

# 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. Students struggling with anxiety, stress, depression, or other well-being-related concerns, can contact the Johns Hopkins Student Assistance Program (JHSAP at [jhsap.org](http://jhsap.org) (<http://jhsap.org/>)). Additional resources are available at <https://www.hopkinsmedicine.org/getting-help> (<https://www.hopkinsmedicine.org/getting-help/>).

## Diversity and Inclusion

At Johns Hopkins we strive to be a model of a pluralistic society in which we acknowledge, embrace, and engage diverse identities, perspectives, and experiences. We seek to build and buttress an inclusive intellectual and physical environment to ensure that all members of our community know with certainty that they belong at Johns Hopkins. And we aspire to equitably share the benefits and burdens of dismantling persistent systemic barriers to individual and communal success.

We believe, fundamentally, that every person has equal dignity and worth, and our unwavering commitment to diversity, equity, and inclusion is rooted in this predicate principle. These core values are essential to our

university's academic, research, and public service missions, and bolster our commitment to excellence. Our search for truth and knowledge for the good of humanity depends on bringing the greatest variety of viewpoints and voices to bear on the challenges before us as students, scholars, staff, neighbors, and citizens.

At the intersection of these values is justice. Over the course of history, our nation and university have breached the ideals of justice by discriminating on the basis of race; ethnicity; sex; gender identity and expression; religious belief and observance; disability; socio-economic status; veteran/military status and other factors. We recognize the painful truth that such discrimination has inflicted multigenerational harm and further disenfranchises members of our society. Although our polity and our institution have made meaningful progress, we are by no means past the injury and loss caused by discriminatory practices.

Johns Hopkins assumes its responsibility as a leading research university to work to achieve diversity, equity, and inclusion, and we hold ourselves accountable for our progress through transparency, open communication, and an ongoing, unflinching assessment of met and unmet needs.

More details and resources can be found at the following link: Diversity at JHU (<https://diversity.jhu.edu/>) (<https://diversity.jhu.edu>)

## 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 courses by providing an Accommodation Letter issued by Student Disability Services (SDS). Please request accommodations for courses as early as possible to provide time for effective communication and arrangements.

For further information or to start the process of requesting accommodations, please contact Student Disability Services at the School of Medicine: [GradDisabilityOffice@jhmi.edu](mailto:GradDisabilityOffice@jhmi.edu).

## 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:

<https://www.hopkinsmedicine.org/som/offices/finaid/>.

## 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, and calculus;
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 2, 2023**.

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> (<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: <https://www.hopkinsmedicine.org/som/training/graduate-programs/academics/academic-resources/policy-finder.html>

### LIST OF PATHOBIOLOGY REQUIREMENTS FOR GRADUATION:

#### Required Core Courses:

ME.300.800	Research in Pathobiology ( <i>ongoing throughout PhD study</i> )
ME.800.803	Pathobiology Journal Club ( <i>ongoing throughout PhD study</i> )
ME.800.811	Introduction to Responsible Conduct of Research
ME.300.713	Pathology for Graduate Students: Basic Mechanisms of Disease
ME.100.716	Analysis of Macromolecules: Energetics, Structure and Function
ME.260.709	Molecular Biology and Genomics
ME.110.733	Principles of Genetics

ME.110.728	Cell Structure and Dynamics
ME.360.728	Pathways and Regulation
ME.250.703	Graduate Immunology
ME.300.710	Pathobiology and Disease Mechanisms
ME.300.714	Pathology for Graduate Students: Cancer
ME.300.716	Pathology for Graduate Students: Immunology and Infectious Disease
ME.300.715	Pathology for Graduate Students: Neuropathology
ME.300.717	Grant Writing 101 ( <i>2nd Year</i> )
ME.300.711	Introduction to Translational Research I ( <i>during or after 3rd Year</i> )
ME.300.712	Introduction to Translational Research II ( <i>during or after 3rd Year</i> )

### 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 an 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 complete and the doctorate is awarded. Students must meet with their Committee at least once per year to review progress.

### Electives

All students in their second 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

Graduate students are required to attend the weekly Pathobiology Journal Club Course and all are expected to attend weekly Pathobiology lunch meetings as well as all lab meetings in their mentor/thesis advisor's departments throughout their training period. 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 second-year and beyond students. Attending keynote speaker(s) will deliver a special lecture and faculty members and alumni will discuss their research. 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.

### AWARD OF THE PhD DEGREE AT THE JOHNS HOPKINS UNIVERSITY

*Administrated 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/index.htm> (<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 semester 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.*

Over about a 5 year period, our trainees achieve a deep working understanding of the biology of human aging and 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 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 discussion, 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.