

PATHOBIOLOGY, PHD

Program Overview

Pathology is an integrative discipline that looks simultaneously at the whole organism and its component cells, tissues, and molecules to study the causes and mechanisms of disease. It is a discipline that strives to understand the mechanisms of disease at fundamental levels, and to apply this understanding to improve management of these diseases in the clinical setting. The **Pathobiology Graduate Program** provides a strong background in pathology and related basic sciences to prepare students for academic, research, teaching, and biotechnology careers.

Program of Study

The Graduate Program in Pathobiology of the Department of Pathology offers a program of study leading to the Ph.D. degree in Pathobiology.

The Program provides students with opportunities to elucidate the mechanisms and origins of human diseases through an integrative approach emphasizing systemic processes based on molecular and cellular pathologic underpinnings. Students are prepared with formalized classroom instruction in all general areas of disease mechanisms and undertake specialized training (including thesis research) one of five programmatic areas: Immunopathology, Microbiology & Infectious Disease, Neoplasia, Neuropathology, Vascular Biology & Hemostasis.

Applicants are not required to designate a specific programmatic area of interest at the time of application or matriculation, and laboratory rotations across multiple disciplines are typical for students in the Program. However, special funding opportunities may be available for applicants with commitment to a particular discipline.

Pathobiology encompasses fundamental and applied studies of the biological basis of disease. Like the discipline of pathology itself, it straddles the traditional basic and clinical sciences. Research in Pathobiology is typically aimed toward the discovery of the basic mechanisms that cause disease with the goal of developing fresh insights leading to improved treatments or preventative measures. Thus, the students in the Pathobiology program are prepared for careers in the translation of basic biological principles to solve specific disease problems.

Learner Mental Health and Well-Being

The health and wellness of students are of utmost importance to us here at Johns Hopkins. If you are struggling with anxiety, stress, depression, or other wellbeing-related concerns, please consider contacting Mental Health Services (<https://studentaffairs.jhu.edu/university-health-services/mental-health/#:~:text=The%20UHS%20Mental%20Health%20team,call%20410-955-1892>) at 410-955-1892 or one of the other wellness resources within Student Health and Well-Being (<https://wellbeing.jhu.edu/>). If you are concerned about a friend, please encourage that person to seek out support. If you or someone you know needs immediate assistance for a mental health concern, please call the Behavioral Health Crisis Support Team at 410-516-9355. Clinicians can respond in person to your location and offer support and resources.

Diversity and Inclusion

Johns Hopkins University is committed to the shared values of diversity and inclusion in order to achieve and sustain excellence. We firmly believe that we best promote excellence in clinical care, scholarship, research, and education by recruiting and retaining a diverse group of students, faculty, and staff, and we strive to promote a sense of

inclusion and belonging for every member of our community. We fully recognize that diverse groups are a major driving force for excellence, creativity and innovation, and are the driving force behind our ability to make advancements that will improve the human condition for all. We firmly embrace these beliefs as reflected in the Core Values (<https://www.hopkinsmedicine.org/about/mission/>) of Johns Hopkins.

For more information about Diversity and Inclusion in the School of Medicine, visit the Office of Diversity, Inclusion and Health Equity (<https://www.hopkinsmedicine.org/diversity/>), the Graduate Biomedical Education page on Diversity and Inclusion (<https://www.hopkinsmedicine.org/som/education-programs/graduate-programs/diversity/>), and the School of Medicine Diversity | Johns Hopkins Medicine (<https://www.hopkinsmedicine.org/diversity/som-diversity-index/>).

Accommodations

Johns Hopkins University values diversity and inclusion. We are committed to providing welcoming, equitable, and accessible educational experiences for all students. Students with disabilities (including those with psychological conditions, medical conditions and temporary disabilities) can request accommodations for this course by providing an Accommodation Letter issued by Student Disability Services (SDS). Please request accommodations for this course as early as possible to provide time for effective communication and arrangements.

Students who would like to request disability-based accommodations should contact the Disabilities Service Coordinator, Ellen Kaplan, at SOM-SDS@jhmi.edu or complete the online accommodations application (<https://hunter.accessiblelearning.com/JHU/ApplicationStudent.aspx>). Documentation guidelines are provided on the application. As a student with approved accommodations, it is your responsibility to provide the course directors and course coordinators with a copy of your letter at the beginning of each course or as soon as possible after receiving your accommodations letter. Exam accommodations need to be requested 5 business days prior to all written exams or assessments. In addition, for medical students, clerkship accommodations for any Standardized Patient (SP) examinations must be requested at the beginning of the clerkship so that appropriate preparations can be completed before an SP event requiring accommodation.

