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College of Tropical Agriculture and Human Resilience

Molecular Biosciences and Bioengineering

Graduate Handbook

2025



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Background & Notes Regarding This Graduate Student Handbook

This Graduate Student Handbook was first assembled under the guidance of former Graduate Chair Dr. JP Bingham with the help of MBBE graduate students. As the faculty, science and technology, course offerings and procedures change over time, the Graduate Student Handbook needs to be periodically updated by the current core MBBE Graduate Faculty together with the Graduate Chair. Continued input from current graduate students is vital and appreciated! Thank you all for pointing out errors and suggesting additions to this important document.

About MBBE

The Department of Molecular Biosciences and Bioengineering (MBBE) is part of the College of Tropical Agriculture & Human Resilience (CTAHR) at the University of Hawaii at Manoa (UHM). The majority of faculty and research programs are located on the Manoa campus in the following buildings: Agricultural Science Building, Harold St. John Laboratory, and Gilmore Hall. The Department members conduct scholarly research on molecular biology, biochemistry, bioengineering, environmental engineering, functional genomics, proteomics, bioinformatics and biotechnology, as it pertains to living organisms and the environment. Our research programs aim to gain new knowledge and develop new technologies for modern agriculture, bioremediation, bioprocessing, and biotechnology industries. The innovations developed within the department help to improve bioproduction systems for food, feed, fiber, bioenergy, and therapeutic applications, as well as to minimize the impact of human activities on the environment.

Mission

The mission of MBBE is to develop and apply state-of-the-art approaches to molecular and cell biology and biotechnology to problems facing tropical agriculture, bioenergy production, medicine, bioengineering, and the environment and to facilitate the transfer of this technology to others in the college, university, state, and Pacific region. This role of leadership in biotechnology is accomplished through the development of research programs utilizing cutting-edge science, through formal and informal collaborative interdisciplinary research with other faculty in the college, university, and worldwide, and through the instruction and development of a renowned graduate program based on tropical agricultural biotechnology, medicine, environmental remediation and bioengineering.

MBBE Graduate Student Learning Outcomes

The MBBE M.S./Ph.D. graduate program aims to cultivate creativity and provide an environment that promotes rigorous cutting-edge scientific inquiry, discoveries and enthusiastic learning in an interdisciplinary atmosphere. MBBE graduate students aim to create new knowledge and technologies within a broad-based education that engages and motivates them to be lifelong learners and contributors to society. MBBE graduates will carry a passion for learning and be active caretakers of the society and planet. The extent to which these goals are reached is assessed with the following Student Learning Outcomes (SLO's), in which students:

- 1) Are able to understand, describe and explain fundamental core STEM science concepts and have proven the ability to comprehend and convert these concepts into experimental approaches and hypothesis-driven research on biological systems.
- 2) Activities are demonstrated by written works, a contribution of results for published articles, as primary author(s)/co-author(s), in peer-reviewed scientific journals of basic and applied molecular biosciences and bioengineering.
- 3) Present research at national and international conferences as evidenced by published abstracts and poster and/or oral presentations.
- 4) Can communicate orally and in writing in a clear, well-organized manner that effectively informs and clarifies scientific principles and laboratory techniques to others, as evidenced by provision of seminars, technical reports, dissertations or theses, providing details of scientific and scholarly activities and findings.
- 5) Are well prepared for employment in the critically important and dynamic biotechnology, chemical and biosciences fields (government, academia, industry).

Admission Requirements for M.S. and Ph.D. Programs

Minimum qualifications for admittance:

- An undergraduate STEM degree from an accredited U.S. college, university or equivalent degree from a recognized foreign institution of higher learning
- A grade point average (GPA) of at least 3.0 on a scale of 4.0
- Students with a BS or BA degree will be admitted only to M.S. and not to Ph.D.
- Direct admission to the Ph.D. program will require completing an M.S. degree. Students with international M.D. or equivalent degrees (and without an M.S.) will be admitted to M.S. degree only and not directly to Ph.D.
- Candidates applying for the Ph.D. degree must have prior research experience.
- Publications in peer-reviewed scientific journals are a desired qualification for Ph.D. applicants.

All prospective foreign students must submit TOEFL or IELTS scores (see Graduate Division for exceptions). Please refer to the [Graduate Division website](#) for minimum requirements. Applicants may ask the Graduate chair if they have further questions. It's preferable for students to submit scores from the GRE General Test, but the GRE is not mandatory.

All applicants are expected to have completed courses or equivalents in physics, chemistry, basic biology, genetics, biochemistry, physiology, and one additional upper-division course in cellular or molecular biology. While not a requirement, physical chemistry is highly recommended. Students may be accepted with deficiencies in one or more of these areas; however, deficiencies must be made up during the first year of enrollment and will not count toward graduation requirements.

Complete applications received by September 30 and March 15 are assured full consideration for admission to the subsequent Fall and Spring semesters, respectively. In exceptional cases late applications may be considered. Complete applications will be evaluated by an Admission committee consisting of the Graduate Chair, and two to four MBBE faculty members. The admission committee aims to submit the recommendations for admission to Graduate Student Services by November 16 and May 1, allowing incoming students sufficient time to prepare for the admission process.

General Degree Requirements for All MBBE Graduate Degrees (except M.S. Plan B)

Your research committee should consist of faculty members whose expertise is up-to-date and directly relevant to your project. This will help you with the design of impactful research using up-to-date technology. Committee members without such expertise will not contribute significantly to your research project. Beware that the quality of your research, the skills and techniques learned through graduate work, usually presented during a job interview seminar, could significantly impact your career path. You should plan to have at least two meetings with your committee prior to proposing your research project to the public (see details below). These informal meetings should provide a great atmosphere for committee members to provide constructive criticism to your planned research. Annual meetings with your committee between the research proposal seminar and final defense seminar will provide you with an opportunity to update the committee members on your progress and collect input. This is particularly important if things don't go as planned.

Your research advisor will be your committee chair and primary mentor. Given that, for most students, this is their first encounter with research, students should rely on their advisor for day-to-day issues. Depending on your laboratory, you might have daily, weekly, or monthly lab meetings with your advisor to collect input. You should also set up an annual meeting with your advisor to ensure that your research project is on schedule (and make adjustments if necessary), and plan your public seminars well in advance.

Proposal and Defense Seminars are expected to include a 45-minute presentation followed by a period of answering questions from the public. During a subsequent period of up to two hours the committee meets privately with the candidate to clarify details of the proposed/defended research and make suggestions. Approval of the research proposal by the committee signifies that the proposed research, if completed, will justify awarding of the relevant degree following a successful defense. This protects the student from being asked to perform additional work in order to obtain the degree. Therefore, proposals and proposal seminars should contain clearly defined goals that can reasonably be achieved prior to the planned defense date, as well as detailed descriptions of the methods. Proposal and Defense Seminars must be announced to MBBE faculty and students at least one week prior to the scheduled event and contain a complete list of committee members, a seminar title, and a well-written abstract that describes 1) the problem addressed by the research along with 2) the methods and expected results (for proposal seminar) or major results and impact (for defense seminars). Seminars must take place during regular business hours and during the Fall or Spring semesters.

Research (thesis and dissertation) Committee

Refer to individual degree details for exact composition of [committee members](#). However, it is mandatory that at least one faculty member will be from the MBBE Department Core faculty, while other members can be MBBE co-operating graduate faculty.

It is important that the list of your committee members should be approved by the graduate chair before you contact the members. You can identify the list of existing MBBE cooperating graduate faculty on this website: <https://manoa.hawaii.edu/graduate/select-committee-member>.

General Degree Requirements for M.S. Plan-A

Minimum Course Requirements for MBBE Students

Twelve credits of 600-level courses (not including MBBE 699 or seminar courses), six credits of 400-level courses (not including MBBE 499), six credits of MBBE 699 and six credits of MBBE 700 (or with 699 transfers – 11 Cr MBBE 699 + 1 Cr MBBE 700). 600 level courses (excluding 610, 611, and 699) can be substituted for 400 level courses. The list of approved courses is presented in this handbook. Your major advisor and the Graduate Chair must approve all courses to be taken if they are not on the list in this handbook. Graduate students are encouraged to take one credit seminar (MBBE 610 or equivalent) each academic year. At least one seminar credit is required for an M.S. degree. The thesis proposal or defense seminar cannot be used to meet this requirement. **At least 10 of the 18 (51%) required course credits must be from MBBE courses.**

Proposal

Proposal should follow the format of a mini manuscript that includes an introduction (literature review), hypothesis, objectives/aims, methods and timeline.

The committee must be approved by the Graduate Chair and Graduate Division.

