

TROPICAL MEDICINE GRADUATE PROGRAM

Graduate Student Handbook



Department of Tropical Medicine, Medical Microbiology & Pharmacology

John A. Burns School of Medicine, University of Hawai'i at Mānoa
Basic Science Building., 651 Ilalo Street,
Honolulu, HI 96813
Phone (808) 692-1607, Fax (808) 692-1979

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Introduction

This handbook sets forth the basic policies, requirements and procedures for students pursuing graduate degrees and certificates in Tropical Medicine. You should review the contents to be clear about your responsibilities as a student and the responsibilities of the program to you. If you have any questions about this handbook, please contact the graduate chair, Dr. Sandra P. Chang (sandrac@hawaii.edu; (808) 692-1607). The faculty wish you success and hope that this handbook will serve as a useful guide in pursuing your career goals.



TROPICAL MEDICINE STUDENTS AND FACULTY

Program Overview

Tropical Medicine is the study of health issues, including infectious diseases, that occur more commonly in tropical regions and subtropical regions of the world. However, in today's era of globalization and modern transportation, diseases that were once confined to the tropics now play a significant role in the global resurgence of infectious diseases. As such, the discipline of Tropical Medicine has greatly increased in importance in the past 20 years.

The Department of Tropical Medicine and Medical Microbiology at the John A. Burns School of Medicine was founded in 1972. In 2004, it merged with the Department of Pharmacology to become the Department of Tropical Medicine, Medical Microbiology and Pharmacology. The department offers graduate programs leading to the MS and PhD degrees in Biomedical Sciences (Tropical Medicine) and the Graduate Certificate in Tropical Medicine.

A major goal of the Tropical Medicine graduate program is to provide Hawai'i and its neighboring Asian and Pacific Nations with the expertise needed to conduct research, training, and education in diseases prominent in their geographical areas. Tropical Medicine faculty perform research on dengue, West Nile virus encephalomyelitis, congenital Zika syndrome, HIV/AIDS, hepatitis, viral and bacterial encephalitis, malaria, Kawasaki disease, and emerging infectious diseases, such as Ebola virus disease and coronavirus disease 2019 (COVID-19). An interdisciplinary approach is taken which encompasses the fields of immunology, microbial pathogenesis, epidemiology, pharmacology, laboratory diagnostics, socio-ecological systems, and human, microbial and vector ecology. The department's research seeks to answer fundamental questions associated with the transmission dynamics and pathogenesis of the tropical infectious diseases, as well as conduct translational research to improve the diagnosis, treatment, and prevention of tropical infectious diseases. These studies can be laboratory-based, clinic-based, community-based, or include a combination of these approaches.

The field of Tropical Medicine requires knowledge of virology, bacteriology, parasitology, entomology, immunology, cell and molecular biology, molecular evolution, epidemiology, ecology, bioinformatics, behavioral science and clinical medicine. In addition offering training in multiple disciplines, the department also supports the One Health approach which recognizes the interconnections of human health, animal health, and ecosystem/environmental health. In this respect, the Tropical Medicine graduate program at UH Mānoa provides learning opportunities available in few other university departments. The department participates in joint research projects with several community hospitals

and collaborates closely with the State of Hawai`i Department of Health, providing instruction and expertise in emerging infection preparedness and infectious disease diagnosis using the latest technologies. In addition to local collaborations, department faculty have partnered with international institutions in the Pacific, Southeast Asia and Africa to conduct field research in infectious diseases.

Faculty

Regular Graduate Faculty	Research Interests
<u>William Boisvert, Ph.D.</u> <u>Interim Department Chair</u>	Immunity and inflammation in the pathogenesis of atherosclerosis
<u>Sandra P. Chang, Ph.D.</u> <u>Graduate Program Chair</u>	Immunology, molecular biology, molecular approaches to vaccine development, One Health
<u>Saguna Verma, Ph.D.</u> <u>Graduate Program Co-Chair</u>	Molecular, biochemical aspects of viral diseases
<u>William L. Gosnell, Ph.D.</u> <u>Graduate Certificate Chair</u>	Host-parasite interactions, malaria, immunology
<u>Virginia S. Hinshaw, Ph.D.</u> <u>(Emeritus)</u>	Influenza virus epidemiology, pathogenicity, immunology and vaccines
<u>George S.N. Hui, Ph.D.</u>	Parasitology, immunology, cell biology
<u>Pakiele H. Kaufusi, Ph.D.</u>	Pathogenesis of West Nile virus encephalitis
<u>Vedbar Khadka, Ph.D.</u>	Bioinformatics, systems biology, cancer, biostatistics, data mining
<u>Axel Lehrer, Ph.D.</u>	Viral vaccine development, filoviruses
<u>Iain MacPherson, Ph.D.</u>	HIV/AIDS biomarkers, vaccine development
<u>Jourdan McMillan, Ph.D.</u>	Effect of molecular adjuvants on B cells, One Health
<u>F. DeWolfe Miller, Ph.D.</u> <u>(Emeritus)</u>	Epidemiology of infectious diseases
<u>Vivek R. Nerurkar, Ph.D.</u>	Pathogenesis of infectious diseases, delineating cellular and molecular mechanisms underlying microbe-host interaction
<u>Juwon Park, Ph.D.</u>	Regulation of the development and progression of fibrosis; fibroblast-dependent regulation of inflammation
<u>Bruce Shiramizu, M.D.</u> <u>(Emeritus)</u>	Pathology of HIV-associated disorders

Angela Sy, Ph.D.	Health disparities and community-engaged research
Diane W. Taylor, Ph.D. (Emeritus)	Immunology of malaria in pregnant women and newborns
Albert To, PhD	
Alanna Tseng, PhD	Immune response to SARS-CoV-2 and other viral pathogens
Wei-Kung Wang, M.D., Sc.D.	Pathogenesis of arboviral and zoonotic viruses
Angel A. Yanagihara, Ph.D.	Biochemistry of cubozoan venoms
Cooperating Graduate Faculty	Research Interests
John M. Berestecky, Ph.D.	Enteric bacteria
John Chen, Ph.D.	Applied statistics, data science, healthcare data analytics, research design, statistical education and collaboration, statistical resources development
Youping Deng, Ph.D.	Bioinformatics, biomedical informatics, artificial intelligence and machine learning, cancer, genomics, systems biology
Tung Hoang, Ph.D.	Pathophysiology, genomics and transcriptomics of pathogenic bacteria
Mukesh Kumar, Ph.D.	Flavivirus pathogenesis, microRNA regulation, viral encephalitis
Yuanan Lu, Ph.D.	Gene therapy for HIV-1 infection, gene transfer approaches for neuroAIDS, immunodiagnosis of herpesvirus infection of green turtles, aquaculture virology
Marian E. Melish, MD	Staphylococcal infection and toxins, clinical infectious disease, Kawasaki syndrome
Catherine Pirkle, Ph.D.	Maternal and child health, oceans and human health, One Health
Sladjana Priscic, Ph.D.	Ribosomal regulation in <i>Mycobacterium tuberculosis</i>
Cecilia M. Shikuma, M.D.	HIV/AIDS clinical trials

Richard Yanagihara, M.D., M.P.H. (Emeritus)	Transdisciplinary investigations of emerging and re-emerging infectious diseases, use of infectious agent biological markers to trace ancient and recent movements of human populations
Affiliate Graduate Faculty	Research Interests
Brenda Y. Hernandez, Ph.D.	Human papillomavirus, hepatitis virus, viral carcinogenesis, epidemiology
Jennifer Honda, Ph.D.	Environmental, host, and microbial factors driving nontuberculous mycobacterial lung disease emergence
Stacey Honda, M.D.	Cancer research, pharmacogenomics, molecular diagnostics
Allison Imrie, Ph.D.	Dengue immunology and epidemiology
Edwin Kamau, PhD	clinical and genomic studies of anti-microbial resistant bacteria and parasites
Kenton J. Kramer, Ph.D. (Retired)	Parasitology, epidemiology, leptospirosis, HIV sero-diagnosis
Michael M. Lieberman, Ph.D.	Vaccine development, vaccinology, viral pathogenesis
Kevin Palmer, Ph.D.	Global public health and tropical diseases such as malaria, dengue and lymphatic filariasis
Adjunct Faculty	Research Interests
Melissa Agsalda-Garcia, Ph.D.	Anal cancer/dysplasia screening for HIV+ patients
Alan Garcia, Ph.D.	Clinical immunology including acute rheumatic fever; monoclonal antibody technology
Kalpana Kallianpur	
James F. Kelley, M.P.H., Ph.D.	Pathogenesis of flaviviruses; malaria surveillance
Jerome H. Kim, M.D.	Vaccine development
Marc Le Pape, Ph.D.	Biomedical informatics; application of computer science, cognitive science and statistics to the design of Health Management Information Systems

Administrative & Technical Staff

Name	Designation	Email Address	Phone No.
Cori Watanabe	Institutional Support	corit@hawaii.edu	808-692-1654
Jaylene Meyer	Institutional Support	jmeyer8@hawaii.edu	808-692-1606
Cole Flottman	Institutional Support	coleflo@hawaii.edu	808-692-1617
Eileen Nakano	Research Support	etnakano@hawaii.edu	808-692-1612
Teri Wong	Research Support	teriwong@hawaii.edu	808-692-1651

Master's Degree (MS) Program Requirements

Master's Plan A (Thesis)

Note: All student progress forms have been converted to an online format ([Graduate Division Quali Build](#)) and must be completed and submitted by the student at the appropriate points in their training.

Coursework requirements

- 30 credit hours (must be taken for an A-F letter grade)
- 18 credit hours approved course work including TRMD core courses, excluding 699 and thesis 700
 - Minimum 12 credit hours in courses numbered 600-798
- Required core courses (16 cr):
 - TRMD 603 Parasitology (3 cr)
 - TRMD 604 Immunology (2 cr)
 - TRMD 605 Virology (3 cr)
 - TRMD 608 Bacteriology & Mycology (3 cr)
 - TRMD 653 Bioinformatics (3 cr)
 - CMB 626 or MICR 614 Research Ethics (2 cr)
- Other required courses:
 - TRMD 690 Seminar (1 cr) – enrolled each semester; seminar presentation once per year
 - TRMD 601 Journal Club (1 cr) – enrolled once per year
 - TRMD 699 Directed Research (var cr) – enroll each semester; variable number of credits agreed upon with research mentor
- Registration in thesis TRMD 700 during last semester; at least 9 credit hours of TRMD 700 (may convert credits of 699 to 700 by memo)
 - Students enrolled in one credit of TRMD 700F are considered full-time students
 - Requires Graduate Division approval of *Enrollment in GRAD 700F form* (all forms are available online on the [Graduate Division Forms](#) page).

