of paper being presented; amount requested for travel, registration fees, food, and lodging.

TRANSPORTATION

For the most up-to date information regarding transportation and parking, including shuttle and bus routes and schedules, visit http://safety-security.uchicago.edu/transportation/. The following is a summary of the services available on campus:

Shuttle Service
The University of Chicago provides free daytime and nighttime shuttle service around the campus area and the neighboring communities to all students, faculty, staff, and University of Chicago Medicine staff. The daytime shuttles, called UGo Daytime Shuttles, cover 7 routes. The night time shuttles, referred to as UGo NightRide Shuttles, begin at 5:00 p.m. and cover four routes. The end times for both daytime and night time shuttles vary, so be sure to check the transportation website for current times. The shuttles run year-round except on University observed holidays. A UChicago or University of Chicago Medicine ID is required.

CTA
CTA bus routes #171 U of Chicago/Hyde Park and #172 U of Chicago/Kenwood are free to passengers displaying a valid UChicago or University of Chicago ID. All CTA busses are ADA accessible and equipped with bike racks.

Safety escort
If you are concerned about your safety within the University's patrol area, you can request a safety escort from the University Police on an emergency basis. To do so, call the University Police dispatcher at 123 from any campus telephone or by dialing 773 702-8181 from any telephone. Depending on the demands of the police patrolling the area at that time, a car will be sent to accompany you to your destination.

Biking
Another way to get around campus is biking, whether using your own bike or one obtained from Divvy, the City of Chicago's bike sharing program. With Divvy, you can purchase a 24 hour pass or an annual membership. To learn more about the program or to become a Divvy member go to http://sustainability.uchicago.edu/resources/bike_sharing/divvy_discount/. Student discounts are offered for annual memberships.

Parking
You may obtain an assigned parking space on campus by paying a monthly fee. Assignments for campus lots are available at the Campus Parking Office (773 702-8969), located at 5525 South Ellis Avenue.

Appendix 1: Course Descriptions

Autumn Quarter: students will take two or three classes as assigned by the graduate advisor. Students are also encouraged to do a laboratory rotation. Examples for these classes are:

IMMU/MICR 31200- Host Pathogen Interactions
This course will explore the basic principles of host defense against pathogens and pathogens' strategies to overcome host immune mechanisms. The course will address evolutionary aspects of innate and adaptive immune responses, while also studying specific examples of viral and bacterial interactions with their hosts. The reviews of relevant immunological mechanisms necessary for appreciation of host/pathogen interactions will be incorporated in the studies of specific cases. This course explores the basic principles of host defense against pathogens, including evolutionary aspects of innate and adaptive immunity and immune evasion strategies. Specific examples of viral and bacterial interactions with their hosts are studied in depth. A review of immunological mechanisms involved in specific cases is incorporated in the course.
Instructor: Chervonsky, Term: Autumn

BCMB/MGCB 30400 - Protein Fundamentals
This course covers the physical-chemical phenomena that define protein structure and function. Topics include: the principles of protein folding, molecular motion and molecular recognition; protein evolution, design and engineering; enzyme catalysis; regulation of protein function and molecular machines; proteomics and systems biology. Workshop of X-ray Crystallography: The workshop is an addendum to Protein Fundamentals and is required for all BCMB students. This one week workshop will provide students with an intensive introduction to protein structure determination by x-ray crystallography. In addition to lectures, an extensive laboratory component will give students the opportunity to carry out protein crystallization, data collection (at Argonne), structure determination, refinement, model building and validation. Instructors: Arac-Ozkan, Piccirilli Term: Autumn

BCMB 30600 - Nucleic Acid Structure and Function
This course focuses on the biochemistry of nucleic acids. Topics include nucleic acid structure, folding, and chemistry, protein-nucleic acid interactions, non-coding RNAs, and enzymology of key processes such as DNA replication, repair and recombination. A special emphasis is placed on primary literature.
Instructors: Rice, Pan, Term: Autumn

BCMB/MGCB 31400 - Genetic Analysis of Model Organisms
Fundamental principles of genetics discussed in the context of current approaches to mapping and functional characterization of genes. The relative strengths and weaknesses of leading model organisms are emphasized via problem-solving and critical reading of original literature.
Instructors: Bishop, Ferguson, Malamy, Moskowitz Term: Autumn

BCMB/MGCB 31600 - Cell Biology I
Eukaryotic protein traffic and related topics, including molecular motors and cytoskeletal dynamics, organelle architecture and biogenesis, protein translocation and sorting, compartmentalization in the secretory pathway, endocytosis and exocytosis, and mechanisms and regulation of membrane fusion.
Instructors: Turkewitz, Glick, Term: Autumn