It is mandatory to have at least one MBBE core faculty as part of the committee. Ad hoc committee members are not recommended unless necessary, e.g., there is no expertise among the existing MBBE or cooperating graduate faculty. Ad hoc committee members will be limited to only one request.

All M.S. students shall define and discuss their research projects with their major advisor and write a research proposal with specific objectives within the first semester.

Thesis Proposal Seminar: All M.S. students must present their preliminary results and research plan in a proposal seminar within one year of their entrance into MBBE. M.S. students conducting research outside the Manoa campus may present their proposal seminars in their laboratory locations.

CTAHR Symposium Presentation

M.S. plan-A students must make at least one presentation at any research symposium such as the CTAHR symposium. They are also encouraged to make presentations at other national and international professional conferences.

Thesis Defense

M.S. plan-A students must publicly present their thesis research in the final semester (preferably within two years of their entrance into MBBE). Students should consult with their committee and the Graduate Chair in advance to ensure a convenient and available date for this presentation that will also meet Graduate Division deadlines of thesis or dissertation submission. Planning should be from the submission deadline backwards so that the deadline can be observed. Please pay attention to Graduate Division deadlines for thesis or dissertation submission, which may change each year. A hardcopy seminar notice/invitation must be posted online and/or in visible places in the department and other appropriate locations. A seminar notice must be emailed to all MBBE and BE graduate faculty and students at least a week ahead of the defense date.

Publication

Students are encouraged to publish a paper in a peer-reviewed scientific journal before the defense date, particularly for Ph.D. students. It is recommended to minimize or avoid publishing in predatory and poor-quality journals. In publications, the MBBE departmental address should appear as the student’s primary or secondary address. For details, please see the online “[General guidelines and requirements for Ph.D. degree in MBBE.](#)”

MBBE M.S.-Plan A

Suggested Completion Date	Requirements	Completed
Year 1	Choose PI ^a and Project	
	Form Committee	
Year 2	Project Presentation and Oral Exam	
	Report Submission	
	1 – 610 seminar credit	
Required for Degree Completion	6 – 400 level credits	
	12 – 600 level credits	
	6 – 699 research credits	
	6 – 700 research credits	

^a It is highly recommended that students select or be assigned to a faculty advisor upon admission or at least an interim one or the Graduate chair advising them from their first semester.

General Degree Requirements for M.S. Plan-B

Minimum Course Requirements

Eighteen (18) credits of 600-level courses (excluding MBBE 699 and seminar courses), nine (9) credits of 400-level courses (excluding MBBE 499), three (3) credits of MBBE 699. Graduate students are encouraged to take one (1) credit of MBBE 610 or equivalent each academic year. 600 level courses (excluding 610, 611, and 699) can be substituted for 400 level courses. At least one (1) seminar credit is required for an M.S. degree. The final research presentation cannot be used to meet this requirement. The Graduate Chair must approve all courses. **At least 14 of the 27 course credits (51%) of the required-minimum course credits counting towards degree completion must be MBBE courses.**

Research Report and Committee Composition

Plan-B students are also required to conduct a research project for at least two semesters. The results of this research should be written as a 'research report' and submitted to a committee composed of (1) a research advisor and (2) another MBBE Dept. Core graduate faculty. If another faculty cannot be identified, the Graduate Chair will serve as the second committee member. The research adviser should have level 2 or 3 regular or cooperating graduate faculty appointment with the MBBE graduate program. The written research report should be at least about 10-20 pages, double-spaced, with the following sections: abstract (200-300 words), introduction (background and justification, 1-page), literature review (3-7 pages), hypothesis, objectives, materials and methods (3-7 pages), results and discussion (3-10 pages), and references.

Final Presentation and Oral Exam

The results of the research must also be presented as a seminar in the final semester. At the end of the presentation, the committee will ask questions about the research project and other related subjects. For graduation, a student must obtain a satisfactory evaluation from the committee.

MBBE M.S.-Plan B

Suggested Completion Date	Requirements	Completed
Year 1	Choose PI ^a and Project	
	Form Committee	
Year 2	Project Presentation and Oral Exam	
	Report Submission	
	1 - 610 credit	
Required for Degree Completion	9 - 400 level credits	
	18 - 600 level credits	
	3 - 699 research credits	

^a It is highly recommended that students select or be assigned to a faculty advisor upon admission or at least an interim one or the Graduate chair advising them from their first semester.

General Degree Requirements for Ph.D.

Temporary Committee

In the first semester, the Graduate Chair appoints a temporary committee for each Ph.D. student. The committee is comprised of the student's supervisor (major advisor), the Graduate Chair, and a MBBE cooperating faculty member listed on the website: <https://manoa.hawaii.edu/graduate/select-committee-member/>. The committee advises the student on coursework and other academic and research-related matters.

Coursework

Students with a previous Master's degree in the biosciences are required to take a minimum of three (3) credits of 400-level (excluding 499) and nine (9) (credits of 600-level (excluding 699 and excluding any seminar designated courses) courses from the list of approved courses (refer to the "[courses](#)" tab above). **7 of the 12 credits (51%) must be from MBBE courses.** Students who change their candidacy from a Master's degree to a Ph.D. degree without completing their Master's degree are required to take an additional two (2) courses (three (3) credits each of 400 and 600-level). The total courses required for the Ph.D. degree without a Master's degree are nine (9) credits 400-level (excluding 499) and fifteen (15) credits of 600-level (excluding 699) courses from the list of approved courses (refer to the "[courses](#)" tab above). **13 of the 24 credits (51%) must be from MBBE courses.** 600-Level courses are a major priority in any graduate degree and can substitute for 400-level coursework loads, but not the reverse.

Any courses not listed in the handbook must be pre-approved by the principal advisor and Graduate Chair. Failure to do so will jeopardize their inclusion towards the degree program. A minimum of twelve (12) credits of MBBE 699 (directed research) and one (1) credit of MBBE 800 are also required of all students. Students are required to take one (1) seminar credit (MBBE 610 or equivalent) each academic year. The dissertation proposal or defense seminar cannot be used to meet this requirement. MBBE 800 should be taken once the student has had the Form 2 approved by the Graduate Division. It is not necessary to wait and it is also financially better for self-funded students as 1 credit of 800 is considered full-time and charged at the resident rate if this is the only course to be taken – see <https://manoa.hawaii.edu/registrar/tuition-fees/Graduate/>.

NOTE: Identified deficiencies, as stated in the Offer Letter, DO NOT count towards the course requirements.

Dissertation committee

After completing the qualifying exam and before the end of the second year, the Ph.D. student shall form a dissertation committee in consultation with his supervisor and the Graduate Chair. **The committee must be approved by the Graduate Chair.** **It is mandatory to have at least one MBBE core faculty (and other members will be MBBE cooperating graduate faculty) as part of the committee for students conducting research outside MBBE Dept.** It is important that the list of your committee members should be approved by the graduate chair before you contact the members. Ad hoc committee members are not recommended unless necessary, e.g., there is no expertise among the existing MBBE or cooperating faculty. Ad hoc committee member will be limited to only one request. This committee will consist of five faculty members, four of which are MBBE faculty or affiliated cooperating faculty. A fifth member is the University Representative (UR). Check the Graduate Division Website for approved committee members and UR for our MBBE Graduate Program (<http://manoa.hawaii.edu/graduate/content/list-committee-member>). For more information about Committee Composition & Potential Members, please see <https://manoa.hawaii.edu/graduate/committee-composition-potential-members/>

Who can serve as a University Representative (UR) on your Committee?

As you may note from the above website that the UR should be a level 3 graduate faculty appointee, completion of service on a Ph.D. committee (does not need to be chair) and at arm's length from the student's program and all committee members.

"The UR fulfills the following functions:

- The UR serves as a liaison between Graduate Division and the student's committee. S/he is to ensure administration of proper procedures with regard to the comprehensive exam and dissertation, fair treatment of the student throughout this process and that the level of research and integrity are appropriate to the student's degree objective.
- The primary responsibility of the UR is ensuring the integrity of the process and appropriate treatment of and participation by the student." <https://manoa.hawaii.edu/graduate/committee-composition-potential-members/>

"Requirements to serve as University Representative:

- Level 3 member of the graduate faculty on UH Mānoa campus.
- Experience serving on dissertation committees at UH Mānoa (i.e., completion of service where at least one candidate has graduated).
- From a different graduate program and at "arm's length" from the committee chair and faculty in the student's graduate program.
- Participation in committee meetings and attendance at the comprehensive exam and dissertation-related presentations (e.g., proposal and defense)
- Able to clearly communicate issues/concerns to the chair of the committee and work collaboratively to resolve them.
- If issues and concerns are not resolved with the chair of the committee, the UR should share these issues and concerns with Graduate Division."