MS Plan A Schedule

Initial Steps Upon Admission

- Preliminary conference with graduate program chair

- Appointment of research advisor

Master's Plan A Form 1 - Pre-Candidacy Progress (complete relevant sections but do not submit)

- Preliminary conference with academic adviser (graduate program chair)
- Identification and remediation plan for deficiencies (if applicable)

Diagnostic Evaluation

- Following second semester of residence after completion of core courses
- Open book, short essay exam to provide preliminary evaluation of Tropical Medicine core knowledge base
- Used to advise the student on course of study and areas needing improvement to prepare for qualifying examination

General (Qualifying) Examination

- Taken Summer or early Fall of second year of residence
- General exam (closed book, short essay answers with oral follow-up) consisting of questions composed by faculty examination committee
- Evaluates student's knowledge base of Tropical Medicine core (general medical microbiology, microbial evolution, virology, bacteriology, parasitology, immunology, and pharmacology)
 - Students must pass all subject areas to pass the exam
- Used to advise course of study to correct any weaknesses noted by examination committee

Pass

- Advancement to candidacy for MS degree
- An MS student whose exam and overall academic performance has been exceptional may be recommended for the PhD program upon completion of the MS degree or for immediate transfer to the PhD program

Fail

- Failed sections or the entire exam may be repeated once within 6 months of the date of the first exam
- A student who fails the general examination a second time will be dismissed from the program

Completion and submission of *Master's Plan A Form 1 - Pre-Candidacy Progress*

Indicates successful completion of qualifying examination

Master's Thesis Committee

- Selection of permanent advisor by end of first year (chair of thesis committee)
- Appointment of two other members of TRMD graduate faculty to committee
- Preparation of individualized timeline and Individual Development Plan (IDP) for MS Plan A degree (see sample at end of handbook)
- A department graduate program representative (Dr. Chang or Dr. Verma) should be included in all committee meetings and the thesis defense to maintain uniformity and equity of standards and procedures.
 - Copies of all committee documents should be provided to department representative
 - The graduate chair should be informed of who will serve as the graduate program representative for each MS student

Advance to Candidacy

- Submission of thesis topic orally and as a written proposal to thesis committee for their review and approval
- Format of written thesis proposal to be specified by thesis committee but should consist of sections on background and significance, specific aims, research design and methods, and preliminary studies.
- Thesis proposal should be presented as a departmental seminar
- Written proposal and proposal seminar should be completed and approved by the end of the third semester
- Obtain certification, approvals and guidance as needed from the Office of Research Compliance:
 - Committee on Human Studies <http://www.hawaii.edu/irb/> ph. (808)539-3955
 - Environmental Health & Safety Office www.hawaii.edu/ehso/; ph. (808)956-8660
 - UH Animal Welfare Program <https://researchcompliance.hawaii.edu/programs/animal-welfare/>

Completion and submission of *Master's Plan A Form 2 - Advance to Candidacy*

- Indicates Committee approval of thesis proposal
- Submission of copies of all required approval/compliance documents
- *Master's Plan A Form 2 must be submitted and approved prior to registering for Thesis 700*

Final Examination

- Research seminar and oral examination covering thesis research and related areas
- Conducted by thesis committee as a seminar open to all graduate faculty, students and general public followed by a closed session with committee
- Seminar announcement must be sent out to department at least 2 weeks prior to seminar
- To be held at least 3 weeks before the end of term during which degree is conferred
- A student failing the final examination may repeat it once at the discretion of the thesis committee
- A student who fails the examination a second time will be dismissed from the program.

Completion and submission of *Master's Plan A Form 3 – Thesis Evaluation*

- Certification of final oral exam and thesis defense by thesis committee

Completion and submission of *Master's Plan A Form 4 - Thesis Submission*

- Approval of the written thesis by thesis committee (replaces thesis signature page)
- [Style and Policy Manual for Theses and Dissertations](#)

For details on graduation requirements, see [Graduation Checklist for Masters Plan A Thesis candidates](#)

Master's Plan B (Non-Thesis)

Tropical Medicine MS students are admitted into the MS Plan A program only; conversion to MS Plan B may be made in exceptional circumstances and requires program approval

Note: Student progress forms for MS Plan B students are maintained by the department.

Preliminary conference with graduate program chair

- Appointment of interim advisor
- Pre-Candidacy Progress (Form I) (complete relevant sections)
 - Preliminary conference with interim academic adviser
 - Identification and remediation plan for deficiencies (if applicable)

Diagnostic Evaluation

- End of second semester of residence
- Open book, short essay exam to evaluate background in infectious disease microbiology & immunology
- Used to advise the student on course of study and areas needing improvement

General (Qualifying) Examination

- Summer following second semester of residence
- General exam (closed book, short essay answers with oral follow-up) with questions composed by TRMD faculty
- Evaluates student's knowledge base of Tropical Medicine core (general medical microbiology, molecular evolution, virology, bacteriology, parasitology, immunology, pharmacology)
- Used to evaluate student progress and advise course of study to correct weaknesses

Pass

- Advancement to candidacy for MS degree

Fail

- Failed sections or the entire exam may be repeated once within 6 months of the date of the first exam
- A student who fails the general examination a second time will be dismissed from the program

- Advancement to candidacy for MS degree

Pre-Candidacy Progress (Form I) (complete relevant section and file internally) following successful completion of qualifying examination

Coursework requirements

(see section on Tropical Medicine Curriculum for course details)

- 30 credit hours (must be taken for an A-F letter grade)
- 18 credit hours approved course work including TRMD core courses and excluding 699 and Plan B 695
- Required core courses:
 - TRMD 603 Parasitology
 - TRMD 604 Immunology
 - TRMD 605 Virology
 - TRMD 608 Bacteriology & Mycology
 - TRMD 653 Bioinformatics
 - CMB 626 or MICR 614 Research Ethics
- Other required courses:
 - TRMD 690 Seminar – enrolled each semester; seminar presentation once per year
 - TRMD 601 Journal Club – enrolled once per year
- Minimum 12 hrs in courses numbered 600-798
- Registration in 6 research credits: TRMD 695 (research paper; 3 cr) during last semester; 3 cr. hrs of TRMD 699/695

Master's Plan B Committee

- Permanent adviser; selected by end of the first year
- Two other members of TRMD faculty
- Preparation of individualized timeline for MS Plan B degree (see sample) and Individual Development Plan (IDP)

Study Program and Research Project proposal

- Meet with committee to decide on study program before end of second semester
- Additional courses
- Research project proposal
- Obtain certification, approvals and guidance as needed:
 - Committee on Human Studies
<http://www.hawaii.edu/irb/> ph. (808) 539-3955
 - Environmental Health & Safety Office www.hawaii.edu/ehso/ ph. (808)956-8660
 - Institutional Animal Care and Use Committee
<http://www.hawaii.edu/ansc/IACUC/> ph. (808)956-4446

Completion and internal filing of modified Advance to Candidacy Form II

Final examination

- Presentation of research seminar and written paper covering research project
- Completion and internal filing of modified Progress Report Form III
- Certification of completion of research seminar and written paper

For details on graduation requirements, see [Graduation Checklist for Masters Plan B candidates](#)

Doctor of Philosophy (PhD) Program Requirements

Note: All student progress forms have been converted to an online format ([Graduate Division Quali Build](#)) and must be completed and submitted by the student at the appropriate point in their training.

Coursework requirements

- All PhD candidates, other than graduates of the TRMD MS program, are required to enroll in the TRMD core curriculum to prepare for the General (Qualifying) Examination.
- Required core courses:
 - TRMD 603 Parasitology
 - TRMD 604 Immunology
 - TRMD 605 Virology
 - TRMD 608 Bacteriology & Mycology
 - TRMD 653 Bioinformatics
 - CMB 626 or MICR 614 Research Ethics
- Other required courses:
 - TRMD 690 Seminar – enrolled each semester (CR/NC); seminar presentation once per year (Letter Grade)
 - TRMD 601 Journal Club – enrolled once per year
- Advanced courses:
 - Doctoral students are expected to enroll in *four advanced courses* in at least three of the major areas of Tropical Medicine (Parasitology, Immunology, Virology, Bacteriology/Mycology) during their graduate training
 - The comprehensive exam will be based on three of the major areas selected for advanced courses; students need to take one course in three major areas before taking the comprehensive exam.
- Additional courses which, based on the recommendations of their adviser and dissertation committee, are essential to prepare them for a research career in their area of specialization

PhD Schedule

Initial Steps Upon Admission

Preliminary conference with graduate program chair

Appointment of research advisor

Doctorate Form 1 - Pre-Candidacy Progress (complete relevant sections)

- Preliminary conference with interim academic adviser
- Identification and remediation plan for deficiencies (if applicable)

Diagnostic Examination

- Objective
 - Evaluate the readiness of the student to take the qualifying examination
- Eligibility
 - Student has completed the first-year core courses (TRMD 603, 604, 605, 608)
 - Usually taken during the summer after the first year
- Format
 - Open-book, written examination; short essay answers
 - One question on each of the following topics
 - Virology
 - Parasitology/Entomology
 - Bacteriology/Mycology
 - Immunology
 - General
 - Epidemiology
 - Molecular Evolution
 - Pharmacology
 - Duration of written examination (3-4 hours)
 - Administered by Tropical Medicine Examination Committee
- Outcomes
 - After evaluation of the student's performance by the Tropical Medicine Examination Committee, a recommendation will be made to the student regarding areas of remediation, if any is needed, before scheduling the qualifying examination
 - Examination is evaluated but results are not included in the student's academic record

Qualifying Examination

- Objective
 - Demonstrate proficiency in core disciplines of Tropical Medicine at the PhD level
- Eligibility
 - Student has completed the first-year core courses (TRMD 603, 604, 605, 608) and has passed the diagnostic examination
 - Usually taken during the fall semester of the second year
- Format
 - Closed-book, written examination; short essay answers
 - Duration of written examination (4 hours)
 - Specified number of questions per section:
 - Virology - 2
 - Parasitology/Entomology - 2
 - Bacteriology/Mycology - 2
 - Immunology - 2