GEOS 36650 - Environmental Microbiology
The objective of this course is to understand how microorganisms alter the geochemistry of their environment. The course will cover fundamental principles of microbial growth, metabolism, genetics, diversity, and ecology, as well as methods used to study microbial communities and activities. It will emphasize microbial roles in elemental cycling, bioremediation, climate, and ecosystem health in a

variety of environments including aquatic, soil, sediment, and engineered systems.
Instructor: Coleman, Term: Autumn

MICR 30600 - Fundamentals of Bacterial Physiology
This course meets one of the requirements of the microbiology specialization. This course introduces bacterial diversity, physiology, ultra-structure, envelope assembly, metabolism, and genetics. In the discussion section, students review recent original experimental work in the field of bacterial physiology.
Instructor: Missiakas, Term: Autumn

Winter Quarter: students will take two classes assigned by the graduate advisor. Students are also encouraged to do a laboratory rotation. Examples for these classes are:

BCMB/MGCB 31200 - Molecular Biology I
This course will cover nucleic acid structure and DNA topology; methodology; nucleic-acid protein interactions; mechanisms and regulation of transcription in eubacteria, and of replication in eubacteria and eukaryotes; mechanisms of DNA recombination and repair
Instructors: Rothman-Denes, Bishop, Term: Winter

BCMB/ECEV 31100 - Evolution of Biological Molecules
The course connects evolutionary changes imprinted in genes and genomes with the structure, function and behavior of the encoded protein an dRNA molecules. Central themes are the mechanisms and dynamics by which molecular structure and function evolve, how protein/RNA architecture shapes evolutionary trajectories, and how patterns in present-day sequence can be interpreted to reveal the interplay data of evolutionary history and molecular properties. Core concepts in macromolecule biochemistry (folding and stability of proteins and RNA, structure-function relationships, kinetics, catalysis) and pmolecular evolution (selection, mutation, drift, epistasis, effective population size, phylogenetics) will be taught, and the interplay between them explored. Instructors: Drummond, Thornton, Term: Winter

BCMB/MGCB 31700 - Cell Biology II
This course covers the mechanisms with which cells execute fundamental behaviors. Topics include signal transduction, cell cycle progression, cell growth, cell death, cancer biology, cytoskeletal polymers and motors, cell motility, cytoskeletal diseases, and cell polarity. Each lecture will conclude with a dissection of primary literature with input from the students. Students will write and present a short research proposal, providing excellent preparation for preliminary exams. Instructors: Glotzer, Kovar, Term: Winter

ECEV 32000 - Introduction to Scientific Computing for Biologists
The course introduces students to fundamental concepts and practices in biological scientific computing.

ECEV 33365 - Evolutionary and Genomic Medicine: Dynamics at the Host-Microbe Interface
Evolution is regularly investigated in free-living organisms, but some of its most fascinating and important examples occur in the interface between free-living and non-free-living states. In this course, we will use evolutionary and ecological principles to study the dynamics of viruses, unicellular organisms and cells in multi-cellular organisms relevant to human medicine. Instructors: Cobey and Wu.

ECEV 35600 - Principles of Population Genetics
Examines the basic theoretical principles of population genetics, and their application to the study of variation and evolution in natural populations. Topics include selection, mutation, random genetic drift,

quantitative genetics, molecular evolution and variation, the evolution of selfish genetic systems, and human evolution. Instructors: Steinrucken and Kreitman, Term: Winter

GEOS 33800 - Global Biogeochemical Cycles
This survey course covers the geochemistry of the surface of the Earth, focusing on biological and geological processes that shape the distributions of chemical species in the atsmosphere, oceans, and terrestrial habitats. Budgets and cycles of carbon, nitrogen, oxygen, phosphorous, and sulfur are discussed, as well as chemical fundamentals of metabolism, weathering, acid-base and dissolution equilibria, and isotopic fractionation. The course examines the central role that life plays in maintaining the chemical disequilibria that characterize Earth's surface environments. The course also explores biogeochemical cycles change (or resist change) over time, as well as the relationships between geochemistry, biological (including human) activity, and Earth's climate. Instructor: Waldbauer, Term: Winter

IMMU 31500 - Advanced Immunology I
This course explores the basic principles of the immune system, including tolerance, the development and differentiation of lymphocyte subsets, the regulation of the class of immune responses, memory, cell homing and migration, cell-cell interactions, antigen presentation and recognition., Instructor: Bendelac, Term: Winter

MICR 31600 - Molecular Basis of Bacterial Disease
This course meets one of the requirements of the microbiology specialization. This lecture/discussion course involves a comprehensive analysis of bacterial pathogens, the diseases that they cause, and the molecular mechanisms involved during pathogenesis. Students discuss recent original experimental work in the field of bacterial pathogenesis. Instructor: Shuman, Term: Winter