Facilities

Classroom instruction is conducted in the lecture, seminar, and conference rooms of the School of Medicine. Student research is conducted in the state-of-the-art research facilities of program faculty. These fully equipped laboratories support studies ranging from molecular, cellular, and physicochemical analyses through whole animal and informatics-based techniques. The Program takes special advantage of its clinical service laboratories and clinical activities to familiarize students with and provide resources for translational research.

Financial Aid

Candidates accepted into the Program are offered full support providing payment of tuition, health, dental and vision benefits as well as a stipend for the duration of their studies. For more details regarding financial aid opportunities, please visit their page at: Financial Aid | Johns Hopkins Medicine (<https://www.hopkinsmedicine.org/som/education-programs/graduate-programs/admissions/financial/>).

Admission Requirements

Students typically matriculate in July or August. The following 6 key elements for are required for application and ultimately for admission into the Program:

1. a bachelor's degree from a qualified college or university;
2. your updated CV;
3. coursework with laboratory in inorganic & organic chemistry, general biology, with anatomy and physiology recommended;
4. official transcripts of undergraduate grades;
5. a minimum of three letters of recommendation; and
6. a one-to-two page personal statement including your research and career goals.

GRE Scores Not Required. As of Sept, 2019, when applying to the Graduate Program in Pathobiology, we no longer require the **GRE General or Subject Tests scores**, however if taken, applicants are invited to share their scores.

Underrepresented minority students are strongly encouraged to apply and to contact the program directors for guidance. Personal interviews at Johns Hopkins are preferred.

Vivien Thomas PhD Scholars

The Vivien Thomas Scholars Initiative (VTSI) is a new endowed fellowship program at Johns Hopkins for PhD students in STEM fields. It provides full tuition, stipend, and benefits while also providing targeted mentoring, networking, community, and professional development opportunities. Students who have attended a historically black college and university (HBCU) or other minority serving institution (MSI) for undergraduate study are eligible to apply. To be considered for the VTSI, all application and supplementary materials must be received by **December 1, 2025**.

More information about the VTSI program is available at the link below.

Vivien Thomas Scholars Initiative | Office of the Provost (jhu.edu)
(<https://provost.jhu.edu/about/vivien-thomas-scholars-initiative/>)

Pathobiology Program Inquiries should be directed to the program contact listed on the program webpage (<https://pathology.jhu.edu/education/phd-program/>).

PROGRAM AND SOM REQUIREMENTS

GRADUATE STUDENT POLICIES

All students are expected to read and follow guidelines stated in current posted policy available at the following link: Policy Finder | Johns Hopkins Medicine (<https://www.hopkinsmedicine.org/som/education-programs/graduate-programs/student-academic-resources/policy-finder/>)

Required Core Courses:

Code	Title	Credits
ME.300.800	Pathology Research (ongoing throughout PhD study)	3
ME.300.803	Pathobiology Journal Club (ongoing throughout PhD study)	3
ME.800.811	Introduction to Responsible Conduct of Research	1
ME.300.713	Pathology for Graduate Students: Basic Mechanisms	3

ME.300.716	Pathology for Graduate Students: Immunology/ Infectious Disease	1
ME.260.709	Molecular Biology and Genomics	1.5
ME.110.733	Principles of Genetics	2
ME.110.728	Cell Structure and Dynamics	1.5
ME.360.728	Pathways and Regulation	2
ME.250.703	Graduate Immunology	4
ME.300.710	Pathobiology and Disease Mechanisms	3
ME.300.714	Pathology for Graduate Students: Cancer	1
ME.300.716	Pathology for Graduate Students: Immunology/ Infectious Disease	1
ME.300.715	Pathology for Graduate Students: Neuropathology	1
ME.300.717	Grant Writing 101 (2nd Year)	3
ME.300.711	Introduction to Translational Research Rotation 1 (during or after 3rd Year)	1 - 18, 1
ME.300.712	Introduction to Translational Research Rotation 2 (during or after 3rd Year)	1

Procedures for Choosing Rotations and a Thesis Environment:

1. Each student will complete 3 research rotations prior to selecting a thesis laboratory. A fourth rotation may be completed if desired.
2. Upon starting the rotation, students and their rotation mentors will complete the Rotation Plan form.
3. Upon completion of the rotation, the mentor will provide an evaluation of the student's work.
4. Students will present their rotation work at the Pathobiology Journal Club or at the annual Pathobiology retreat.
5. The 3 required rotations must be completed during the first year and are traditionally completed with Pathobiology faculty members. Outside Pathobiology faculty rotations may be completed, however these must be approved by the program director(s). If a student chooses to undertake their thesis research with an outside faculty member, the faculty member will need to be considered first by the Pathobiology Executive Committee before joining the program faculty.
6. Each research rotation will be about 3 months in length, with the exception of summer rotations. A full-time summer rotation (July-August) will be about 2 months in length.
7. The student must select a thesis advisor no later than 1 year from the date of admission to the program. **In general, students will not be permitted to conduct their thesis research in a laboratory where they have been previously employed. Any exceptions to this policy will be determined by the Pathobiology Executive Committee.
8. Faculty Advisors Groups: each student, along with a group of other students, will be assigned a faculty advisor during the time period between starting the program and choosing a thesis advisor. The group will meet with AT LEAST once every 4 months. These meetings will be initiated by the group's senior student leader (appointed by the Program).