For definition of level 3 faculty, refer to (<https://manoa.hawaii.edu/graduate/types-levels/>). Level 3 (formerly Full) – members may chair master's and doctoral committees in their home or cooperating graduate programs, prepare and/or assist in preparing/grading qualifying, comprehensive and final exams, in administration of their home graduate program, serve as a university representative and on the Graduate Council. They may also serve as committee members on master's and doctoral committees.

CTAHR Symposium and Other Professional Presentations

Students are encouraged to make a poster presentation at the CTAHR symposium in the first year. They must make at least one more presentation in the symposium before graduation. Students are also encouraged to make additional presentations to sharpen their communication skills. This includes teaching experiences to prepare students for future endeavors.

Students are encouraged to make oral and poster presentations at other national and international conferences. A number of travel scholarships are available from the Graduate Student Organizations. Often, the supervisors provide funds for Ph.D. students' travel expenses. Students can also make presentations in a number of research symposia organized on the UHM campus. These include the Tester, Microbiology, and BioMed Symposia.

Committee meetings

Students should meet at least once a year with their committee to discuss their progress.

Full Proposal and Proposal Seminar

The student should frequently discuss the progress and direction of his/her research with the major advisor. When they agree that the project is going well and there are some convincing research data, the student will be allowed to write a full proposal and then present a proposal seminar.

The full proposal will expand upon the research summary and outline (pre-proposal) described previously. It will contain the following: introduction (substantial literature review, background, research purpose, and justification for the research), objectives, experimental approach, and references. The students must conduct an extensive literature review related to his/her research subject. He/she should discuss with his/her supervisor about the focus of the “review of literature” chapter of his/her proposal, which will eventually be used in the dissertation.

The proposal will be submitted to the committee at least two weeks prior to the seminar for evaluation. All graduate faculty and students are invited to the proposal seminars. The committee will formally endorse the proposal at this stage. **Ideally, the proposal seminar will be done within two years. A proposal seminar must not be delayed beyond three years.** If it is delayed beyond three years, the Graduate Chair will discuss with the committee and consider transferring the student to an M.S. program.

Revision of proposal

Sometimes a project may run into unexpected problems. If this occurs, the project may have to take a new direction and some of the objectives may have to be modified. The student should invite a committee meeting and present a revised proposal.

Comprehensive exam

The permanent committee and the Graduate Chair give this oral exam. The Graduate Chair or a representative appointed by the Graduate Chair serves as the moderator. The committee will ensure that the student has learned molecular biosciences or bioengineering and mastered the subject well. The comprehensive exam must be taken within three years. If it is delayed beyond three years, the Graduate Chair will discuss with the committee and consider transferring the student to an M.S. program.

Publications

Publications are essential requirements of a Ph.D. degree in MBBE. Students should try to complete a manuscript from their dissertation research and get it published in a peer-reviewed scientific journal as soon as possible. Students are encouraged to publish several papers in peer-reviewed journals. There must be at least one research publication as the first author in a standard peer-reviewed journal. Only under an exceptional situation, where the research subject is very problematic, and the supervisor assures and convinces the committee and the Graduate Chair that a publication is forthcoming, a student may be considered for graduation without a publication prior to defense.

Submission of Dissertation to the Committee

The dissertation will follow the format of the proposal, but at this stage, it will contain new results and document a substantial contribution to new knowledge. All chapters of the dissertation must be first

submitted to, and corrected by, the major advisor before submitting to the rest of the committee. The committee may refuse to read the chapters if they contain many grammatical errors and were not previously corrected and approved by the major advisor.

It is highly recommended that the committee be given four (4) weeks to examine either the dissertations or theses; failure to do so gives the committee the right to refuse to examine the materials, thus delaying graduation to the following semester.

It is strongly recommended the student plans accordingly for thesis and dissertation submission - theses and dissertations are due to Graduate Division on the first Friday in April (Spring semester) and November (Fall Semester).

The Graduate Division has a published set of guidelines required by the University. Formatting and the contents of the manuscript must satisfy these requirements, or the dissertation will not be accepted by the University. Ensure that ProQuest submission is also completed, this being a UH Mānoa requirement for graduation.

Dissertation format

- Traditional
- Collection of 3-4 first-authored publications. Students can combine 3 to 4 first-authored publications and present them as independent chapters of the dissertation. Write a small introduction at the beginning with a hypothesis and objectives and a small discussion/conclusion at the end to create a theme and a flow of thoughts when you combine your papers/letters/manuscripts.

A list of publications (published, in-press, to be submitted) and poster presentations should be included, along with conference dates/locations. Publications should be cited in a consistent format, as used throughout the dissertation.

Final dissertation defense

The final dissertation defense seminar is perhaps the most important event for the Ph.D. student. Therefore, the student must prepare well for this presentation. He/she must get approval from the major advisor and the committee for presenting a defense seminar. The student must notify the Graduate Division in advance through the Graduate Chair about the date, time and place of dissertation defense. Graduate faculty and students must be invited to the defense seminar.

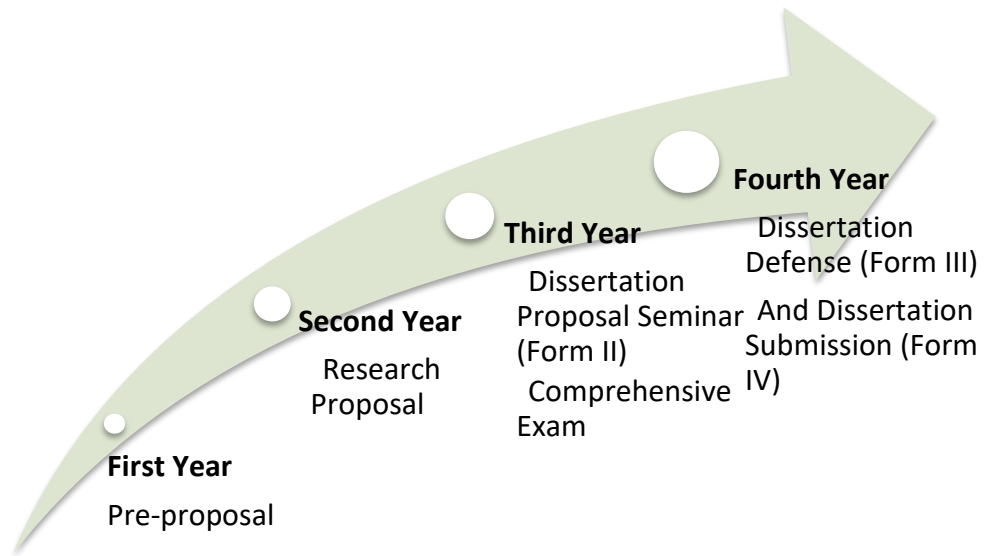
Citing “Department of Molecular Biosciences & Bioengineering” in publications

All graduate students majoring in MBBE who work under the supervision of cooperating or affiliate Graduate Faculty in a laboratory outside of the MBBE department should cite “Department of Molecular Biosciences and Bioengineering” in their publications, at least as the second address. In this case, the address and affiliation of the supervisor’s laboratory can be the primary address. For example:

Lee, B.K.^{1,2}, Hall, Y.¹, and Tan, S.L.² 2025. Development and application of machine learning models in plant disease detection. *Nature* 4:333-341.^[1]_[SEP]

¹Hawaii Agriculture Research Center, Aiea, HI 96701^[1]_[SEP]Department of Molecular Biosciences and Bioengineering, University of Hawaii at Manoa, Honolulu, HI 96822.

Illustrative Timeline for a Ph.D. in MBBE



MBBE PhD Terminus Years

Tasks	Terminus Semester – 1					Terminus Semester				
	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Draft to PI			■							
Incorporate review edits				■						
Submit to committee for review					■					
Incorporate review edits						■				
Notice to grad division								■		
Form III (defense)									◆	
Form IV submit										◆
Graduate										◆

Suggested Timeline and Checklist for the MBBE Ph.D. Program

Forms can be found at <http://manoa.hawaii.edu/graduate/content/forms>

Suggested Completion Date	Requirements	Forms Required	Completed?
Admission Deadline	Application	Form I	
Year 1	Temporary Committee Assigned		
	Choose PI and Project		
	Pre – Proposal and Outline		
	Present in CTAHR Symposium (encouraged)		
Year 2	Form a Dissertation Committee		
	Proposal Seminar	Form II	
Year 3	Comprehensive Oral Exam		
Year 4	Dissertation Final Defense	Form III	
	Dissertation Submission	Form IV	
Required for Degree Completion	1 – 610 credit per year		
	6 – 400 level credits*		
	12 – 600 level credits*		
	12 – 699 research credits		
	1 – 800 level research credit		
	Present in CTAHR Symposium (2X)		
	Present in Outside Symposia (optional)		
	Teaching Experience (optional)		
	Publish in Peer-Review Journal (Required)		

Criteria for Change of Candidacy

Change of candidacy from M.S. to Ph.D.

