

Pathology Department: Graduate Degree Programs Molecular Pathology

Background:

The Molecular Pathology graduate program started in 1969 as the first interdisciplinary graduate program at Wake Forest University. At that time the program was called "Comparative and Experimental Pathology" and was jointly administered by the Departments of Pathology and Comparative Medicine.

With the advent of molecular biology and an increased emphasis on understanding the molecular pathogenesis of diseases, the program name was changed to Molecular and Cellular Pathobiology in the early 1980s to more accurately reflect the training and research focus of the program. In 1998, the Department of Comparative Medicine was merged with the Department of Pathology and administration of the program was eventually consolidated in the Section on Lipid Sciences within the Pathology Department.

Although the Molecular Pathology program is administered by the Department of Pathology, it remains a highly interdisciplinary graduate program with training and support faculty drawn from many other departments including:

- Internal Medicine,
- Biochemistry
- Physiology & Pharmacology,
- Division of Surgical Sciences,
- Pediatrics,
- Public Health Sciences, and
- Microbiology & Immunology.

Goals and Objectives:

The principal goal of our graduate program is to train students for careers in independent research and teaching. The emphasis on research training helps our students become successful biomedical researchers who can contribute to the understanding of the basic mechanisms of complex metabolic diseases, which cause considerable mortality in the US. To accomplish our goal, we offer formal course work in the basic medical sciences and research training in Pathobiology, the study of fundamental mechanisms of disease processes. We have several specific training objectives which include:

1. giving students a strong didactic foundation in biochemistry, molecular biology and genetics, pathology, physiology, and statistics;
2. developing students into critical and independent thinkers; and
3. enhancing written and oral communication skills.

These objectives are met through interdisciplinary course work, participation in seminars, journal clubs, and lab meetings, presentations at regional and national meetings, and the writing of research proposals and manuscripts. Most of our PhD students graduate with at least two or three peer-reviewed, first-author manuscripts as well as several presentations at national meetings.

Please refer to the student awards, honors, and presentations section of the web site for more information: (<http://www.wfubmc.edu/lipidsci/graduate/student/awards.htm>).

Requirements for the PhD Degree:

Required courses:

Required courses have been designed to give students a firm, interdisciplinary foundation in the basic biomedical sciences, yet allow flexibility for the student and his or her adviser to select electives that interest the student or enhance the student's research. Therefore, required courses have been kept to a minimum and are listed below. Please refer to the Graduate Bulletin for a detailed description of each course.

Course Number	Credit Hours	Course Title
BICM 705	3	Biochemistry I
BICM 731	3	Molecular Biology
PSPR 702	4	Basic Physiology and Pharmacology
PATH 702	3	Fundamentals of Pathology
PSPR 741 or CPTS 730*	2 4	Quantitative Methods in Behavioral Science <i>or</i> Introduction to Statistics
MMTS 724	3	Scientific Development and the Business of Science (Spring Semester, Year 2)

**if a student has a strong background in statistics, this course requirement may be waived by the Program Director*

Professional Development and Research Ethics:

To support their scientific training and experiences, all WFU graduate students are required to complete the 2-semester Introduction to Professional Development (GRAD 700/701) In addition, all students must complete a series of four 1-credit courses in Scientific Professionalism (GRAD 713/714 and GRAD 715/716).

Course Number	Credit Hours	Course Title
GRAD 700/701	1/1	Introduction to Professional Development
GRAD 713/714	1/1	Scientific Professionalism and Scientific Integrity
GRAD 715/716	1/1	Bioethics and Social Responsibility

Special Skills Requirement:

The special skills requirement is satisfied by completion of one of the following courses with a grade of B or higher.

Course Number	Credit Hours	Course Title
MOGN 721	2	Computational Analysis in Molecular Biology
PATH 719	3	Microscopic Research Techniques
CPTS	4	Applied Linear Models

Elective Courses:

Examples of *elective courses* that many of our students have taken include the following:

Course Number	Credit Hours	Course Title
BICM 706	2	Intracellular Signaling
BICM 707	2	Biochemical Techniques
BICM 732	3	Molecular Biology II
CABI 703	2	Molecular Pathogenesis of Cancer
CABI 704	3	Cell Biology of Cancer
PATH 717	4	Pathobiology of Atherosclerosis
PATH 710	2	Pathologic Biochemistry
MOGN 741	2	Tutorials in Molecular Biology

Course Number	Credit Hours	Course Title
MOGN 721	2	Computational Analysis in Molecular Biology
PATH 719	3	Microscopic Research Techniques
CEHS 732	4	Applied Linear Models

Preliminary Exam:

Each student must successfully pass a preliminary exam to advance to PhD candidacy. To be eligible for the preliminary examination, students must have an overall grade point average of 3.0 (on a 4.0 scale) and have completed the Special Skills requirement.

The preliminary examination should be completed by the end of the student's second academic year. The preliminary examination must be passed at least 12 months prior to the date of the awarding of the PhD degree.