- General
 - Epidemiology - 1
 - Molecular Evolution - 1
 - Pharmacology - 1
- Follow-up oral examination based on evaluation of written examination by Tropical Medicine Examination Committee
 - Duration of oral examination (1-2 hours)
- Administered by Tropical Medicine Examination Committee
- Outcomes
 - Pass all sections of the qualifying examination at the PhD level (no remediation needed)
 - Pass at the MS level but not at the PhD level
 - Student will need to either retake the entire examination or sections of the examination that were deficient
 - Student must pass at the PhD level
 - Failure to pass at the PhD level will result in conversion to the MS program
 - Do not pass
 - Student may retake the examination once
 - Student will need to either retake the entire examination or sections of the examination that were deficient
 - Failure to pass the examination the second time will result in dismissal from the program
- Completion of qualifying examination allows the student to file Form 1
 - File Form 1 (Pre-Candidacy Progress) with Graduate Division

Completion and Submission of *Doctorate Form 1 - Pre-Candidacy Progress*

- Indicates successful completion of qualifying examination

Teaching experience

- Candidates should gain teaching experience by serving as a teaching assistant in a graduate or undergraduate course, or in the medical education curriculum

PhD Dissertation Committee

- Selection of permanent advisor by end of first year
- Preparation of individualized timeline for PhD degree (see sample)
- PhD Dissertation Committee composition (5 members)
 - Research mentor to serve as dissertation committee chair
 - At least two other members of TRMD graduate faculty
 - One outside member (also called the university representative)
 - Must be senior graduate faculty in a graduate program other than Tropical Medicine
 - See [Graduate Division list of eligible faculty for the role of university representative](#)
 - Appointment of remaining committee member from TRMD or other UH graduate faculty
- Although allowable, committees larger than five members are discouraged
 - For eligible committee members see:
<http://manoa.hawaii.edu/graduate/content/select-committee-member>
- A representative of the department's graduate program (Dr. Chang or Dr. Verma) should be included in all committee meetings, comprehensive exam and the dissertation defense to maintain uniformity and equity of standards and procedures.
 - Copies of all committee documents should be provided to department representative
 - The graduate chair should be informed of the graduate program representative
 - The department representative will serve as an ex officio, non-voting member of the dissertation committee

PhD Comprehensive Exam

The comprehensive exam for Tropical Medicine PhD students has undergone revision that took effect in Fall 2022. Students joining the program before Fall 2022 have the option of selecting either the previous or new comprehensive exam format. Students joining the program in or after Fall 2022 will follow the new comprehensive exam format.

Comprehensive Exam Option #1, for Students Enrolled Before Fall 2022

The Tropical Medicine PhD Comprehensive Examination will consist of the preparation and defense of a research proposal based on the student's dissertation research project. This examination should be administered by the end

of the second year of the student's PhD training.

The format of the proposal is to be specified by the dissertation committee and should generally follow the format of a grant proposal to a major funding agency such as the National Institutes of Health or the National Science Foundation. The proposal should be prepared in consultation with the student's research advisor but should include at least one innovative aim that is not included as part of an existing grant or proposal developed by the advisor.

The student's written proposal will be submitted to the members of the student's dissertation committee and an oral examination, based on the written proposal, will be carried out by the committee. The content of this oral examination may include fundamental concepts underlying the hypotheses addressed in the proposal, technical or experimental design issues, and any other topics that the committee feels are pertinent to the student's understanding of his/her research area.

A majority of the committee must vote to pass the student in order for student to pass the exam. The exam may be repeated once. Failure to pass the comprehensive exam after two attempts will result in dismissal from the graduate program.

Guidelines for preparation of the Comprehensive Exam Proposal:

The following guidelines are based on restructured application instructions for NIH R01 grant applications with some modifications.

For more details and examples of successful R01 proposals, please refer to the following website:

<https://www.niaid.nih.gov/grants-contracts/sample-applications>

Comprehensive Exam Proposal Guidelines

Title of Project (not to exceed 200 characters, including the spaces between words and punctuation)

Biographical Sketch

- Use current format required for NIH proposals (see grants.nih.gov website for current biosketch format pages, instructions, and samples)

Project Summary and Relevance

- State the proposal's broad, long-term objectives and specific aims, making reference to the health relatedness of the project (i.e., relevance to the mission of the agency).
- Describe concisely the research design and methods for achieving the stated goals.
- This section should be informative to other persons working in the same or related fields and, insofar as possible, understandable to a scientifically or technically literate reader. Avoid describing past accomplishments and the use of the first person.
- The second component of the Description is Relevance. Using no more than two or three sentences, describe the relevance of this research to public health. In this section, be succinct and use plain language that can be understood by a general, lay audience.

Specific Aims (1 page)

- State concisely the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will field that the proposed project addresses.
- Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields.
- Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will changed if the proposed aims are achieved.

Research Strategy

- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project.
- Innovation
 - Explain how the application challenges and seeks to shift current research or clinical practice paradigms.
 - Describe any novel theoretical concepts, approaches or methodologies, instrumentation or intervention(s) to be developed or used, and any advantage over existing methodologies, instrumentation or interventions
- Include how the data will be collected, analyzed and interpreted.
- Preliminary Studies:
 - Discuss preliminary studies, data, and/or experience pertinent to this application.
 - Preliminary data are an essential part of a research grant application and help to establish the likelihood of success of the proposed project.

- Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.
- Describe any strategy to establish feasibility and address the management of any high-risk aspects of the proposed work.
- Point out any procedures, situations, or materials that may be hazardous to personnel and precautions to be exercised. A discussion on the use of Select Agents should be provided, if applicable.

Protection of Human Subjects

- Describe and justify the proposed involvement of human subjects, inclusion of women and minorities, and inclusion of children in the work outlined in the Research Strategy section.
- Describe the characteristics of the subject population, including their anticipated number, age range, and health status if relevant.
- Describe sources of material, potential risks to subjects (physical, psychological, financial, legal, or other), and protection against risks
- Describe and justify the sampling plan, as well as the recruitment and retention strategies, informed consent, and the criteria for inclusion or exclusion of any subpopulation.
- Explain the rationale for the involvement of special vulnerable populations, such as fetuses, neonates, pregnant women, children, prisoners, institutionalized individuals, or others who may be considered vulnerable populations. Note that ‘prisoners’ includes all subjects involuntarily incarcerated (for example, in detention centers) as well as subjects who become incarcerated after the study begins.

Vertebrate Animals

If vertebrate animals are involved in the project, address each of the points below. This section should be a concise, complete description of the animals and proposed procedures.

- Provide a detailed description of the proposed use of the animals for the work outlined in the Research Strategy section. Identify the species, strains, ages, sex, and numbers of animals to be used in the proposed work.
- Justify the use of animals, the choice of species, and the numbers to be used. If animals are in short supply, costly, or to be used in large numbers, provide an additional rationale for their selection and numbers.

- Provide information on the veterinary care of the animals involved.
- Describe the procedures for ensuring that discomfort, distress, pain, and injury will be limited to that which is unavoidable in the conduct of scientifically sound research.
- Describe the use of analgesic, anesthetic, and tranquilizing drugs and/or comfortable restraining devices, where appropriate, to minimize discomfort, distress, pain, and injury.
- Describe any method of euthanasia to be used and the reason(s) for its selection. State whether this method is consistent with the recommendations of the American Veterinary Medical Association (AVMA) Guidelines on Euthanasia. If not, include a scientific justification for not following the recommendations.

Select Agent Research

- If any of the activities proposed in the application involve the use of Select Agents at any time during the proposed project period, either at the applicant organization or at any other Project/Performance Site, address the following three points for each site at which Select Agent research will take place.
 - Identify the Select Agent(s) to be used in the proposed research.
 - Provide the registration status of all entities* where Select Agent(s) will be used.
 - If the Project/Performance Site(s) is a foreign institution, provide the name(s) of the country or countries where Select Agent research will be performed.

*An “entity” is defined in 42 CFR 73.1 as “any government agency (Federal, State, or local), academic institution, corporation, company, partnership, society, association, firm, sole proprietorship, or other legal entity.”

- Provide a description of all facilities where the Select Agent(s) will be used.
- Describe the procedures that will be used to monitor possession, use and transfer of the Select Agent(s).
- Describe plans for appropriate biosafety, biocontainment, and security of the Select Agent(s).
- Describe the biocontainment resources available at all performance sites.

Comprehensive Exam Option #2, for Students Enrolled In or After Fall 2022

The comprehensive exam has been revised to ensure that PhD students

demonstrate an advanced knowledge base Tropical Medicine upon completion of their training. The objectives of these revisions are:

- To demonstrate integration of the core disciplines of Tropical Medicine,
- To demonstrate a high level of mastery of Tropical Medicine concepts,
- To demonstrate the ability to apply disciplinary knowledge to real-world problems in Tropical Medicine

Students become eligible for the comprehensive exam after passing the qualifying examination at the PhD level; completing a *minimum* of 3 advanced courses in Tropical Medicine in the following major areas: parasitology, virology, bacteriology, immunology (note that a total of 4 advanced courses are required for PhD students); and participating in Tropical Medicine journal clubs and seminars. The comprehensive examination should be scheduled during the third year of the PhD program. Students should meet with the graduate chair when they are planning to take the comprehensive exam to discuss the three subject areas to be covered in their exam and to schedule the exam.

The structure of the revised comprehensive exam will consist of an oral examination by the Tropical Medicine Examination Committee based on three topics assigned by the committee. These topics will be based on the advanced courses taken by the student. Students may prepare written essays addressing the topics (optional) and may bring their notes and essays to the examination. A list of references and resources used to prepare for the examination should be submitted to the committee two days before the oral exam as a pdf file. The timeframe for preparation for the oral examination will be two weeks after the topics are provided. The duration of the oral examination will be two hours.

The composition of the Tropical Medicine Examination Committee will consist of representatives of the major areas of Tropical Medicine, including faculty teaching advanced courses in these areas.

Students who pass all assigned topics with no remediation needed will pass the comprehensive exam. Students who do not pass all of the assigned topics will need to retake the portion(s) of the examination that was deficient or retake the entire examination if appropriate. Students may retake the examination once. Failure to pass the examination a second time will result in dismissal from the program.

Dissertation Research Proposal

The objectives of the dissertation research proposal are to:

- Demonstrate the academic merit of the student's dissertation research questions and the selection of an appropriate experimental approach to address those questions
- Convince the dissertation committee that the student is ready to develop and start a plan for their dissertation research and that their plan is feasible within the proposed time frame and available resources

Students are eligible to submit the dissertation research proposal once they have passed the Tropical Medicine qualifying examination at the PhD level and are in the 2nd or 3rd year of the doctoral program.