A M.S. student can change to the Ph.D. program without graduating with the M.S. first. Contact the Graduate Chair to notify your intent to change to Ph.D. Program. Check course credit requirements based on table below:

Courses	Credit Requirements with M.S. degree	Additional credits without M.S.	Total credits to change candidacy to Ph.D.	Your total credits until now
400 level (does not include 499)	3	+ 3	6	
600 level (not counting 699)	9	+ 3	12	
699	12	0	12	
610 seminars	1 per year	0	1 per year	
700	N/A	N/A	N/A	
800	1		1	
One Manuscript with MBBE research data	One manuscript related directly to dissertation research		One manuscript related directly to dissertation research	Yes/No/submitted _____

The Graduate Chair must write a strong justification to the Graduate Division requesting your change to Ph.D. Besides the credit requirements, additional criteria include:

1. At least one submitted first-author research publication. A second author research publication will be accepted with written justification from the PI and committee members. A review manuscript is great, but not sufficient for the change as it does not attest or document your research capabilities as a Ph.D. student
2. Describe current research in form of one page abstract
3. Describe the additional work (research) that you intend to do during your Ph.D. It is best to write a mini proposal describing your hypothesis, aims, objectives etc.
4. A support letter from PI
5. Submit a new application

A request to transition from M.S. to Ph.D. can be made as early as the second or third semester of enrollment, provided all performance requirements are met.

Committee Evaluation for Change

Upon receiving a change request, the committee evaluates and reports on the following:

1. **Interest and Motivation for Change** – The most critical factor.
2. **Past Academic Performance** – Progress in MBBE 699 Research Credits and peer-reviewed publication are important factors.
3. **Plan for Ph.D. Completion** – Including a detailed timeline.

Areas of Proficiency Required for Change

Writing Skills

Submission of a first author research publication can attest your research capabilities and writing proficiency. In addition, writing proficiency can be demonstrated through a peer-reviewed, student-authored publication. A peer-reviewed review paper is strongly recommended, as it often serves as the first chapter of the dissertation and demonstrates the candidate's understanding of previous research and current knowledge (MBBE G-SLO 2).

It is advised that students begin drafting the review paper early, under the guidance of their M.S. committee chair and members, to ensure a manageable transition timeline.

Logical Thinking, Research Focus, and Preliminary Data

The M.S. proposal serves as a key indicator of critical thinking, logical reasoning, and practical communication skills (MBBE G-SLO 4). Students are encouraged to publicly present their M.S. proposal during the second or third semester, allowing the committee to identify and address potential issues early.

The Ph.D. proposal (UHM-Form II) should expand on the M.S. proposal, presenting in-depth analysis, additional aims, and new objectives. To prevent audience confusion, Ph.D.-level details should not overwhelm the M.S. proposal presentation.

Change from Ph.D. to M.S.

Submit all the materials from page 7 to 10 first to the Graduate Chair. PI should send a request letter to the MBBE Graduate Chair attached to email. The Graduate Chair will forward the request first to the Admissions Committee for review and approval. Graduation criteria are the same as those for M.S. Plan A or Plan B mentioned above (page 7-10). Once you obtain approval from the Admissions Committee, the Graduate Chair will forward your application to the Graduate Division along with a memo.

Important Websites for Graduate Students

MBBE faculty members

<https://cms.ctahr.hawaii.edu/mbbe/Faculty>

UH grad committee composition and potential members

<http://www.manoa.hawaii.edu/graduate/content/committee-composition-potential-members>

Types and levels of Graduate faculty appointment

<https://manoa.hawaii.edu/graduate/content/types-levels>

Graduate Division forms

<http://manoa.hawaii.edu/graduate/content/forms>

Ph.D. Applications

<https://apply.hawaii.edu/>

Requesting change of credits from 699 to 700

http://manoa.hawaii.edu/registrar/wp-content/uploads/sites/20/2020/02/Drop_Form.pdf

UHM Student Conduct Code

<https://manoa.hawaii.edu/studentssuccess/conduct-code/>

UHM Academic Grievance Procedure

<https://manoa.hawaii.edu/studentssuccess/academic-grievance/>

Graduate Division Academic Grievance

[https://manoa.hawaii.edu/graduate/graduate-student-grievances/ Graduate Faculty Responsibilities](https://manoa.hawaii.edu/graduate/graduate-student-grievances/Graduate_Faculty_Responsibilities)

Use and management of IT resources

<https://www.hawaii.edu/policy/docs/temp/ep2.210.pdf>

Title IX and Kokua resources

<https://manoa.hawaii.edu/titleix/resources/>

Counseling Resources

<https://manoa.hawaii.edu/counseling/>

Statement of use of AI in programs and research.

<https://manoa.hawaii.edu/ovpae/guidance-on-ai>

Work overload form

<http://manoa.hawaii.edu/graduate/content/forms>

We have a new Quali form called [Application for Graduation](#). This was previously a form-fillable PDF. Starting spring 2024, this form will be used for all Advanced Degrees (Masters, Doctoral, and Ph.D.) and Graduate Certificate (GCerts) students. Of importance is the meeting between a student

and their faculty advisor/mentor to discuss the filing of this form by the deadline in the term of projected graduation. Please refer to the [Academic Calendar](#) for those dates.

IRB and IACUC

As required by federal, state and university regulations, UHM students who intend to conduct research that involves the use of human subjects must check with the program, the Office of Research Services, and the Human Studies Program for approval and guidance. Prior to submitting an IRB application, the Human Studies CITI training must be completed. [Human Studies – Office of Research Compliance](#)

UHM students who intend to conduct research that involves the use of vertebrate animals must have IACUC approved protocols. The IACUC evaluates animal use protocols (proposals) for appropriateness of the activities to determine necessity of the work through scientific justification and the humaneness of the procedures that will be experienced by the animal research or training subjects. [UH IACUC – Office of Research Compliance](#)

Summer Courses

Summer courses are administered by the Office of Outreach Services and are not covered by Research Assistant (RA) or Teaching Assistant (TA) tuition waivers. Students holding RA/TA appointments, including international students, are responsible for paying tuition for any summer courses out-of-pocket, as these costs are not included in the university-funded appointment. To obtain a tuition exemption for summer sessions, GAs must submit a separate request to the Outreach College.

Financial Aid

Cost of attendance and residency

The cost of resident tuition is approximately \$17,000/year and non-resident tuition \$35,000/year. Residency requirements can be found in the University's [website](#)

Basic Information

This office provides information and assistance on financial programs offered by the university.

Office: QLC Room 112

Phone: 956-7251

<http://www.hawaii.edu/fas/>

Veteran Affairs Office

Students who are eligible for veteran's benefits may receive information and assistance from the Veteran Affairs staff at the Office of Admissions and Records.

Office: QLC 010

Phone: 956-8010

<https://manoa.hawaii.edu/registrar/va-education-benefits/>

University of Hawaii Scholarships

Scholarships are available through both the CTAHR college and the University of Hawaii. Occasionally scholarships may also be offered from outside sponsors. Students are also encouraged to seek outside funding through grants and other resources.

CTAHR scholarships

<http://www.ctahr.hawaii.edu/site/Scholarships.aspx>

University-wide scholarship search engine

<http://www.star.hawaii.edu/scholarship>

Teaching Assistantships

Half-time teaching assistantships are available through MBBE and other UH departments (20 hours/week). Departments offering TAs include: Biology, Botany, Microbiology and Chemistry. Directly contact the departments for employment availability. Teaching assistantships are only valid for the semester hired with continued employment dependent on availability and performance.

Teaching assistantships include a tuition waiver and stipend dispensed over a 12-month period for 9 months of work.

Foreign teaching assistantships

The English Language Institute has developed a course providing practice for foreign teaching assistants in speaking in classroom situations with an emphasis on oral skills, ESL 111. Practicum for Foreign Teaching Assistants.

Research Assistantships

Faculty members may provide a stipend for students working on funded research projects. Research assistantships include a tuition waiver and stipend dispensed over a 12-month period for 11 months of work. These positions typically have a similar stipend to TAs.