Oral Examination

The Graduate Board Oral Examination tests the breadth and depth of the graduate student's scientific knowledge and readiness to begin thesis research. These exams are administered by the Pathobiology program through an oral examination committee consisting of 3 faculty members. This preliminary oral examination will be scheduled by lottery at the end

of the first-year meeting with the Program Director. The exam takes place during October after the student has completed all required first year courses. The exam is required for graduation.

Thesis Advisor and Advisory Committee

After the first year is completed, the student will choose an advisor from the Pathobiology faculty. After completing the Oral Examination for the Ph.D. Degree for the School of Medicine Programs, a Thesis Advisory Committee will be formed to monitor the student's thesis research progress. The student, with the consent of their advisor, decides on the composition of the thesis committee. The thesis committee consists of at least three experts in the student's field of study or related fields. Committee members help with research direction and technical challenges and oversee the student's progress until research is completed and the doctorate is awarded. Students must meet with their committee at least once per year to review progress.

Electives

All students in their third year and beyond are required to take a one-semester elective course for credit in each academic year. Courses may be taken for a grade or pass/fail. Students may choose a course offered in the Johns Hopkins Medical Institutions, or on the Homewood Campus subject to approval by the Program Director.

Translational Rotations (2 required)

The objectives of these rotations are to give graduate students an interactive exposure with the clinical diagnostic dimension of Pathology. Students should learn the fundamental clinical questions, the current state of the technologies to address these questions, and how basic science can be translated to advances in diagnostic and therapeutic modalities. Students must complete 2 translational rotations as a graduation requirement. These rotations need not require an experimental project involving bench work. If the student wishes to complete such a project, it should be decided jointly between the student and rotation advisor.

Departmental Thesis Seminar

Shortly before your submission of graduation materials, you must present your thesis work to the department in a one-hour talk.

Seminars, Journal Clubs, and Lab Meetings

All Pathobiology students are required to attend the weekly Pathobiology Journal Club course as well as all lab meetings in their mentor/thesis advisor's departments throughout their training period. All first-years Pathobiology students are expected to attend weekly Pathobiology lunch meetings. Students are encouraged to attend the many seminars presented by invited speakers who are involved in cutting edge research.

Pathobiology Annual Retreat:

The annual Pathobiology Retreat (held in early Fall), from 8:00 a.m. to 4:00 p.m. includes a series of short research talks by senior students and poster presentations by third year and beyond students. Attending keynote speaker(s) will deliver a special lecture and faculty members and alumni will discuss their research and career options. All members of the Pathobiology Graduate Program are expected to participate in this event.

Pathology Young Investigators' Day

The Departmental Young Investigators' Day (held March/April) provides residents, fellows, and students with the opportunity to present their clinical, basic, or translational research efforts. This activity allows faculty, fellows, residents, and students to learn more about the diverse ongoing research in the Pathology department. All fellows, residents, graduate students and medical students working with a faculty member who holds an appointment in the Department of Pathology, or the

Pathobiology Program are invited to submit abstracts and present posters at the annual event.

Graduate Student Association Poster Session

The Graduate Student Association Poster Session is held every year. This gives the students the opportunity to showcase their research to both faculty and peers.

Policy for Awarding an Intermediate Master's Degree (IMD)

Policy for Awarding an Intermediate Master's Degree (jh.edu) (<https://hpo-docs.jh.edu/uH4rAZDi/>)

*The Pathobiology Graduate Program may confer an Intermediate Master's Degree (IMD) to recognize a student's achievements enroute to their PhD. This is done upon the student's request and will be subject to the same standards as a Terminal Master's degree, as mentioned below. See policy statement referenced in the above link for more details. **NOTE: Request for the IMD must be received at least one term before student plans to graduate with their PhD.***

1. Successful completion of graduate program IMD course requirements. IMD course requirements must be the same as those for a Terminal Master's Degree.
2. Successful completion of additional SOM or University requirements (e.g., training in the Responsible Conduct of Research).
3. Completion of at least two consecutive semesters of full-time study prior to degree conferral.
4. All IMD students must have successfully passed a required Graduate Board Oral examination.
5. All graduate students receiving an IMD must be a current full-time student at the time of submitting their IMD application.