The format of the research proposal is a written document using the NIH Small Grants Program (R03) format and should meet the following requirements:

- The proposal should include two or three specific aims
- Preliminary data are required in the proposal
- Adherence to NIH R03 guidelines (e.g., one-page Specific Aims; six page Research Strategy)
- Budget pages are *not* required
- Timeline may be adjusted to allow for flexibility in the student's training program

In addition to the written proposal, the student also should present their research proposal orally at a department seminar or at another scheduled time. A follow-up meeting to review and discuss the research proposal will be conducted by student's dissertation committee, including one representative of the Tropical Medicine graduate program either as a regular or ad hoc (non-voting) member of the committee.

Successful presentation and defense of the research proposal will be required for approval of the research proposal by student's dissertation committee.

Completion of the research proposal and comprehensive exam enables the student to file Form 2 (Advance to Candidacy) with Graduate Division.

Advance to Candidacy

Submission of dissertation topic and proposal to committee for their review and approval should take place sometime during the second year of training

- For students selecting the comprehensive exam option #1, the written research proposal may be similar to the document prepared for the

comprehensive examination but should specify the actual scope of the dissertation research project

- The dissertation proposal shall be presented as a departmental seminar

Preparation and approval of the research proposal should be completed by the end of the fourth semester.

Certification, approvals and guidance should be obtained as needed and documentation should be provided when submitting Form 2:

- Committee on Human Studies
<http://www.hawaii.edu/irb/ph>. (808)539-3955
- Environmental Health & Safety Office
<http://www.hawaii.edu/ehso/ph>. (808)956-8660
- Institutional Animal Care and Use Committee
<http://www.hawaii.edu/ansc/IACUC/ph> (808)956-4446

Summary of requirements for submission of *Doctorate Form 2 - Advance to Candidacy*

- Appointment of dissertation committee
- Committee approval of research topic and proposal
- Successful completion of the comprehensive exam
- Submission of all required approval/compliance documents

Form 2 must be approved by Graduate Division in order for the student to register for Dissertation 800

Final Examination and Dissertation Defense

- Administered by the dissertation committee upon completion of the dissertation research in the form of a seminar presentation, defense and oral examination
- Final Oral Examination form must be submitted to Graduate Division at least two weeks before the oral defense date.
 - *The department should also be informed of the scheduled defense date.*
 - The defense seminar announcement must be published in the UH Mānoa calendar and circulated to all faculty and student via email.
- Committee evaluation is based on the following criteria:
 - Student's proficiency in the area of specialization within the field of Tropical Medicine commensurate with the expectations of the PhD degree
 - Production of a body of work which is on par with program expectations for the specific degree
 - Ability of the student to effectively communicate and defend this body of work
 - A majority of the committee must vote to pass the student in order for

- student to pass the defense.
- The defense may be repeated once.
 - Failure to pass after two attempts will result in dismissal from the graduate program.
 - The final oral defense must be completed at least 6 weeks before end of semester in which the degree granted

Completion and submission of *Doctorate Form 3 - Dissertation Evaluation*

- Approved by doctoral committee members who participate in final defense, including proxies
- Signifies approval of dissertation document and student's defense by the doctoral committee
- Submit to Graduate Division no later than 3 wks prior to dissertation due date

Completion and submission of *Doctorate Form 4 - Dissertation Submission*

- Replaces signature page of dissertation
- Signifies approval of the content and form of the final dissertation document
- Signed by dissertation committee chair and majority of committee, including committee member(s) who may have been absent at the defense
- Due date specified in UH Mānoa Academic Calendar
 - An extension may be requested for dissertation submission to the Tropical Medicine graduate chair in the form of a written request
 - The dissertation must be submitted to ProQuest no later than the last day of the semester in order to graduate that semester.

For details on graduation requirements, see [Graduation Checklist for PhD Doctoral candidates](#)

Summary of Tropical Medicine Graduate Program Requirements

Requirements	MS Plan A	MS Plan B	PhD
Course credits	30 credit hours	30 credit hours	N/A
	18 credit hours approved coursework, excluding 699 and 700	18 credit hours approved coursework, excluding 699 and 695	
Required, core courses	TRMD 603 TRMD 604 TRMD 605 TRMD 608 TRMD 653 CMB 626 or MICR 614–Research ethics	TRMD 603 TRMD 604 TRMD 605 TRMD 608 TRMD 653 CMB 626 or MICR 614–Research ethics	TRMD 603 TRMD 604 TRMD 605 TRMD 608 TRMD 653 CMB 626 or MICR 614–Research ethics
Required courses	TRMD 601 – journal club, enroll once per year	TRMD 601 – journal club, enroll once per year	TRMD 601 – journal club, enroll once per year
	TRMD 690 – seminar; enroll every semester; research presentation once per year	TRMD 690 – seminar; enroll every semester; research presentation once per year	TRMD 690 – seminar; enroll every semester; research presentation once per year
Advanced courses	Advanced courses as recommended by the thesis committee		At least four advanced TRMD courses in three areas of Tropical Medicine
Research requirements	TRMD 699: Directed Research	TRMD 699: Directed Research (3 cr hrs)	TRMD 699: Directed Research

	TRMD 700: Thesis Research (9 cr hrs)	TRMD 695: Research Paper (3 cr hrs)	TRMD 800: Dissertation Research
Diagnostic evaluation	End of second semester	End of second semester	End of second semester
Qualifying exam	Third semester	Third semester	Third semester
Comprehensive exam	N/A	N/A	After selection of research topic and dissertation committee and completion of advanced course requirements
Thesis/Dissertation Committee selection	End of second semester	End of second semester	Estimated end of fourth year
Thesis/Dissertation proposal	Second or third semester	Second or third semester	Estimated end of fourth year
Thesis/Dissertation defense	Fourth semester	Fourth semester (research seminar)	
Thesis/Dissertation submission	End of fourth semester	End of fourth semester (research paper)	

Academic Policies

Undergraduate and graduate students in the School of Medicine must adhere to the academic policies, student conduct code, and grievance policies of UH Mānoa. A summary description of these policies may be found in the online catalog:

- Academic Policies

<https://manoa.hawaii.edu/ovpae/academic-policies/> (M5.200 General Academic Policies)

- UH Mānoa Student Conduct Code

http://www.studentaffairs.manoa.hawaii.edu/policies/conduct_code/

- Graduate Academic Grievance Procedures

http://www.studentaffairs.manoa.hawaii.edu/policies/academic_grievance/

- Title IX: Prohibition of Sex Discrimination in Education

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

- Student Success Resources

The Division of Student Success (DSS) houses student support services to build success inside and outside the classroom. If you want learning assistance, academic advising, career resources and guidance, counseling, family and relationship support, identity-based support, services for underrepresented groups, health and wellness services, opportunities for leadership growth, and community engagement, you will find this and more in DSS, (808) 956-3290

<https://manoa.hawaii.edu/studentssuccess/departments/>.

Contact the department chair or graduate program chair if you have any questions or need advice regarding these policies.

Curriculum

Prerequisites: All students are required to have a background of undergraduate courses in medical microbiology, molecular and cell biology, organic chemistry and biochemistry, physics, and mathematics. An introductory course in immunology (e.g. MICR 461) is highly recommended.

The required and/or recommended courses for Tropical Medicine MS and PhD programs are divided into three groups:

Group I - Tropical Medicine Core Courses

The core curriculum for MS and PhD students is as follows:

Semester Hours	Course Title	Credit
<i>Fall Semester Yr 1:</i>		
TRMD 603	Infectious Disease Microbiology I: Parasitology	3
TRMD 604	Concepts in Immunology and Immunopathogenesis	2
TRMD 653	Bioinformatics for Infectious Disease	2
<i>Spring Semester Yr 1:</i>		
TRMD 605	Infectious Disease Microbiology II: Virology	3
TRMD 608	Infectious Disease Microbiology III: Bacteriology & Mycology	3
<i>Fall or Spring Semester, Yr 1 or 2:</i>		
CMB 626 or MICR 614	Research Ethics	1-2
<i>Fall and Spring Semesters each yr:</i>		
TRMD 690	Seminar in Tropical Medicine & Public Health*	1
<i>Fall or Spring Semesters each yr:</i>		
TRMD 601	Journal Club	1
<i>Fall and Spring Semesters each yr:</i>		
TRMD 699	Directed Research (under research advisor)	var
<i>Final Semester:</i>		

TRMD 700	MS Thesis research	9**
TRMD 800	PhD Dissertation research	1

* Students must enroll for a grade (A-F), make a presentation once per academic year, and attend all seminars. Students may enroll for Cr/NCr during the other semester of that academic year and attend all seminars without making a presentation.

**All or a portion of TRMD 699 credits may be converted to 700 to total 9 credits for graduation upon submission of a memo to Graduate Division by the graduate chair.

Group II - Tropical Medicine Elective Courses

To be selected by the student and his/her adviser and graduate committee according to the student's interests and needs.