Assistantship Guidelines

Graduate assistants are required to maintain full-time status with a minimum of 6 credits and a maximum of 9 credits. All assistantships also come with the option of purchasing health care as an employee of the University of Hawaii.

Alternate University Employment

Other employment opportunities within the university can be found at:
<http://workatuh.hawaii.edu/>

MBBE Faculty

<p>Dr. Pratibha Nerurkar MBBE Department Chair Professor</p> <p>Phone: (808) 956-9195 Office: Ag. Sci. 415-H Email: pratibha@hawaii.edu</p>	<p>Education: Ph.D. in Biochemistry (oral carcinogenesis) University of Bombay (Mumbai), Mumbai, India</p> <p>Courses Taught: MBBE 375 – Essential Biochemistry MBBE 402 – Principles of Biochemistry MBBE 651 – Signal Transduction and Regulation of Gene Transcription MBBE 610 – Traditional Seminar Series</p> <p>Research Interests: Complementary and alternative medicine (Hawaiian and Ayurvedic medicine) for type 2 diabetes, nanotechnology for agriculture, metabolomics, lipidomics, gut microbiome (animal and human studies) and food fermentation. .</p>
<p>Dr. Jon-Paul Bingham Associate Professor</p> <p>Phone: (808) 956-4864 Office: Gilmore 111 Email: jbingham@hawaii.edu</p>	<p>Education: Ph.D. in Biochemistry (Peptide synthesis/proteomics) University of Queensland, Brisbane, Australia</p> <p>Courses Taught: MBBE 402 – Principles of Biochemistry (4 Cr) MBBE 402L – Principles of Biochemistry Laboratory (2 Cr) MBBE 610 – Molecular Biosciences Seminar (1 Cr) MBBE 611 – Professional Development Seminar (1 Cr) MBBE 666 – Fermentation Biochemistry (3 Cr)</p> <p>Research Interests: My main interest is discovering novel biologically active peptides from venomous marine creatures and furthering their biological application(s) via bioengineering. Other interests include: value-added products from Hawaiian agriculture; fermentation biochemistry; genomics/bioinformatics; peptide structure determination and modelling; mushroom cultivation techniques and technologies.</p>
<p>Dr. Dulal Borthakur Professor</p> <p>Phone: (808) 956-6600 Office: Ag. Sci. 415-F Email: dulal@hawaii.edu</p>	<p>Education: Ph.D. Molecular Biology University of East Anglia, Norwich, England</p> <p>Courses Taught: MBBE/BIOL 401 – Molecular Biotechnology MBBE/BIOL 408 – Molecular Cell Biology MBBE/Micro 601 – Molecular Cell Biology MBBE/Micro 602 – Molecular Biology and Genetics</p>

	<p>Research Interests: Research interests focus primarily on the biochemistry and molecular biology aspects of two tree-legumes: <i>Leucaena leucocephala</i> and <i>Acacia koa</i>.</p>
<p>Dr. David Christopher Professor</p> <p>Phone: (808) 956-8550 Office: Ag. Sci. 415-B Email: dchr@hawaii.edu</p>	<p>Education: Ph.D. Molecular and Cellular Biology University of Arizona, Tucson, AZ M.S. Plant Genetics Weizmann Institute of Science</p> <p>Courses Taught: MBBE 401 – Molecular Biotechnology, MBBE/BIOL 304 – Biotechnology: Science and Ethical Issues</p> <p>Research Interests: Research focus on mechanisms regulating senescence, protein folding and turnover, sub-cellular trafficking of proteins, abiotic stress (i.e. heat, salinity), and transport of cations in plants. Some additional focus on plant biotechnology approaches to creating disease resistance. Methods include genomics, biochemistry, plant molecular and cellular biology and genetics</p>
<p>Dr. Young Cho Assistant Professor</p> <p>Phone: (808) 956-9270 Office: Ag. Sci. 402-F Email: ybcho@hawaii.edu</p>	<p>Education: Ph.D. Crop Sciences, University of Illinois Urbana-Champaign</p> <p>Courses Taught: MBBE/Micro 602 – Molecular Biology and Genetics</p> <p>Research Interests: My research focuses on improving tropical plant resilience to environmental stress and advancing biotechnology for crop enhancement. Our research targets key Hawaiian crops like cacao, coffee, papaya, and macadamia, addressing both biotic and abiotic stresses. By leveraging genomics and biotechnology, we collaborate with growers to overcome real-world challenges, aiming to improve crop performance, sustainability, and adaptation to environmental stresses in Hawaii and other tropical regions.</p>
<p>Dr. Zhi-Yan (Rock) Du Assistant Professor</p> <p>Phone: (808) 956-8819 Office: Ag. Sci. 415-L Email: duz@hawaii.edu</p>	<p>Education: Ph.D. Biochemistry and Molecular Biology The University of Hong Kong, Hong Kong</p> <p>Courses Taught: MBBE 401 – Molecular Biotechnology</p> <p>Research Interests: Research interests include lipid metabolism plants, microalgae, fungi, and bacteria, symbiosis among the organisms, and synthetic biology for bioproducts</p>
<p>Dr. Nan Jiang</p>	<p>Education:</p>

<p>Assistant Professor</p> <p>Phone: (808) 956-7942 Office: Ag. Sci. 415-D Email: nanjiang@hawaii.edu</p>	<p>Ph.D. Biochemistry and Molecular Biology Ohio University, Athens, OH</p> <p>Courses Taught: MBBE/BIOL 402 – Principles of Biochemistry MBBE 402L – Principles of Biochemistry Laboratory MBBE 620 – Plant Biochemistry</p> <p>Research Interests: Engineering plant metabolism using transcription factors, understanding specialized metabolites as signaling molecules, exploring mechanism of specialized metabolite biosynthesis and regulation, and elucidating the biosynthesis of natural products in native Hawaiian plants</p>
<p>Dr. Samir Khanal Professor</p> <p>Phone: (808) 956-3812 Office: Ag. Sci. 415-B Email: khanal@hawaii.edu</p>	<p>Education: Ph.D. Environmental Engineering Hong Kong University of Science and Technology, Hong Kong.</p> <p>Courses Taught: BE 373 – Transport Phenomena BE 410 – Biomass Conversion to Biofuels and Bioenergy</p> <p>Research Interests: Waste to resources, Biological waste treatment, Anaerobic digestion, Nanobubble technology, Aquaponics, machine learning and AI in bioprocessing</p>
<p>Dr. Qing X. Li MBBE, Graduate Chair and Professor</p> <p>Phone: (808) 956-2011 Office: Ag. Sci. 402-J Email: qingl@hawaii.edu</p>	<p>Education: Ph.D. Agricultural and Environmental Chemistry, University of California, Davis, CA</p> <p>Courses Taught: MBBE 412 – Environmental Biochemistry MBBE 687 – Advanced Lab Techniques MBBE 610 – Molecular Biology and Biotechnology Seminar</p> <p>Research Interests: Address problems relevant to agrochemicals and food for human and environment health, via, for example, proteomics, microbial metabolism, pesticides, anti-Alzheimer’s, anti-inflammation, food safety, and environmental fate studies.</p>
<p>Dr. Gernot Presting Professor</p> <p>Phone: (808) 956-8861 Office: St. John 515 Email: gernot@hawaii.edu</p>	<p>Education: Ph.D. Plant Pathology Wisconsin University, Madison, WI</p> <p>Courses Taught: MBBE/BIOL 406 – Cellular Biology</p>

	<p>MBBE/BIOL 483 – Introduction to Bioinformatics Topics for Biologists MBBE 610 – Molecular Biosciences Seminar MBBE 683 – Advanced Bioinformatics Topics for Biologists</p> <p>Research Interests: Members of the laboratory have investigated maize (corn) centromere function for the past 15 years. Recently, the group has made great strides in elucidating how the epigenome (primarily proteins attached to chromosomal DNA) interacts with centromere function, gene expression and retrotransposon insertions. The Presting laboratory also hosted the 2008 and 2018 University of Hawaii undergraduate iGEM teams. The 2018 team worked on engineering retrotransposons for gene delivery into corn.</p>
<p>Dr. Garrett Roell Assistant Professor</p> <p>Phone: (808) 956-8048 Office: Ag. Sci. 402-C Email: groell@hawaii.edu</p>	<p>Education: Ph.D. Energy, Environmental, and Chemical Engineering Washington University in St. Louis, St. Louis, MO</p> <p>Courses Taught: BE 437 – Biosystems Unit Operations MBBE 447 / BE 447 – Artificial Intelligence for Bioprocesses MBBE 610 – Molecular Biosciences Seminar</p> <p>Research Interests: The Roell lab aims to advance the process of industrial fermentation. Our research focuses on the development of tools that use fermentation results and omics data to generate actionable insights. The platforms we develop assist in large-scale data generation and explore novel applications that will further the field of synthetic biology.</p>
<p>Dr. Wei-Wen (Winston) Su Professor</p> <p>Phone: (808) 956-3531 Office: Ag. Sci. 415-O Email: wusu@hawaii.edu</p>	<p>Education: Ph.D. Chemical Engineering Lehigh University, Bethlehem, PA</p> <p>Courses Taught: MBBE 260 – Mass and Energy Balances MBBE 460 – Bioreactor Design and Analysis MBBE 451 – Synthetic Biology</p> <p>Research Interests: Research interests include synthetic biology, metabolic engineering, protein engineering, bioprocess engineering, and plant molecular farming/plant biotechnology.</p> <p>The development of a novel synthetic protein domain that functions like a “protein intron” and enables highly controllable coordinated and synchronous co-expression of multiple proteins</p>