All course work need not be completed before the examination, but at least 75-85% should be completed and all required courses for our program must be completed.

Time Table for Preliminary Exam for Second Year Students

Time (2nd Year):	Activity
May	Pre-Proposal submitted to Program Director and Preliminary Exam Committee appointed
May	Pre-proposal approved or revised
June-July	Research proposal written
August 1	Research proposal submitted to committee and preliminary exams scheduled
August-September	Oral preliminary exams completed

The preliminary examination consists of an *oral examination* administered by a Preliminary Examination Committee. The oral exam consists of a defense of the student's research proposal, which is written using the format recommended by the National Institute of Health (NIH). The student has free choice of the topic, which may or may not be the subject of the dissertation research. At least three months prior to the date of the preliminary examination, the student must submit a pre-proposal to the Chairperson of the Preliminary Examination Committee outlining the research proposal. Included in the pre-proposal should be a statement of the hypothesis, rationale, specific aims and a description of the project in sufficient detail without including details of methodology. The pre-proposal typically is no longer than two single-spaced, typewritten pages.

Within one week the committee will either approve or reject the pre-proposal. If the pre-proposal is rejected, the Preliminary Examination Committee will meet with the student to address the deficiencies and provide guidance for remediation. Following approval of the pre-proposal, the student will prepare a detailed written research proposal following NIH guidelines. Preparation of the written proposal must be completed within two months of approval of the pre-proposal. The proposal must be submitted to the committee at least one month before the scheduled date of the examination, which is determined by the student and Chair of the Examining Committee.

The outcome of the oral exam is determined by the Examining Committee. In case of failure, the committee can recommend that the student be dropped from the program or that reexamination be allowed. A second examination will be scheduled no earlier than six months from the date of the first examination. A student may be reexamined only once.

Upon successful completion of the preliminary exam, the student is promoted to PhD degree candidacy status by the Dean of the Graduate School of Arts and Sciences.

Dissertation:

The candidate shall prepare a dissertation embodying results of the investigative efforts in his or her field of research concentration with supervision by the student's Research Advisory Committee. Students may choose to include submitted, accepted for publication, or published manuscripts as chapters in the dissertation. Please refer to the Graduate School guidelines for more information on the format of the dissertation. A final copy of the dissertation must be submitted to the Dean of the Graduate School at least four weeks prior to the proposed defense date and distributed to the Final Examination Committee at least three weeks before the final examination. The chairperson of the Final Examination Committee will poll the committee at least ten days before the proposed date of the examination to determine the acceptability of the dissertation.

Fifty copies of the doctoral program are prepared, and after the chairperson of the Final Examination Committee has determined the dissertation to be defensible, the Graduate Office is notified and the programs are distributed according to the distribution list given by the Graduate Office. A minimum of five copies of the dissertation must be printed on 100% rag bond; three copies are taken to the Graduate Office, of which two go to the library and one goes to the department. At the time the dissertation is submitted, an abstract of 350 words or less must be submitted in duplicate for publication in Dissertation Abstracts International. A nonrefundable dissertation fee of \$50 covers the cost of this service. Other agencies of publication are encouraged, but such publication does not remove the requirement for submission of the abstract to Dissertation Abstracts International.

Final Examination:

The Final Examination Committee for the dissertation is appointed by the Dean of the Graduate School and consists of at least five members of the graduate faculty. With the approval of his or her adviser, a student may recommend a faculty member from outside the department or program who will serve as the Chair of the Final Examination Committee. The dissertation adviser must justify the participation of external experts who are not members of the graduate faculty on the basis of research, publications and/or professional activities. If the external expert is to be a voting and signing member of the Final Examination Committee, the adviser must communicate to the Dean of the Graduate School, in writing, the qualifications of the external expert. Other faculty members may attend the final examination and participate in the questioning. The examination covering the student's major field of concentration and the dissertation is held no later than ten days before graduation.

After the examination of the degree candidate, the chair shall ask each of the members of the Final Examination Committee whether the candidate has passed unconditionally, passed upon rectifying deficiencies, or failed. If all committee members agree that the student has passed unconditionally, the committee members shall sign the title sheet and the student shall be recommended for award of the degree. If reservations are expressed by committee members, the chair of the committee shall ensure that the reservations are communicated to the student and the Dean of the Graduate School. The student and the adviser are jointly responsible for ensuring that the dissertation is modified to meet the committee's reservations. When the dissertation has been modified, the student passes the examination. The committee members shall sign the title sheet, and the student shall be recommended for award of the degree.

If, in the opinion of more than one member of the thesis or dissertation committee, the student has failed the examination, there is no consensus to pass. The chair of the committee shall advise the student that the dissertation fails to meet the requirements of the Graduate School. The chair shall ensure that the student knows the reason(s) for failure. If the student submits a revised or new dissertation for consideration by the Graduate School, at least three members for the new dissertation committee shall be drawn from the original committee. If the modified or new dissertation fails to meet the requirements of the Graduate School, the student shall be dismissed from the Graduate School.