Process for Application and Awarding of IMD for Pathobiology:

- PhD program requirements and procedures for the IMD must be clearly stated in the PhD Program's Handbook.
- Eligible students may submit a request for an IMD to their PhD Program at least one term before they plan to graduate with their PhD degree. Requests will be reviewed by the Committee on Master's and PhD Programs according to the regular degree conferral schedule (see below). Only one degree (IMD or PhD) may be conferred per term.
- Students who have graduated or left the SOM are not eligible to request an IMD.
- Students receiving an IMD are not eligible to participate in SOM Convocation, because these students have not completed their studies at the SOM.
- Students who receive an IMD but do not complete the requirements for the PhD degree should follow procedure for a Terminal Master's degree. The IMD and Terminal Master's degrees are equivalent. These students will not receive a second degree but will be eligible to participate in SOM Convocation.
- The SOM will provide the conferred IMD diploma by mail or by other means to the student.

Policy for Awarding the PhD Degree at the Johns Hopkins University

Administered by the Doctor of Philosophy Board

From the Doctor of Philosophy Board website:

The SOM policy is based on NIH guidelines (<https://grants.nih.gov/policy/>). Students must receive training that includes a significant small-group component, allowing issues to be openly discussed with fellow students and faculty discussion leaders. A training program should provide at least eight hours of class time -- with at least three hours of face-to-face discussion -- and address at least the following topics:

1. *The scientist as a responsible member of society*
2. *Research misconduct*
3. *Data acquisition and management*
4. *Authorship and publication practices*
5. *Mentor and trainee responsibilities*
6. *Use of animals in research*
7. *Conflicts of interest*
8. *Collaborative research*
9. *Human subjects if applicable*

It is the responsibility of each program to design a curriculum that satisfies these requirements. Contact the Associate Dean for Graduate Biomedical Education for any questions.

Degree Requirements:

There are three fundamental requirements for the Ph.D. at Johns Hopkins University: dissertation, residence, and oral examination. None of these requirements can be modified or changed without unanimous consent of the schools and the Provost.

1. **Dissertation:** *All Ph.D. students must successfully complete a dissertation in accordance with relevant school and program guidelines prior to degree conferral.*
2. **Residence:** *All Ph.D. students must have completed two consecutive semesters of full-time study prior to degree conferral.*
3. **Oral Examination:** *All Ph.D. students must successfully pass a required oral examination conducted by five faculty members. The oral examination must include the chair and at least one other member from outside the candidate's home department.*

It is university policy that all program and university requirements for the Ph.D. must be completed in 9 years or less from start of the doctoral program. The Doctor of Philosophy Board reviews all candidates for the Ph.D. prior to conferral to ensure that the fundamental requirements for the Ph.D. have been met within the time frame delineated.

Documents provided by the Program to the student's Payroll Administrator, included in packet:

- PhD Student Payroll Termination Form

Deadlines for documentation:

- Deadline for submission of materials for December conferral: November 1st
- Deadline for submission of materials for May conferral: April 1st
- Deadline for submission of materials for August conferral: July 1st

Conferral Dates:

- Thursday before Memorial Day in May
- Last weekday before the fall term begins in August
- Last weekday in December

Over about a 5 year period, our trainees achieve a deep working understanding of the biology of human diseases, as well as state-of-the-art and high-throughput experimental approaches related to human disease. We accomplish our mission through a curriculum and environment that are **different and unique**. We encourage change, creativity, and out-of-the-box reasoning. The intensive coursework during the first year of training is designed to build a foundation in contemporary molecular, cell, and structural biology, signal transduction pathways, neurobiology, genetics and genomics, immunology, and bioinformatics, all filtered through the prism of human pathology and translational medicine. These classes, along with 3 lab rotations and oral presentations based on this work, culminate with the student selection of a thesis lab headed by a faculty member who is accredited for mentor compliance by institutional and programmatic review.

A unique aspect of the program is the inclusion of **translational rotations** in a clinical pathology setting; these rotations directly reinforce the humanity, compassion, and importance of the student's research project to the ultimate goal of alleviating the suffering caused by human diseases. Most students garner peer-reviewed publications during their training, and some successfully compete for NIH F31 individual training grants. Using coursework, supplemental library-based teaching tools, annual program retreats, as well as weekly journal clubs and discussions, scientific ethics, rigor, reproducibility, transparency and logic, and moral values are inculcated as Kantian categorical imperatives. The outstanding, interdisciplinary, and diverse programmatic and collaborative faculty and resource-rich environment act as catalysts for students to explore, thrive, and consolidate their novel research to launch their careers.

Historically, pathobiology graduates are well-trained biomedical scientists and have successfully embraced varied career paths and leadership positions in **academia (63%)**, **industry (17%)**, medicine, clinical laboratory medicine, entrepreneurship, business, government, and science writing. The Graduate Program in Pathobiology strives for students to have an important, global impact on the pathologic basis of human disease and health-related research.