	<p>from a single open reading frame in eukaryotic cells. A US patent has been awarded for the technology and such a technology provides an essential enabling platform to advance agricultural and medical biotechnology. Other research projects include development of synthetic protein scaffolds to enhance hydrolysis of lignocellulosic biomass, valorization of papaya fruit waste by bioconversion of seed oil using metabolically engineered yeast to produce high-value biochemicals and aquaculture feeds.</p>
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Selection of Courses

Plan your courses in consultation with your mentor and the Graduate Chair. Choose courses from the approved curriculum list of courses (refer to the list on next page). 51% of the total required minimum course credits counting toward your degree must be MBBE designated courses. The other 49% of course credits should be selected from the list of approved courses. If you undertake any course outside the listing, you and your PI must fill out a course-approval form justifying the need for that course in support of your research project.

Seminar courses are mandatory for both M.S. and Ph.D. students. Students must take at least one MBBE 610 class.

What is the goal of a seminar course?

- Expose students to different topics in their research field
- Prepare students to present scientific research reports
- Strengthen their writing skills by attending a grant writing course

The seminar classes such as MBBE 610 and MBBE 610 equivalent courses will count towards the seminar course requirement but not the total 600 credits.

Special topics courses (such as MBBE 691) will be counted towards your 600-level courses. A student can only receive credits for a 691 course one time per department. For example, if a student takes MBBE 691 and TPSS 691, they will receive credits for both classes, but if they take MBBE 691 twice, they will only receive credits the first time.

List of Approved Courses

List of approved MBBE Courses (400 level)

- BE 405, 410, 411, 420, 431, 437, 447, 460
- MBBE 401, 401L, 402, 402L, 408, 412, 422, 447, 451, 460, 483, 491, 499
- BIOL 407
- CHEM 445
- ICS 435
- MICR 461, 463

List of approved MBBE courses (600-level)

- MBBE 601, 602, 610, 611, 620, 625, 627, 650, 651, 652, 666, 683, 687, 691, 699, 700, 800
- ANSC 603
- BIOL 641, 652, 657,
- CEE 636
- CMB 606
- FSHN 601, 685
- PEPS 606
- TPSS 603, 604, 615

Elective courses for MBBE graduate studies

Graduate students may choose courses not on this list as electives to count to their MBBE degrees provided they obtain pre-approval from the Graduate Chair and their supervisor before enrolling in the course. The mentor will be required to fill out a course approval form with justification.

Approved Course Details

MBBE 401 Molecular Biotechnology (3) General principles, applications, and recent advances of the rapidly growing science of biotechnology. Topics include impact of biotechnology on medicine, animal sciences, environment, agriculture, forensics, and economic and socio-ethical issues. Pre: C (not C-) or better in BIOL 275 or consent. (Cross-listed as BIOL 401)

MBBE/BOL 401 Lab CRISPR/Cas9 (3)

Will cover the principles of CRISPR and practice gene-editing methods using CRISPR systems. Hands-on experience how to design and generate constructs for prokaryotic (bacteria) and eukaryotic organisms (yeast and microalgae) to explore the gene-to-phenotype relationship. Pre: MBBE 304 or MBBE 375, and BIOL 275L, or BIOL375L, or consent. The lab must be taken concurrently with MBBE/BIOL 401 Molecular Biotechnology or after passing the 401 course.

MBBE/BIOL 402 Principles of Biochemistry (4) Molecular basis of living processes in bacteria, plants and animals; emphasis on metabolism of carbohydrates, lipids, proteins and nucleic acids. Pre: C (not C-) or better in BIOL 275/275L, CHEM 272 and CHEM 273; or consent. (Cross-listed as BIOL 402 and PEPS 402) **DB**

MBBE/BIOL 402L Principles of Biochemistry Lab (2) (1 Lec, 1 3-hr Lab) Principle techniques of biochemical laboratory. A-F only. Pre: 402 (or concurrent), BIOL 402 (or concurrent).

MBBE 405 Marine Functional Genomics and Biotechnology (3) Fundamental principles governing environmental biotechnology applications; emphasis on processes mediated by microorganisms, development of remediation technologies, environmentally friendly biocatalysis, models to describe the behavior of microbial communities, and emerging biotechnology for environmental microbiology. A-F only. Pre: MICR 130 or MICR 351, or consent. (Spring only) (Cross-listed as OCN 403)

MBBE 407 Cellular Biology I (3)

Cell structure and function. Structure, chemistry, and functions of organelles and macromolecules. Pre: C (not C-) or better in 275/275L, and CHEM 273; or consent. (Cross-listed as BIOL 407)

MBBE 408 Cellular Biology II (3)

Cell structure and function. Structure, chemistry, and functions of organelles and macromolecules. Pre: C (not C-) or better in BIOL 407; or consent. (Cross-listed as BIOL 408)

MBBE 412 Environmental Biochemistry (3) Biochemical and chemical principles of occurrence, distribution, biotic and abiotic conversion, fate, and impact of synthetic and natural molecules in the environment. Important pollutants will be used as case studies to illustrate the principles. A-F only. Pre: CHEM 162 or CHEM 171; or consent. (Spring only) (Cross-listed as PEPS 412)

MBBE 420 Hazardous Materials (3) Introduction to state and federal environmental regulations relative to hazardous substances. Analysis of specific health and environmental impacts of hazardous waste. Pre: CHEM 151 (or concurrent) or consent.

BE 420/MBBE 422 Sensors and Instrumentation for Biological Systems (3) Design course focused on fundamentals of electronic interfacing, control and automation, including biological processes. Topics include sensor physics, basic instrumentation, digital communication, and programming of microcontrollers and other portable computer systems. Pre: (160, 211, and BE 350 or MATH 302 or MATH 307 or EE 326) with a minimum grade of C; or consent. (Cross-listed as BE 420 and EE 422)

BE 447/MBBE 447 AI for Bioprocesses (3) Explores how artificial intelligence can be integrated with bioprocess techniques. Using real-world data and hands-on coding, learn how machine learning can be used to generate practical insights.

MBBE 451 Synthetic Biology (3)

Introduction to principles, tools, and applications of synthetic biology; molecular techniques and design/analysis of synthetic gene circuits, synthetic-biology parts/devices, CRISPR-based systems, engineered microbial cell factories, for industrial, agricultural, medical applications. A-F only. Pre: PHYS 152 (or PHYS 272), BIOL 275/275L; or consent. (Alt. years: fall)

MBBE 460 Bioreactor Design and Analysis (3) Application of mass/energy balances and reaction kinetics for the design and analysis of bioreactors for microbial, plant, and animal cell cultures. Pre: 322 (with a minimum grade of C-) or BE 373 or CEE 320; or consent. (Cross-listed as BE 460)

MBBE 483 Introduction to Bioinformatics Topics for Biologists (3) Focuses on the use of computational tools and approaches to analyze the enormous amount of biological data (DNA, RNA, protein) available today. A-F only. Pre: BIOL 171 (or equivalent), or consent. (Once a year) (Cross-listed as BIOL 483)

MBBE 490 Lab Automation: Advanced Techniques in Plant Molecular Biology (3) Combined lab lecture on semi-automated systems used to analyze and manipulate nucleic acids and proteins. A-F only. Pre: 401 and BIOL 275/275L, or consent. (Once a year, cross-listed with BIOL 483)

MBBE 499 Directed Research (V) Limited to undergraduate students qualified to carry on research problems in plant physiology, biochemistry, and molecular biology. A-F only.