TRMD 602	Laboratory Methods in Tropical Medicine
TRMD 606	Tropical Medicine Lab Rotation
TRMD 607	Neurovirology
TRMD 609	Advances in Medical Immunology
TRMD 610	Infection and Immunity
TRMD 650	Ecological Epidemiology
TRMD 651	Vaccinology
TRMD 652	Advanced Genetics & Evolution of Infectious Diseases
TRMD 653	Bioinformatics and Molecular Evolution
TRMD 654	Advances in HIV/AIDS
TRMD 655	Principles of Biostatistics
TRMD 671	Advanced Medical Parasitology
TRMD 672	Advanced Medical Virology
TRMD 673	Advanced Medical Bacteriology
TRMD 675	Epidemiology of Tropical Infectious Diseases
TRMD 695	Plan B Master's Project
TRMD 699	Directed Reading/Research
TRMD 705	Special Topics in Tropical Medicine

Group III - Elective Courses in Related Fields (see UH Mānoa catalog for updated course listings)

Asian Studies (ASAN)

600 Asian Studies Seminar

Biochemistry (BIOC)

- 441 Basic Biochemistry
- 644 Metabolic Biochemistry

Cell & Molecular Biology (CMB)

- 606 Introduction to Neurosciences
- 621 Cell Molecular Biology I
- 622 Cell Molecular Biology II
- 625 Advanced Topics in Genetics
- 626 Ethics in Biomedical Research
- 640 Neuropharmacology
- 650 Population Genetics
- 654 Genetics Seminar
- 669 Essentials in Grant Writing
- 671 Techniques in Genetics
- 705 Special Topics in Neurosciences

Geography (GEOG)

- 410 Human Role in Environmental Change
- 411 Paleoenvironmental Change
- 388 Introduction to GIS
- 489 Applied Geographic Information Systems
- 654 Seminar in Geography of S.E. Asia
- 665 Seminar in Geography of the Pacific

Interdisciplinary Studies (IS)

- 650 Principles of Applied Evolutionary Ecology
- 651L Laboratory in Applied Evolutionary Ecology

652L Laboratory in Applied Evolutionary Ecology

Microbiology (MICR)

461 Immunology
463 Microbiology of Pathogens
470 Bacterial Microbial Pathogenesis
475 Bacterial Genetics
485 Microbes and Their Environment
490 Virology
601 Molecular Cell Biology
614 Research Ethics
625 Advanced Immunology
630 Microbial Genome
632 Advanced Microbial Physiology
655 Advanced Virology
661 Regulations of Gene Expressions in
Microorganisms
671 Bacterial Genetics
680 Advances in Microbial Ecology
681 Host-Parasite Relationships
685 Molecular and Cellular Bacterial Pathogenesis

Molecular Biosciences & Bioengineering (MBBE)

601 Molecular Cell Biology
602 Molecular Biology and Genetics
611 Professional Development
621 Metabolic Engineering

625	Biological Instrumentation
627	Molecular Diagnostics: Principles and Practices
650	DNA and Genetic Analysis
651	Signal Transduction and Regulation of Gene Transcription
683	Advanced Bioinformatics Topics for Biologists
687	Advanced Lab Techniques

Pharmacology (PHRM)

601	General Pharmacology
602	Systematic Pharmacology
604	Neuropharmacology

Plant & Environmental Protection Sciences (PEPS)

486	Insect-Microbe Interactions
641	Insect Physiology
661	Medical and Veterinary Entomology
662	Systematics and Phylogenetics
671	Insect Ecology
675	Biological Control of Pests
686	Insect Transmission of Plant Pathogens

Public Health Sciences (PH)

611	Fundamentals to One Health
646	Grant Writing in Public Health
650	Ecological Epidemiology

652	Interdisciplinary Seminar
655	Biostatistics I
656	Biostatistics II
658	Computer Applications in Public Health
663	Principles of Epidemiology I
664	Principles of Epidemiology II
666	Seminar in Infectious Disease Control
669	Epidemiological Study Design Critique
675	Community Engaged Research and Practice
690	Global Health Challenges
692	Clinical Epidemiology
692	Statistical Methods in Epidemiological Research

Zoology (ZOOL)

487	Molecular Ecology
619	Seminar on Science Teaching
631	Biometry
632	Advanced Biometry
642	Cellular Neurophysiology
652	Population Biology
690	Conservation Biology

Student Learning Outcomes

Master of Science in Biomedical Sciences (Tropical Medicine)

1. Demonstrate a fundamental knowledge base in the major sub-disciplines of the field of Tropical Medicine: bacteriology, virology, mycology, parasitology, immunology, molecular epidemiology and evolution, infectious disease ecology, pharmacology and bioinformatics.
2. Demonstrate a mastery of technical and experimental methodologies required to conduct research in the field of Tropical Medicine.
3. Demonstrate the ability to plan, execute, interpret, and evaluate experimental studies in Tropical Medicine.
4. Demonstrate skills required for instruction, assessment and mentoring of undergraduate and MS level students.
5. Demonstrate proficiency in written and verbal communication skills in classroom lectures and other teaching formats and in professional seminars and presentations.
6. Demonstrate sufficient mastery and scientific maturity to assess the work of peers in related fields.

Doctor of Philosophy in Biomedical Sciences (Tropical Medicine)

1. Demonstrate an advanced knowledge base in the major sub-disciplines of the field of Tropical Medicine: bacteriology, virology, mycology, parasitology, immunology, molecular epidemiology and evolution, infectious disease ecology and bioinformatics.
2. Demonstrate a mastery of technical and experimental methodologies required to conduct research in the field of Tropical Medicine.
3. Demonstrate the ability to plan, execute, interpret, and evaluate experimental studies in Tropical Medicine.
4. Demonstrate skills for instruction, assessment and mentoring of undergraduate, MS and PhD level students.
5. Demonstrate skills to verbally communicate scientific concepts and results in classroom lectures and other teaching formats and in professional seminars and presentations.
6. Demonstrate written communication skills as required in various professional duties including manuscript preparation for scientific publication, preparation of research grant applications, preparation of lecture notes, development of introductory and advanced courses in related disciplines.
7. Demonstrate sufficient mastery and scientific maturity to assess the work of peers in related fields.
8. Develop administrative skills to manage a research laboratory, supervise technical and professional staff, and assume responsibilities and provide leadership as a faculty member.

Tropical Medicine (TRMD) Course Descriptions

TRMD 350 One Health: Preparing for the Next Pandemic (3) Focuses on the COVID-19 pandemic as a case study of a global health problem that is optimally approached from a One Health perspective. A-F only. Pre: ANSC 200, BIOL 101, MICR 130, PH 201, or consent of instructor. (Spring only) (Cross-listed as IS 350) DB

TRMD 395 One Health Journal Club (1) Students gain critical reading skills in the presentation and discussion of published literature on One Health-related topics. Repeatable unlimited times. A-F only. Pre: PH 441. (Fall only) (Cross-listed as IS 395)

TRMD 431 Principles of Medical Parasitology (2) Epidemiology, pathogenesis, immunobiology and diagnostic aspects of human parasitic infections; principles of host-pathogen interactions; public health aspects of parasitic infections. Repeatable one time. A-F only. Pre: MICR 351 with a grade of B or higher or equivalent. (Spring only)

TRMD 440 International Training in Biosciences Research (3) Combines weekly lectures by faculty for discussion of the 9 Steps of Research and completion of training courses for working with human subjects, including research ethics, laboratory safety, blood-borne pathogens, and principles of health disparity. MHIRT cohort only. A-F only. (Summer only)

TRMD 441 International Health Disparities (2) Overview of biosciences research related to health and health disparities in a global setting as well as in Hawai'i. Workshop topics include health research, Native Hawaiian health, global health, and cultural competency. MHIRT cohort only. A-F only. (Summer only)

TRMD 442 Research Abroad (5) Hands-on research experience at assigned international sites. Students learn research and analytical skills in the field and laboratory setting, and present data to peers and faculty upon completion of the training. MHIRT cohort only. A-F only. (Summer only)

TRMD 463 Medical and Urban Entomology (3) (2 Lec, 1-3-hr hybrid Lab) Biology, ecology, health and economic impacts, and control of urban insect pests and medically important arthropods that act as vectors of diseases. Pre: PEPS 363 or BIOL 265, or consent. (Cross-listed as PEPS 463)

TRMD 485 One Health Practicum (3) Provide certificate students with real-world experience and opportunity to integrate and apply classroom learning in a professional environment. Intended for students who prefer to pursue a supervised, practical experience rather than a research-based project. A-F only. Pre: PH 441. (Cross-listed as IS 485)

TRMD 490 One Health Seminar (2) Weekly presentations and discussions on current events and research in the field of One Health. Presentation topics may include research progress, literature reviews, or research proposals. Repeatable unlimited times. A-F only. Pre: PH 441. (Spring only) (Cross-listed as IS 490)

TRMD 499 Reading and Research (V) Directed reading and research in laboratory; diagnostic aspects of bacterial, parasitic, and viral infections. Pre: consent.

TRMD 500 Master's Plan B/C Studies (1) Enrollment for degree completion. Pre: Master's Plan B or C candidate and consent.

TRMD 512 Unit II Concurrent Elective (1) Elective course for first-year medical students. CR/NC only. Pre: BIOM 551 and consent.

TRMD 513 Unit III Concurrent Elective (1) Elective course for first-year medical students. CR/NC only. Pre: BIOM 551 and consent.

TRMD 514 Unit IV Concurrent Elective (1) Elective course for second-year medical students. CR/NC only. Pre: BIOM 551 and consent.

TRMD 515 Unit V Concurrent Elective (1) Elective course for second-year medical students. CR/NC only. Pre: BIOM 551 and consent.

TRMD 525 Unit V Block Elective (1) Required elective for second-year medical students; objectives to be determined by contract. One option is a review of USMLE step. CR/NC only. Pre: BIOM 551.

TRMD 545 Topics in Tropical Medicine (V) Elective for fourth-year medical students for advanced study of selected topics within the field of tropical medicine and medical microbiology. Pre: fourth-year standing.

TRMD 595 (Alpha) Selected Topics in Infectious Diseases (1) Elective for medical students; (B) infectious diseases & One Health; (C) parasitology; (D) epidemiology; (E) immunology. MD majors only. CR/NC only. Pre: MDED 554 or consent. Fall only.

TRMD 599 (Alpha) Selected Research Topics in Infectious Diseases (1) Research elective for medical students; (B) infectious diseases; (C) parasitology; (D) epidemiology; (E) immunology. MD majors only. CR/NC only. Pre: MDED 554 or consent. Fall only.

TRMD 601 Tropical Medicine Journal Club (1) Discussion of current literature relevant to Tropical Medicine. Repeatable.

TRMD 603 Infectious Disease Microbiology I: Medical Parasitology (3) Epidemiology, pathogenesis, immunobiology and diagnostic aspects of human parasitic infections;

principles of host-pathogen interactions; public health aspects of parasitic infections. Repeatable one time. A-F only. Pre: MICR 351 or equivalent. Fall only.

TRMD 604 Concepts in Immunology and Immunopathogenesis (2) Immunological concepts relating to infectious diseases and host pathogen interactions. Repeatable one time. A-F only. Pre: MICR 461 (or equivalent) or consent. (Cross-listed as PH 665)

TRMD 605 Infectious Disease Micro II (3) This course will cover different families of animal viruses of importance to human diseases. The genome, structure, and replication cycle of viruses, as well as host immune responses, epidemiology, clinical features and animal models will be covered and integrated to understand the pathogenesis of diseases caused by different viruses and intervention strategies of therapy and vaccine. Repeatable one time. A-F only.
Pre: MICR 351 and TRMD 604; or consent. Spring only. (Cross-listed as PH 667)

TRMD 606 Tropical Medicine Laboratory Rotations (V) Practical experience in use of equipment and procedures in infectious disease and immunology research; introduction to research in tropical medicine. Repeatable unlimited times. Pre: 604 (or concurrent), or consent. (Cross-listed as PH 668)

TRMD 607 Neurovirology (1) Seminar course on neuroinvasive viruses giving basics of viruses causing nervous system diseases and discussing recent advances in the research field of neurovirology. Pre: MICR 351 or equivalent; or consent. Fall only.