Laboratory Rotations for First Year Students:

Matriculating students are expected to perform up to three laboratory research rotations during their first year. Laboratory rotations allow the student to experience the environment of the lab and to be better informed of research opportunities within each lab. The rotation also helps the faculty to assess the student's potential for research. After each rotation, the student is expected to give a short presentation (15-20 minutes) describing the project and possible research results to the faculty and other students. Typically, the presentation is given at the weekly meeting of the Lipid Sciences Journal Club.

By the end of the first academic year, the student is expected to have chosen an adviser for his or her dissertation research. The approximate time frame of the rotations is listed below, but the length of each rotation may be modified to complete specific projects, upon approval of the Program Director. More time is allotted for the first rotation to compensate for the full course load in the fall semester of the first year and holiday interruptions.

First Year Student Laboratory Rotations

1st Rotation	August-December
2nd Rotation	January-March
3rd Rotation	April-June

Student Advisory Committees:

Research Advisory Committee

A Research Advisory Committee is formed to guide the student in the planning and conduct of his or her dissertation research. Within six months after choosing a research adviser, the student in consultation with his or her adviser submits to the Program Director the names of faculty they wish to serve on the student's Research Advisory Committee. The Research Advisory Committee consists of the student's adviser and at least three other members of the graduate faculty. The committee should consist of faculty who can adequately judge the quality and quantity of research performed by the student and help advise the student on solutions to experimental problems that may arise during the course of experimentation. The committee can also aid the student in professional development.

The Research Advisory Committee is appointed by the Program Director based on the recommendations of the student and adviser and on the need to balance faculty effort on various committees. To achieve continuity in students' education and development, there will be

significant overlap in the composition of the Research Advisory Committee, the Preliminary Examination Committee and the Final Examination Committee.

The Research Advisory Committee must meet at least once every six months after the Committee is formed until the student graduates to review student progress. The student is responsible for arranging the meeting and must prepare a short written progress report covering the previous six months of research. After the Committee meeting, the student is responsible for summarizing the consensus of the Committee with a short written addendum to the progress report. The report is then signed and dated by the student and the student's adviser and given to the Program Director.

Preliminary Examination Committee

The Preliminary Examination Committee is appointed by the Program Director with input from the student and adviser. The committee usually includes at least three members of the Molecular Pathology graduate faculty. However, up to two members of the Wake Forest University Graduate faculty from outside the Molecular Pathology graduate program may serve to cover particular areas of expertise. The chair of the Preliminary Examination Committee is charged with organizing and overseeing the exam and is appointed by the Program Director. The student's research adviser is not a member of the committee and can only participate in the exam as an observer.

Final Examination Committee

A Final Examination Committee is appointed by the Dean of the Graduate School upon the recommendation of the Program Director and consists of the following five members of the graduate faculty: the chairperson of the major department or a faculty member chosen by the chairperson, the student's adviser, another member of the major department, a representative from within or outside the department who possesses relevant expertise, and a member from outside the major department who represents the Graduate Council and who serves as chairperson.

Evaluation of Progress:

The progress of all students in the Molecular Pathology program will be evaluated at the end of each semester by the Program Director. A student who does not maintain a 3.0 GPA will be notified by the Program Director in writing that he/she is on probation. If, after the following semester, the GPA remains below 3.0, the student will be notified by the Program Director of pending dismissal. Formal action for dismissal, however, will be taken only after the student's program and progress have been reviewed by a committee of the Molecular Pathology graduate faculty appointed by the Program Director. To facilitate this, the student first should discuss the deficiency with the committee and a plan to resolve the deficiency must be brought to the full faculty.

For the student to continue in the program the full faculty must, by a majority vote, approve the remediation plan. If the faculty votes not to continue the student, a letter to this effect must be sent to the Dean of the Graduate School indicating that the student no longer meets the Molecular Pathology Graduate Program's criteria for continuation. This step is necessary because it is only if a student falls below a 2.5 GPA that he/she is no longer eligible to continue based on

the graduate school's policy. A graduate program, however, may have more rigorous requirements. Consistent with the policy of the Wake Forest University Graduate School, if at any time a student's GPA falls below 2.5, they will be placed on academic probation by the graduate school.

The student will have one semester to bring his or her GPA to 2.5 or greater or face dismissal from graduate school by the Dean. A student may appeal this action through the Program Director. By majority vote, the faculty may recommend that the student be given additional time to bring up the GPA. If so, the written reasons for this request will be provided to the Dean of the Graduate School, who will make the final decision as to whether to allow this student to continue in the program, and the conditions that must be satisfied.

Contact Information:

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For Further Information:

More about Molecular Pathology: <http://www1.wfubmc.edu/lipidsci/graduate/index.htm>

More about the Graduate School: <http://graduate.wfu.edu>

Graduate School Bulletin: <http://graduate.wfu.edu/admissions/bulletin.html>