MBBE 601 Molecular Cell Biology (3) Provide fundamental concepts and dynamic characteristics of the molecules of the prokaryotic and eukaryotic cell, their biosynthesis and regulation, and the mechanisms that regulate cellular activities. A-F only. Pre: basic course in cell and molecular biology, or consent. (Fall only) (Cross-listed as MICR 601)

MBBE 602 Molecular Biology and Genetics (3)

Graduate-level basic course on molecular biology and genetics. Prepares students to understand advanced concepts in related subjects such as biochemistry, cell biology, cancer biology, immunology, plant genetics, and genomics. Pre: 402/BIOL 402 (with a minimum grade of B or higher), or with consent from instructor. (Alt. years: fall) (Cross-listed as MICR 602)

MBBE 610 Molecular Biosciences Seminar (1) Traditional seminar course on different topics. A-F only.

MBBE 611 Professional Development and Responsible Conduct of Research (1). Will be considered as a seminar course.

MBBE 620 Plant Biochemistry (3) Comprehensive study of chemical constituents and biochemical processes unique to the plant kingdom with emphasis on selected aspects of current interest. A-F only. Pre: 402 or consent.

MBBE 625 Biosensor Principles and Applications (3) Elaboration of common biochemical interactions used to quantify biological molecules, and the electrical technologies used to detect them. Discussion of the desirable properties of biosensors, miniaturization and applications related to medicine, agriculture, bioproduction and environment. Pre: consent. (Cross-listed as BE 625)

MBBE 627 Molecular Diagnostics: Principles and Practices (3) Molecular diagnostics principles, comparative genomics, genome annotation and bio-informatics, phylogenetics, gene target selection, advanced primer, and probe design. Repeatable one time. Graduate students only or consent. A-F only. (Fall only) (Cross-listed as PEPS 627)

MBBE 650 DNA and Genetic Analysis (2) Combined lecture-lab for students interested in genetic analysis of humans, animals, and other species. Molecular techniques, such as PCR, DNA marker identifications, transgenics, expression analysis and functional genomics, are included. Open to nonmajors. Pre: graduate standing or consent. (Cross-listed as ANSC 650 and FSHN 650)

MBBE 651 Signal Transduction and Regulation of Gene Transcription (3) Lecture/discussion on molecular mechanisms involved in the transmission of regulatory signals from the cell surface to the nucleus. A-F only. Pre: CMB 621, and CMB 654 or equivalent; or consent. (Fall only)

MBBE 652 Molecular Plant Fungi Interactions (3) Focuses on the actions of plant pathogens and the responses of compatible and incompatible host plants. Latest research on this topic will be evaluated by discussing publications reporting pathogenesis mechanics. Graduate standing only. Pre: 405 or PEPS 405, or 480, or MICR 351. (Every 2 years) (Cross-listed as PEPS 652)

MBBE 666 Fermentation Biochemistry. (3) This course explores fermentation processes, their products, and the biochemistry behind their development, commercial production, and analysis. It also highlights the entrepreneurial spirit of transferring biotechnology to create value-added products with a distinctive Hawaiian identity.

MBBE 683 Advanced Bioinformatics Topics for Biologists (4) Teaches problem-solving with bioinformatic tools. Real-world problems will be provided and worked out, students encouraged to provide their own research problem where they require assistance. Graduate student must work on genomics research project requiring bioinformatic analysis, working knowledge of UNIX OS, Perl, Java or C. A-F only. Pre: ICS 471 and ICS 491 and ICS 691 (or equivalent), or consent. (Alt. years)

MBBE 687 Advanced Lab Techniques (3) (2 Lec, 1 3-hr Lab) Advanced laboratory techniques used in life science research. Pre: graduate standing or consent. (Cross-listed as ANSC 687 and FSHN 687)

MBBE 699 Directed Research (V) Repeatable up to 64 credits.

MBBE 700 Thesis Research (V) CR/NC only.

MBBE 800 Dissertation Research (V) CR/NC only.

Available alternative courses

(Seek approval from Graduate Chair for all alternatives. Also refer to the table format of listings on the following pages)

FSHN 485 Nutritional Biochemistry I (3) Metabolism and biochemistry of carbohydrates, lipids, and proteins, including chemical structure, digestion, absorption, transport, cellular/molecular functions in human nutrition; integration of metabolic pathways; energy metabolism and balance, including relevance to chronic disease. Pre: PHYL 142/142L or PHYL 302/302L; BIOC 341 or higher or MBBE 375 or MBBE 402.

FSHN 486 Nutritional Biochemistry II (3) Metabolism and biochemistry of vitamins, minerals, and dietary fiber, including chemical structure, digestion, absorption, transport, and cellular/molecular functions in human nutrition; relevance to establishing nutrient requirements and to mechanisms of chronic disease. Pre: 485 or consent.

FSHN 657 Grant Writing for Graduate Students (1) Combined lecture/discussion on grants and grant writing. Designed to introduce graduate students to grants and grant proposal writing through lectures, class discussion, writing assignments, and peer review. Open to CTAHR graduate students only; others with consent. (Fall only) (Cross-listed as ANSC 657 and TPSS 657)

FSHN 685 Nutrition and Disease: Cellular and Molecular Aspects (3) In-depth lecture, discussion, and student presentations on selected topics relating nutrition to the etiology and prevention of chronic diseases at the cellular and molecular level. Repeatable one time. Pre: 485 and 486; statistics; or consent.

Table of Potential MBBE Electives

Multiple course numbers are provided if the course is cross-listed.

Course Number	Course Title (Cr)	Description
BIOL 407	Molecular Biology (3)	Relationship between structure and function at macromolecular level. Pre: C (not C-) or better in 275/275L and CHEM 273, or consent. (Cross-listed as MCB 407)
ICS 435	Machine Learning Fundamentals (3)	Introduction to machine learning concepts with a focus on relevant ideas from computational neuroscience. Information processing and learning in the nervous system. Neural networks. Supervised and unsupervised learning. Basics of statistical learning theory. Pre: (311 or EE 367) and 314, or consent. Recommended: MATH 307. (Once a year)
BE 410	Biomass Conversion to Biofuels and Bioenergy (3)	Overview of biofuel/bioenergy production; fundamental concepts in biofuel/bioenergy production; renewable feedstocks; thermochemical and biochemical conversions of biomass to biofuel/bioenergy; biodiesel production; environmental impacts, economics and life-cycle analysis; value-added processing of biofuel residues; selected case studies. A-F only. Pre: 373 or consent. (Once a year)
BE 411	Food Engineering (3)	Principles and applications of thermodynamics, electricity, fluid mechanics, heat transfer, psychrometry, and material and energy balances of food processing and preservation. Pre: (BIOL 171, CHEM 162 or CHEM 171 or CHEM 181A, MATH 243 or MATH 253A, PHYS 151 or PHYS 170) with a minimum grade of C; or consent. (Once a year) (Cross-listed as FSHN 411) DP
BE 437	Biosystem Unit Operations (3)	Introduction to unit operations in biological, environmental, food, and manufacturing processes. Integration of biology and chemistry into engineering using basic concepts in mass and energy conservation and transport in reacting and non-reacting systems. A-F only. Pre: 373; and either CEE 320 or ME 322; or consent. DP
CHEM 445	Synthesis and Analysis of Organic Compounds (3)	Introduction to multi-step synthesis and instruments/analytical techniques used to characterize organic compounds. Retrosynthesis and diastereoselective reactions; spectroscopy (optical methods, NMR), mass spectrometry. Chromatography (GC, HPLC) and coupled techniques (GCMS, LCMS). CHEM or BIOC majors only. A-F only. Pre: 273 with a grade of C (not C-) or better, or departmental approval. (Spring only) "Course is useful for students that are working with NMR and organic synthesis. It provides students with strong background in analysis and synthesis of organic compounds."