TRMD 608 Infectious Disease Micro III (3) This course will cover the basic structure, physiology and genetics of pathogenic bacteria as well as the host response to these organisms. Major bacterial diseases will be covered in depth to correlate bacterial structure, physiology, epidemiology and host response to these microorganisms to understand the pathogenesis of the diseases they cause. Repeatable one time. A-F only.
Pre: MICR 351 and TRMD 604; or consent. Fall only.

TRMD 609 Advances In Medical Immunology (3) Presentations/discussions of current literature concerning recent advances in immunology relevant to disease and to disease processes. Pre: consent. (Alt. years: spring)

TRMD 610 Infection and Immunity (2) This course will provide a detailed description of specific pathogens (bacterial, viral, parasitic and fungal) and their interactions with the human immune system, including innate and acquired immunity.

TRMD 650 Advanced Epidemiological Ecology of Infectious Diseases (2) Applications of population biology, pathogen/host life history, and population genetics to infectious disease epidemiology, including micro- and macro-parasites, and implications to disease control and prevention of strategies. A-F only. Pre: 604 (or concurrent) and 605 (or concurrent), or consent. (Alt. years: spring)

TRMD 651 Vaccinology (2) History/evolution of vaccines, current and next generation vaccines, vaccine immunology, adjuvants, vaccine strategies, vaccines for viral, bacterial and parasitic diseases, vaccine proof-of-concept and downstream development studies; vaccine safety production processes. A-F only. Pre: 605 (Virology) and 604 (Immunology), or consent. (Spring)

TRMD 652 Advanced Genetics and Evolution of Infectious Diseases (2) An evolutionary perspective to examine the interactive responses between infectious agents and the immune system. Topics will include natural selection, life history evolution, population genetics of pathogens and hosts, and anti-microbial resistance. A-F only. Pre: 604 (or concurrent) and 605 (or concurrent), or consent. (Alt. years: spring)

TRMD 653 Bioinformatics I (3) Provides fundamental concepts in bioinformatics with strong emphasis on hands-on training. Topics such as molecular biology, sequence alignment, biological databases, phylogeny, and genomics including microarray and RNA-sequence analysis. Repeatable one time, but credit earned one time only. Open to nonmajors. A-F only. (Fall only) (Cross-listed with QHS 610)

TRMD 654 Advances in HIV/AIDS (2) History of HIV, basic biology and virology, epidemiology, HIV pathogenesis and immunology, clinical features, and co-morbidities. Treatment and prevention of HIV/ AIDS, including research methods, statistics, cultural competence, genetics, pathophysiology, drug and vaccine development. Repeatable unlimited times. A-F only. Pre: 604 and 605, or consent. (Fall only)

TRMD 655 Fundamentals of Biostatistics (3) Fundamental biomedical statistics concepts and tools will be introduced, as well as their applications to biomedical data. Students will perform hands-on analysis using statistical software and learn to interpret and present the results. A-F only. (Fall only) (Cross-listed as QHS 601)

TRMD 671 Advanced Medical Parasitology (2) Consideration of ultrastructure, physiology, biochemistry, in-vitro cultivation and host-parasite relationship of parasites of medical importance. A-F only. Pre: consent. (Alt. years: fall)

TRMD 672 Advanced Medical Virology (2) In-depth study of the major groups of viruses pathogenic for human; virus replication, host range, pathogenesis, immunology, and epidemiology. Pre: 605 or equivalent, or consent. (Alt. years: fall)

TRMD 673 Advanced Medical Bacteriology (2) Role of bacteria in infectious diseases, with emphasis on clinical aspects and identification of etiological agents. Pre: 605 or equivalent, or consent.

TRMD 675 Epidemiology of Tropical Infectious Diseases (3) Epidemiology of infectious diseases as it relates to tropical medicine. Lecture/seminar format. A-F only. Pre: TRMD

graduate standing or consent. (Spring only)

TRMD 690 Seminar in Tropical Medicine and Public Health (1) Weekly discussion and reports on current advances in tropical medicine and public health. (Cross-listed as PH 755)

TRMD 695 Plan B Master's Project (3) Independent study for students working on a Plan B Master's project. A grade of Satisfactory (S) is assigned when the project is satisfactorily completed. Pre: graduate standing in TRMD.

TRMD 699 Directed Research (V) Directed research in medical microbiology (bacteriology, parasitology, virology). Pre: consent.

TRMD 700 Thesis Research (V) Research for master's thesis. Approval of department faculty required.

TRMD 705 Special Topics in Tropical Medicine (V) Advanced instruction in frontiers of tropical medicine and public health. Repeatable. (Cross-listed as PH 756)

TRMD 705 Special Topics in Tropical Medicine (One Health) (3) Advanced instruction in the One Health approach. Repeatable. (Cross-listed as PH 756)

TRMD 800 Dissertation Research (V) Research for doctoral thesis. Approval of department faculty and Graduate Division are required.

Financial Support

Graduate Assistantships (GAs)

Departmental graduate assistantships (GAs) are funded by the John A. Burns School of Medicine and are offered by the Department of Tropical Medicine, Medical Microbiology and Pharmacology to outstanding first-year PhD students. The Tropical Medicine Admissions and Awards Committee administers these departmental GAs. In addition, graduate students may receive funding by faculty mentor-provided GAs from research grants or institutional funds. These GAs are offered to qualified students by their faculty mentors.

Teaching assistants (TAs) usually have a 9-month appointment that aligns with the academic year. While the Department of Tropical Medicine, Medical Microbiology and Pharmacology does not have its own TA positions, TAs for graduate students are available in through other departments that offer undergraduate courses. The specific duties of a TA vary depending on the needs of the department and on the qualifications and experiences of the TA. All TAs serve under the direction and supervision of a regularly appointed member of the faculty. They may teach a section of a multi-section course or a laboratory section of a course. In addition, they may assist a faculty member in grading assignments or exams, advising students, or performing course-related administrative duties. Occasionally, an experienced TA may be assigned as the instructor of a course. In such a case, the TA must meet all the qualifications required of a lecturer for the course or have completed a relevant training program. All new TAs are required to attend a training session offered by the Office of Faculty Development and Academic Support — Center for Teaching Excellence.

University policy stipulates that in a course taught by a TA, the determination of final grades is the responsibility of the supervising faculty. However, since the TA plays a significant role in determining grades, the supervising faculty and the TA should thoroughly discuss course grading policies and procedures. To ensure fairness to all students enrolled in the course, grading policies and procedures should be announced in the beginning of the semester. TAs should be knowledgeable about official university policies on credits and grades, disciplinary actions, and academic grievance procedure. They should also be aware of the various student services available at the Office of Student Affairs, so that they may refer students to the appropriate resources when necessary.

Research assistants (RAs) usually have an 11-month appointment. In general, a RA supports the research activities of a faculty who is the principal investigator of a funded project. The specific duties of a RA vary depending on the needs of the project and on the

qualifications and experiences of the RA. The duties may be directly or tangentially related to the RA's program of study, while results from the research project may be incorporated into a thesis or dissertation as relevant. Some RAs exercise a great degree of independence while performing their duties; others carry out specific tasks that leave little room for independent judgment. RAs should be knowledgeable about official university policies on research and publication.

GA Compensation

GA compensation adheres to the schedule (based on 0.50 FTE per year) approved by the UH Board of Regents. Newly appointed GAs are compensated at a pay step recommended by the department or unit of hire following compensation guidelines established by Graduate Division. GAs with research duties are appointed at pay steps based on their qualifications and experiences, the needs of their departments or units, and the availability of funds.

Tuition Exemption

GAs with 0.50 FTE appointments receive a full tuition exemption. New GAs with 11-month appointment must be employed for at least 12 weeks during the first semester to qualify for a tuition exemption. Tuition exemptions apply to fall and spring semesters, and *may not* be used for Outreach College and Distance Education courses. Summer Session tuition exemptions, when available, are issued by the Outreach College. GAs are responsible for the payment of fees. GAs who resign before serving at least three-quarters of a semester are liable for repayment of tuition exemptions.

Health Plan & Parking Permits

GAs with 0.50 FTE appointment who serve for a minimum of three months are eligible for employee health plan benefits. For more information, contact the personnel officer in the department or unit of hire.

Availability of parking permits is limited. Parking at the JABSOM Kakaako campus is handled by the Facilities Management & Planning Office.

WICHE Program

The Tropical Medicine graduate program participates in the Western Regional Graduate Program (WRGP), administered by the Western Interstate Commission on Higher Education (WICHE). The program enables legal residents of WICHE member states to enroll in selected out-of-state graduate programs at reduced tuition rates. Below is a list of WICHE member states.

- Alaska
- American Samoa

- Arizona
- California
- Colorado
- Commonwealth of the Northern Mariana Islands
- Federated States of Micronesia
- Guam
- Hawai'i
- Idaho
- Montana
- Nevada
- New Mexico
- North Dakota
- Oregon
- Republic of the Marshall Islands
- Republic of Palau
- South Dakota
- Utah
- Washington
- Wyoming

Through WRGP, legal residents of WICHE member states may enroll in selected out-of-state graduate programs at resident tuition rates. They apply directly to the institutions of their choice and identify themselves as WICHE WRGP applicants. WICHE WRGP applicants applying to UH Mānoa are required to meet the GPA requirement of 3.0 or higher, or otherwise possess certain exceptional abilities as affirmed by the UH Mānoa graduate program to which they apply.

Graduate Student Scholarships and Awards

Graduate Division Achievement Awards

A limited number of merit-based Graduate Division Achievement Scholarships are available to qualified Tropical Medicine graduate students.

Eligibility & How to Apply

To be eligible, a student must be a student in the master's or doctoral program and have a cumulative GPA of 3.5 or above. Students apply through their graduate programs. Awards are competitive.

Award Amount

The award amount varies, depending on the purpose of the award and funding availability. Minimum award is \$500.