Spring Quarter: students will take two classes assigned by the graduate advisor. Students are also encouraged to do a laboratory rotation. Examples of these classes are:

MICR 33000 – Bacteria/Bacteriophage Genetics and Cell Biology
The graduate-level course is focused on providing students with a) an understanding of the foundational principles of bacterial genetics, and methods of genetic analysis, and b) how expression of genetic material is regulated in bacteria and phage, and c) mechanisms that govern the construction, development, and division of bacterial cells and multicellular communities. Instructors: Crosson, Rothman-Denes, Shuman, Term: Spring

MICR 35000 - Advanced Virology
Advanced Virology reviews various questions related to virus-host interactions. We cover how viruses are detected and controlled by the innate and adaptive immune systems and what mechanisms have they evolved to counteract the host protective responses. We will exemplify these mechanisms using viruses from such families as Orthomyxoviruses, Paramyxoviruses, Retroviruses and Herpesviruses. Instructors: Golovkina, Gack Term: Spring

BCMB 30800 - Single Molecule Biochemistry
This course presents a series of advanced case studies designed to familiarize students with current single molecule research. Topics include: motor proteins and the cytoskeleton, nucleic acid processing enzymes, ion channels, and force spectroscopy and macromolecule folding. Instructors: Rock, Bezanilla, Term: Spring

BCMB/MGCB 31300 - Molecular Biology II
The content of this course covers the mechanisms and regulation of eukaryotic gene expression at the

transcriptional and post-transcriptional levels. Our goal is to explore research frontiers and evolving methodologies. Rather than focusing on the elemental aspects of a topic, the lectures and discussions highlight the most significant recent developments, their implications and future directions. Instructors: Staley, Ruthenburg, Term: Spring

BCMB/BPHS 32200 - Biophysics of Biomolecules
This course covers the properties of proteins, RNA, and DNA, as well as their interactions. We emphasize the interplay between structure, thermodynamics, folding, and function at the molecular level. Topics include cooperativity, linked equilibrium, hydrogen exchange, electrostatics, diffusion, and binding. Instructor: Sosnick, Term: Spring

GEOS 36600 - Geobiology
Geobiology seeks to elucidate the interactions between life and its environments that have shaped the coevolution of the Earth and the biosphere. The course will explore the ways in which biological processes affect the environment and how the evolutionary trajectories of organisms have in turn been influenced by environmental change. In order to reconstruct the history of these processes, we will examine the imprints they leave on both the rock record and on the genomic makeup of living organisms. The metabolism and evolution of microorganisms, and the biogeochemistry they drive, will be a major emphasis. Instructors: Coleman, Waldbauer, Term: Spring of odd numbered years

IMMU 30266 - Molecular Immunology
This course is available on alternate years (Spring of odd numbered years) and is also considered a basic biochemistry course. Molecular Immunology examines the structural principles of immune recognition by antigen receptors of the innate and adaptive immune systems, the discrimination between self and non-self and the molecular fundamentals of cell stimulation and signaling. Primary literature is integrated with lectures on commonly used biochemical, structural and immunological techniques.
Instructor: Adams, Term: Spring of odd numbered years

IMMU 32000 - Advanced Immunology II
This class will explore the molecular and biochemical mechanisms by which lymphocytes develop and are activated in response to antigen. This will include the signal transduction pathways and transcriptional networks involved in these processes, as well as the molecular mechanisms underlying the generation of receptor diversity. Instructors: Kee, Gounari, Term: Spring

IMMU 37000 – Mucosal Immunology
This course addresses how the gut associated lymphoid tissue distinguishes innocuous dietary antigens and commensal bacteria from pathogenic microbes and mounts an appropriate response. The realization that we live in a dynamic relationship with the trillions of bacteria that form the commensal microbiome has added additional complexity to our understanding of this conundrum. In this course a topic will be introduced with a lecture and review article for the first class of each week. In the second class each week, students will lead the discussion of the primary articles assigned. The course will be graded on class participation and a final essay-based exam. Nagler; Spring.

MGCB 32000 - Quantitative Analysis of Biological Dynamics
This course covers quantitative approaches to understanding biological organization and dynamics at molecular, sub-cellular and cellular levels. A key emphasis is on the use of simple mathematical models to gain insights into complex biological dynamics. We also will cover modern approaches to quantitative imaging and image analysis, and methods for comparing models to experimental data. A series of weekly computer labs will introduce students to scientific programming using Matlab and exercise basic concepts covered in the lectures.

MICR 34600 – Introduction to Virology
This class on animal viruses considers the major families of the viral kingdom with an emphasis on the molecular aspects of genome expression and virus-host interactions. Our goal is to provide students with solid appreciation of basic knowledge, as well as instruction on the frontiers of virus research.
Instructor: Manicassamy, Term: Spring