ANSC 641	Seminar in Animal Science (1)	Topics of current interest and current research related to nutrition, genetics, and physiology. Repeatable three times. Pre: consent.
ANSC 657	Grant Writing for Graduate Students (1)	Combined lecture/discussion on grants and grant writing. Designed to introduce graduate students to grants and grant proposal writing through lectures, class discussion, writing assignments, and peer review. Open to CTAHR graduate students only; others with consent. (Cross-listed as FSHN 657 and TPSS 657)
CMB 606	Introduction to Neurosciences	An interdisciplinary overview of the central nervous system, drawn from current knowledge and research on vertebrate and invertebrate neurobiology. Repeatable one time. Pre: consent. 4.000 Credit hours.
FSHN 601	The Science of Food Systems (2)	Discussion of food systems as they apply to animal science, food science, and human nutrition. Repeatable one time. Pre: graduate standing or consent. (Cross-listed as ANSC 601)
FSHN 685	Nutrition and Disease: Cellular and Molecular Aspects (3)	In-depth lecture, discussion, and student presentations on selected topics relating nutrition to the etiology and prevention of chronic diseases at the cellular and molecular level. Repeatable one time. Pre: 485 and 486; statistics; or consent.
MICR 461,	Immunology	Structure and biological actions of antigens and antibodies; fundamentals of antibody synthesis; the relation of immunology to biology and medical sciences. Pre: 351 or BIOL 171; or consent. Recommended: BIOL 275/275L. (Cross-listed as MCB 461) DB, 3.00 and 2.00 Credit hours
MICR 463	Microbiology of Pathogens	Host-parasite relationships in microbial diseases of humans and animals with emphasis on bacterial pathogens. Pre: 351. Co-requisite: 463L or consent. DB 3.000 Credit hours
PEPS 606	Biology of Plant Pathogens: Bacteria and Viruses	2 Lec, 2 3-hr Lab) Principles and concepts in pathogen biology, epidemiology, and management of plant diseases caused by bacteria and viruses. Laboratory techniques for isolation and identification of pathogens and disease diagnosis. A-F only. Pre: 605 (with a minimum grade of B). 4.000 Credit hours
TPSS 603 ANSC 603	Experimental Design	Design of experiments and variance analyses in biological and agricultural research. Pre: graduate standing or consent. Recommended: ZOO 632. (Cross-listed as ANSC 603)
TPSS 615	Quantitative Genomics and Evolution	Overview and lab-based course exploring theory and methods to understand genome evolution and adaptation; focus will be on a range of organisms. Pre: 453 and 603, or consent. (Cross-listed as PEPS 665)
CHEM 761	Special Topics in Biochemistry: Molecular	From a random coil to a fully folded and functional protein – protein dynamics, function, and proteinopathies.

	<p>Understanding of Protein Folding, Misfolding, and Disease</p>	<p>“Molecular understanding of proteins and their structures are essential in understanding biological activity and function of proteins. This course discusses why proteins form specific structures, protein-protein interactions, and why errors sometimes occur to come up with protective strategies against errors when folding goes wrong. When folding goes wrong in cells, misfolded and/or aggregated proteins may arise unable to perform their functions and sometimes even contribute to neurodegenerative diseases via amyloid formation. Diseases like Alzheimer's, Parkinson's and Amyloid Lateral Sclerosis are very serious proteinopathies without a cure.”</p>
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Frequently Asked Questions

Q: *How do I search peer-reviewed articles at the University of Hawaii?*

A: Go to <http://library.manoa.hawaii.edu>. If trying to find articles on a subject, searching multiple pertinent databases is a good way to start. If the specific article you want is known, it is often best to navigate straight to the article directly through the journal. Many articles are not available online and must either be accessed in UH’s hardcopy collections located at Sinclair or Hamilton libraries or electronically borrowed from another library. To access the University of Hawaii’s electronic collection, you need a UH user name and password.

Q: *Where can I access the forms needed to graduate?*

A: Go to: <http://manoa.hawaii.edu/graduate/content/forms>

Q: *I’m sick! Where can I find a doctor?*

A: In an emergency, dial 911. Most less urgent health issues can be handled by University of Hawaii Health Services (<https://www.hawaii.edu/shs/>).

Q: *Help! Where can I find housing?*

A: For on-campus housing, go to: <http://manoa.hawaii.edu/housing>. Many students also make use of craigslist Honolulu’s classifieds. Graduate students may also consider housing options at the East-West Center and apply to the Student Affiliate program. More details can be found here: <https://www.eastwestcenter.org/campus/housing>

Q: *My out-of-town friend is visiting. Where can I find the best snorkeling?*

A: The most popular and easiest snorkel sites on island include Hanauma Bay on the south shore, Kahe Point (aka Electric Beach) out west, and Shark’s Cove on the north shore (don’t worry, there aren’t any sharks there). Be confident in your swimming ability and always check conditions (<http://www.surfnewsnetwork.com>) before you go. And remember, “if in doubt, don’t go out!”

Q: *How do I register or navigate UHM's important but confusing website(s)?*

A: See instructions below

Registrar for classes:

- Go to <https://www.star.hawaii.edu/studentinterface/>
- Login with your name and password
- On left side, click on add/drop courses
- Select semester and press submit

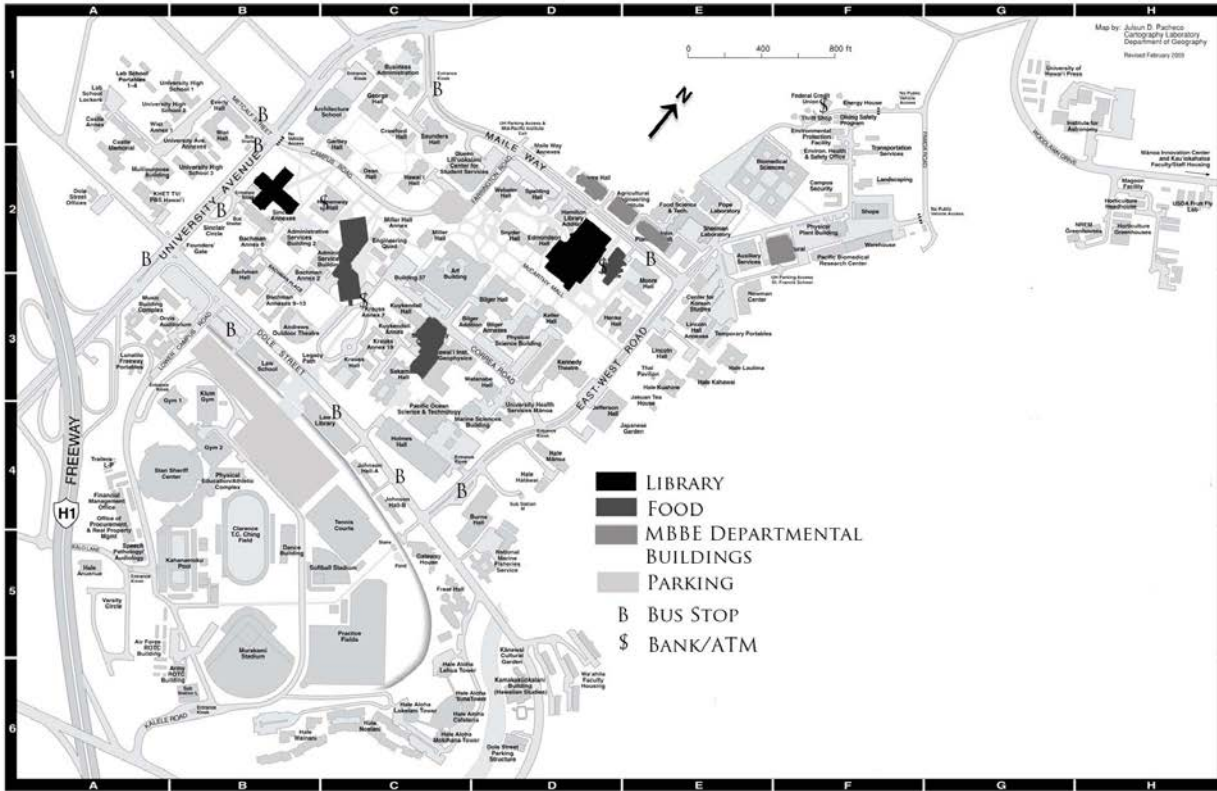
Registrar for scholarships:

- Go to https://www.star.hawaii.edu:10012/Scholarship_live/login.jsp
- Login with your name and password
- On left side, click STAR Degree check/View transcripts
- In Star, click scholarships on the far right side
- Click Enter Scholarships
- Log in with same name and password
- Click my best fit scholarship on the top bar

Calendar of Events:

- Go to <http://www.hawaii.edu/>
- Click on current students
- Click on calendar events on left side navigation pane

UH Manoa Campus Map



MBBE Laboratories

Laboratories	Room	Phone
Dr. Bingham	Gilmore 107	956-4219
Dr. Christopher	Ag Sci 419	956-3540
Dr. Cho	TBD	
Dr. Du	Ag Sci 418	956-8210
Dr. Jiang	Ag Sci 418	956-8210
Dr. Jiang	Ag Sci 408	956-6155
Dr. Khanal	St John 203C	956-7940
Dr. Li	Ag Sci 417	956-2639
Dr. Nerurkar	Ag Sci 414E	956-9426
Dr. Presting	St John 515	956-7432
Dr. Roell	Sherm 228	956-2009
Dr. Su	Ag Sci 416	956-9597