Award Conditions

Award recipients must maintain an enrollment of six credits or more of degree-related courses and a cumulative GPA of 3.5 or above, for the entire period of the award. Recipients will be liable to reimburse UH Mānoa for the full amount of the award, if they fail to meet the award conditions or if for any other reason the award becomes invalid.

Award Distribution Procedure

The Graduate Division allocates achievement scholarships to graduate programs, which in turn distribute the awards to qualified students via BANNER and STAR at the time of registration.

For scholarships made to international students, the total amount of awards distributed via BANNER and STAR may not exceed the total cost of tuition and fees.

UH Foundation Endowment Awards

Joseph E. Alicata Award in Tropical Medicine

The Joseph E. Alicata Award was established in 1981 by Dr. Joseph Alicata and Mrs. Earleen Alicata to encourage the study of Tropical Medicine and Infectious Diseases and to reward outstanding scholastic achievement by graduate students in this field of study. It commemorates the lifetime achievements of Dr. Alicata in parasitology and public health as a professor at the University of Hawaii and a commissioned officer of the US

Public Health Service.

There are two merit-based mechanisms for distribution of the Alicata Award:

1. A graduate stipend and tuition scholarship to selected, incoming PhD students during their first year of graduate training,
2. An achievement award to graduating PhD students during the final semester of their graduate education.

In both cases, the award amount varies depending on the purpose of the award and funding availability.

Hinshaw Biomedical Research Scholarship

A scholarship has been established by Chancellor Virginia S. Hinshaw to assist students with a focus in the field of biomedical science in the Department of Tropical Medicine, Medical Microbiology & Pharmacology at the University of Hawai'i at Mānoa John A. Burns School of Medicine.

Recipients must be full-time, graduate students with a focus on biomedical research in the department. Other required qualifications are a cumulative GPA of 3.0 or above and demonstrated leadership skills and academic excellence.

One to two scholarships in the amount of \$1000-1500 will be awarded annually.

Recipients are eligible for scholarship renewal for a maximum of two years provided they reapply and continue to meet eligibility criteria.

Wallace-Taylor Award

This award was established by Emeritus Tropical Medicine Professor Diane W. Taylor and Dr. Gordon D. Wallace to support Tropical Medicine graduate student to present their research results at scientific conferences and in peer-reviewed scientific publications.

Funds may be used for, but are not limited to, costs associated with attending conferences and publishing their research, and other related expenditures.

Full-time or part-time graduate students pursuing a Tropical Medicine graduate degree within the Department of Tropical Medicine, Medical Microbiology and Pharmacology at JABSOM are eligible to apply. Selection will be based on academic merit and/or quality of research as determined by the selection committee.

Preference will be given to students participating in the “Young Investigator

Awards”. The number and amount of awards will be determined by the selection

committee.

ARCS Foundation Scholar Awards

The non-profit volunteer ARCS Foundation Inc. organization works to keep the US competitive in science and technology by supporting outstanding graduate students in STEM and health fields. The Honolulu Chapter has provided more than \$2 million to UH graduate students since our founding in 1974.

ARCS nominations for the JABSOM awards in medicine are accepted in February. The student must be enrolled in a PhD program until May of the following year. PhD students chosen are usually post Form II and in their 3-5th years of enrollment.

The students is selected without regard to race, gender or religion and must meet the following criteria:

- be a U.S. citizen,
- have a 3.5 GPA or equivalent,
- have at least one year of study remaining as of the year of the award
- be enrolled as a full-time PhD student in the life sciences.

“Life Sciences” shall mean the study of medically relevant fields that involve the scientific study of living organisms, such as microorganisms, animals and human beings, as well as related work in chemistry, computer sciences, engineering, and materials sciences that could eventually be applied towards the study of living organisms. While biology remains the centerpiece of the life sciences, technological advances in molecular biology, chemical synthesis methods for creation of medicines, biotechnology for design and production of protein drugs, and computer sciences (bioinformatics) have led to a burgeoning of specializations and new, often interdisciplinary, fields.

The students selected for this award have one or more peer-reviewed publications.

The student must be available for the poster and oral presentation at UH Mānoa in April and for the award ceremony in May of the award year.

Other Funding Opportunities

In addition to the mechanisms described above, there are intramural and extramural funding opportunities available to Tropical Medicine graduate students. These include travel and research awards from the Graduate Student Organization and other intramural sources. For more information, consult the Graduate Division funding opportunities site:

<http://manoa.hawaii.edu/graduate/content/financial-support>

Individual Development Plan & Timeline

All graduate students are expected to complete an online Individual Development Plan that is created in collaboration with their research advisor during their first year of graduate study. This plan is discussed with and submitted to the department via the graduate chair during the summer of their first year.

The IDP is reviewed by the student and mentor on an annual basis and an updated IDP is submitted and discussed in a meeting with the Graduate Chair once per year, usually during the summer. The format of the IDP closely follows that of the Science Careers IDP (myidp.sciencecareers.org) developed by the Federation of American Societies for Experimental Biology (FASEB).

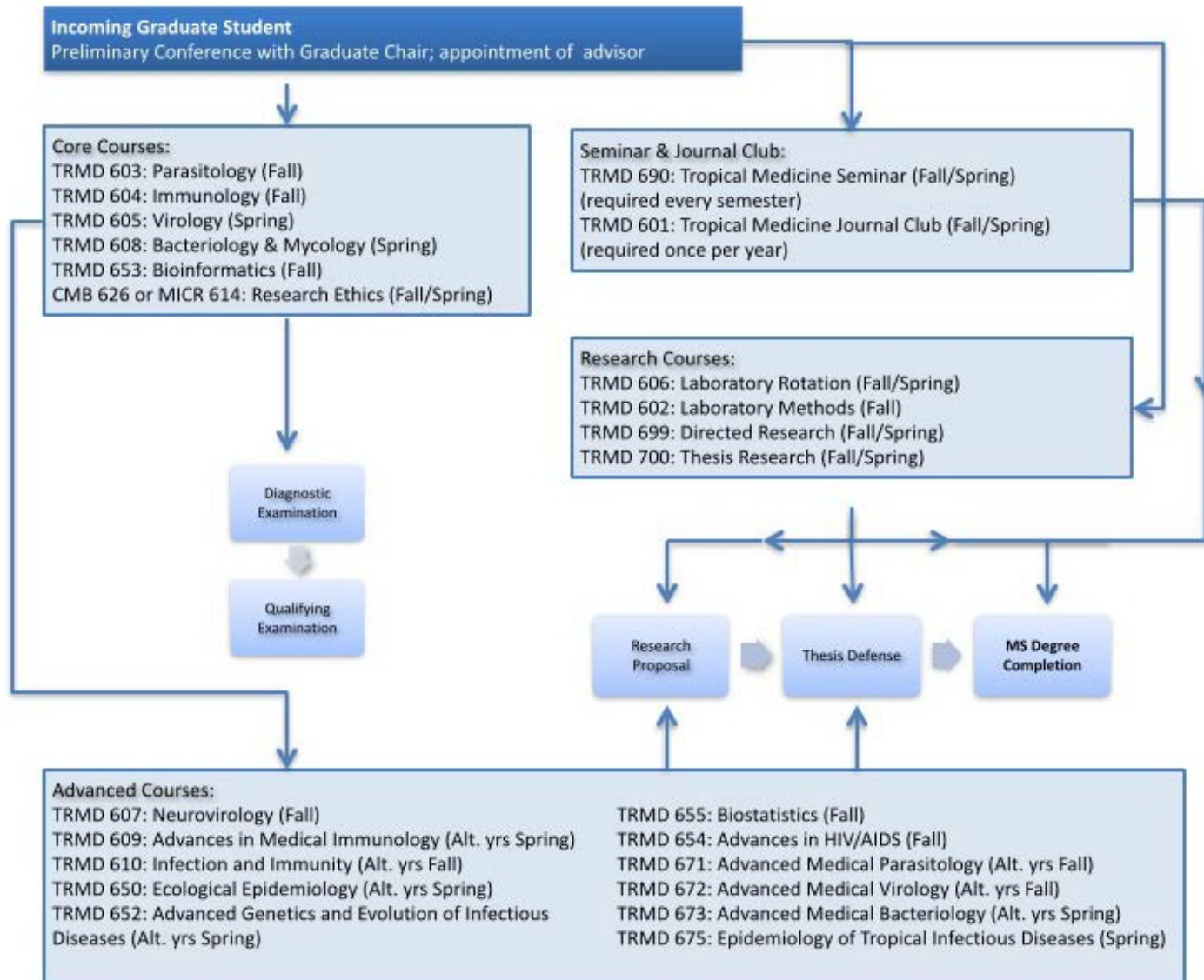
In addition to the IDP, graduate students are expected to prepare and update their individual timelines for achieving benchmarks during their graduate training. An example of a timeline is provided on the following page of this handbook.

Sample TRMD MS Plan A Timeline

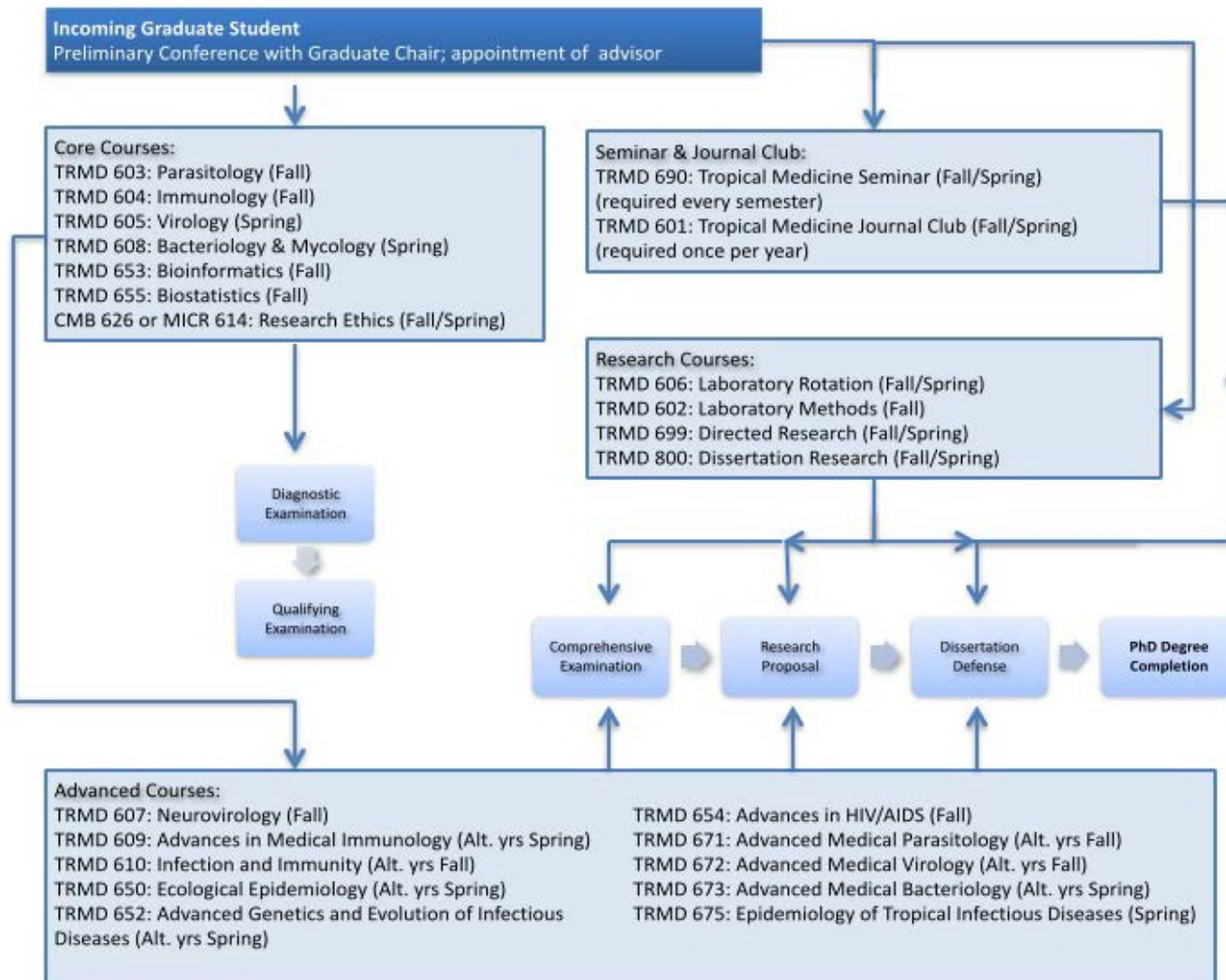
Sample TRMD MS Plan A (Thesis) Timeline

Fall, Year 1	Spring, Year 1	Fall, Year 2	Spring, Year 2
Preliminary conference with graduate chair; appointment of interim advisor	Appointment of permanent advisor & thesis committee; first meeting with thesis committee	Submission of thesis topic & proposal to thesis committee; progress meeting(s) with thesis committee Obtain regulatory approvals for thesis research	Progress meeting with thesis committee Oral examination of thesis research by thesis committee
<u>Core Courses:</u> TRMD 603: IDM I (Parasitology) TRMD 604: Immunology TRMD 653: Bioinformatics TRMD 690: TRMD Seminar (Attend; CR/NC)	<u>Core Courses:</u> TRMD 605: IDM II (Virology) TRMD 608: IDM III (Bacteriology & Mycology) TRMD 690: TRMD Seminar (Presentation of thesis proposal; letter grade)	Elective, Advanced Courses TRMD 690: TRMD Seminar	Elective, Advanced Courses TRMD 690: TRMD Seminar (Presentation of thesis research; letter grade)
TRMD 606: TRMD Lab Rotation	TRMD 699: Directed Research	TRMD 699: Directed Research	TRMD 700: Thesis Research
Fall or Spring: CMB 626 or MICR 614: Research Ethics TRMD 699: Dir. Reading (Journal Club)		Fall or Spring: TRMD 699: Dir. Reading (Journal Club)	
December: Diagnostic Exam	August: Qualifying Exam		
	Completion of Form I: Pre-candidacy progress	Completion of Form II: Advance to Candidacy	Completion of Form III: Certification of final oral exam and thesis defense Completion of Form IV: Committee Approval of Written Thesis
	Poster Presentation at Local Conference	Fall or Spring: Poster or Oral Presentation at National Conference	
		Write and submit manuscript on thesis research	

Tropical Medicine MS Curriculum



Tropical Medicine PhD Curriculum



Curriculum Map for Tropical Medicine

Student Learning Outcomes

1. *Demonstrate a knowledge base in the various disciplines of Tropical Medicine.*

In all graduate courses offered by our department, students are required to be familiar with the background literature as well current developments for in Tropical Medicine. This include trends in the application of new technology and in the underlying mechanisms involved in disease processes. Development of a knowledge base in Tropical Medicine is achieved through our core courses in infectious disease microbiology and immunology (TRMD 603, 604, 605, 608) and a series of advanced courses in each of the sub-disciplines of Tropical Medicine. This is supplemented by elective graduate courses in cell and molecular biology, epidemiology, research ethics, microbiology and immunology offered by other university departments.

For advanced courses in Bacteriology, Immunology, Parasitology and Virology, topics are selected (often in consultation with the students) for in depth study of molecular mechanisms of pathogenesis of the disease, fundamental nature of innate and acquired immunity, molecular and genetic mechanisms involved in the evolution of new type of invasive microbes, drug treatment and resistance, and disease prevention by killed or live attenuated vaccines. Topics also cover impediments that exist in society to availability of drugs and vaccines for disease treatment and prevention.

2. *Demonstrate a mastery of technical and experimental research methodologies.*

Typically, advanced courses and journal clubs offered by the department entail the review of key historical as well as current published papers on selected topics by students and faculty. Emphasis is placed on analysis of experimental design and methodologies and assessment of the scientific validity of experimental data and the overall significance to the field.

The curriculum includes a laboratory rotation course (TRMD 609) and directed research (TRMD 699) that provides hands-on training in laboratory techniques utilized in infectious disease research and introduces them to experimental approaches utilized in the research areas of faculty mentors. These techniques include but are not limited to molecular methodologies, animal and human subjects research, immunological assays, cell culture, virological methods, parasitological methods, bioinformatics and biostatistics, and flow cytometry. In these courses, students are required to maintain a laboratory notebook and prepare written laboratory reports for each rotation.

3. *Demonstrate the ability to plan, execute, interpret, and evaluate experimental studies.*

The most important framework for professional development is the thesis research in the case of Plan A MS students, the non-thesis research project for Plan B MS students, and the dissertation research project for PhD students. Development of a written and oral research proposal in each instance provides a foundation for future research design and grant preparation. The PhD research proposal is written in the format of an NIH grant application and also serves as the basis for the PhD comprehensive examination. The research project provides the ideal hands-on experience for execution, interpretation and evaluation of experimental studies and the foundation upon which the student will be able to evaluate the work of his/her peers. In addition to experimental aspects of the project, preparation of the written thesis document is a critical aspect of training in conducting a comprehensive literature review and preparation of a scientific document. Generally, the thesis or dissertation research provides the foundation for research manuscripts prepared by the student in collaboration with the faculty mentor and is subjected to external peer review.

5. *Demonstrate skills required for instruction, assessment and mentoring of undergraduate and MS students.*

Advanced students are given the opportunity to prepare guest lectures for selected graduate courses which are critiqued by the supervising faculty. Another instructional opportunity is service as a teaching assistant for undergraduate and medical education courses in medical microbiology and immunology. In addition to providing students with an opportunity to improve communication and teaching skills, these learning environments enable them to observe and practice group interaction and leadership skills.

Mentoring skills are developed largely as a result of modeling of these skills by the student's research advisor, members of the student's advisory committee, and other department faculty. Direct experience in mentoring is often provided by interaction, one- to-one instruction and supervision by senior graduate students of undergraduate and beginning graduate students.

6. *Demonstrate proficiency in written and verbal communication skills in various teaching formats and in professional presentations.*

Students are provided with several opportunities to develop verbal communication skills. Many courses require oral student presentations to peers as well faculty after which feedback is provided. In addition, students are required to give a seminar

presentation before the entire department once each year that are evaluated by the seminar faculty coordinator and research mentor. Students are given the opportunity to serve as teaching assistants in the undergraduate Biology and Microbiology programs at UH Mānoa for one or more semesters if they wish to gain additional teaching experience. Many students have taken advantage of this option and have gained a great deal from this experience in addition to receiving a stipend for their work. Finally, verbal communication skills are developed through participation in local, national, and international scientific conferences.

7. *Develop sufficient mastery and scientific maturity to assess the work of peers in related fields.*

Students participate in departmental journal clubs (TRMD 699 Directed Reading) which review primary literature in the various disciplines of Tropical Medicine. In these sessions, students select journal articles and present them before the class. Class participants are expected to read each article and be prepared to discuss the methodology and experimental results, evaluate the validity of the conclusions advanced by the authors, and assess the overall significance of the work to the field.

8. *Demonstrate written communication skills as required in various professional duties including manuscripts for publication, grant applications, and course development.*

Students are expected to prepare one or more manuscripts based on their dissertation research project for submission for publication to a peer-reviewed journal. The PhD comprehensive examination consists of preparation and oral defense of a grant application based on their research topic following submission guidelines of the National Institute of Health or another major funding agency.

9. *Develop administrative skills to manage a research laboratory, supervise technical and professional staff, and provide leadership as a faculty member.*

During their PhD dissertation research, students participate in day-to-day management of their research project. Senior PhD students are actively involved in laboratory training of new technical staff and graduate students at the MS and PhD level, and in assuming leadership roles in advanced courses in their field and in local professional organizations such as the Hawaii Branch of the American Society of Microbiology.

MS/PhD Curriculum Map								
Course or Activity	Intended Student Learning Outcomes*							
	Tropical Medicine Knowledge Base	Mastery of Research Methods	Experimental Design & Execution	Instructional and mentoring skills	Written & verbal communication skills	Peer evaluation & assessment	Manuscript, grant proposal & course development skills	Research laboratory administration skills
TRMD 603, 604, 605, 608	I, A			I, R	R	R		
TRMD 601, 606		I	I, R		I, R		I	
TRMD 607, 609, 650, 651, 652, 653, 654, 655, 671, 672, 673, 675, 705	R, A	R, A	R	I	R			
TRMD 690	I, R	I, R	I, R	I, R	I, R, A	I, R	I, R	
TRMD 699		R	R		R		R	I
TRMD 700		R, A	R, A		R, A		R	R
TRMD 800		M, A	M, A		M, A		M	R
Supervision of undergrad & junior grad students				R		R		I
Teaching Assistantship	R			R		R		

*"I"=introduced; "R"=reinforced and opportunity to practice; "M"=mastery at the senior or exit level; "A"=assessment evidence collected