

Doctor of Philosophy in Pathology

The Department of Pathology and Laboratory Medicine offers a graduate program leading to the PhD degree including research opportunities with emphasis on developmental biology and cell differentiation, cancer biology, stem cell biology, microbial and viral pathogenesis, gene regulation and experimental pathology. This curriculum is designed for advanced research study in molecular and cellular biology and experimental pathology.

The course requirements of the Pathology Department Graduate Program are designed to provide maximum flexibility for the student's specialized needs. Students enrolled in the program are required to take graduate coursework in fields related to molecular and experimental pathology and to choose electives from either Pathology or other Medical Center departments related to their major dissertation work. After passing the Comprehensive Examination, students will devote most of their time to laboratory experimentation and developing a research project. Substantial portions of the research efforts should result in published works in peer-reviewed scientific journals.

The Doctorate of Philosophy in Pathology and Laboratory Medicine provides comprehensive training in understanding the molecular basis of disease and the fundamental mechanisms of cell growth and differentiation. Subspecialized research interests in cancer biology, reproductive and developmental biology, hematopoiesis, vascular biology, and microbial and viral pathogenesis are supported through required and elective coursework and laboratory activities. A Pathology PhD will afford the student the flexibility of tailoring a course of study towards specific research interests and goals, and prepare the student for a career in advanced academia or positions in industry.

The application process is an online process. Application to this graduate program is facilitated through the Interdisciplinary Graduate Program in Biomedical Sciences (IGPBS). (<https://catalog.ku.edu/medicine/graduate-program-biomedical-sciences/>) Detailed instructions on how to apply and the application deadlines are posted on the Interdisciplinary Graduate Program in Biomedical Sciences website <http://www.kumc.edu/igpbs/how-to-apply.html>.

Admission requirements:

- Bachelor's degree from a regionally accredited institution documented by submission of official transcript indicating the degree has been conferred before entering the program. Official transcripts from institutions attended post-baccalaureate are also required. Students with degrees from outside the U.S. may be subject to transcript evaluation indicating the degree is equivalent to a U.S. degree and meets the minimum cumulative GPA requirements.
- A cumulative grade-point average (GPA) of at least a 3.0 on a 4.0 scale for the bachelor's degree.
- Applicants who are not native speakers of English, whether domestic or international, must demonstrate they meet the Minimum English Proficiency Requirement (<https://catalog.ku.edu/graduate-studies/kumc/#EnglishProficiencyRequirement>).

- A background check (<https://catalog.ku.edu/graduate-studies/kumc/#BackgroundCheck>) is required during the admission process; it may affect the student's eligibility to enter the program.
- An official copy of the Graduate Record Examination (GRE) score sent from Educational Testing Service (ETS) to University of Kansas Medical Center - ETS institutional code 6895 - **GRE Scores NOT APPLICABLE TO THE IGPBS.**
- Three letters of recommendation.
- Prerequisite coursework:
 - One year of general chemistry
 - One year of organic chemistry or one semester of organic chemistry and one semester of biochemistry
 - One year of biological sciences
 - One semester of calculus
 - One semester of physics
- Research experience (beyond labs associated with lecture courses) is strongly suggested.
- Interview - the most qualified applicants will receive an invitation for an interview.

Applicants will be assessed based on a combination of GPA, research experience, and interview. After an applicant has been admitted, a program may defer an applicant's admission for one year after which time the applicant must submit a new application.

Admission requirements are subject to change. In most cases, use the catalog of the year student entered the program. *Other years' catalogs*.

Successful completion of the following Interdisciplinary Graduate Program in Biomedical Science (IGPBS) (<https://next.catalog.ku.edu/medicine/graduate-program-biomedical-sciences/>) courses (or their equivalent - specifically for students who have completed a master's degree or have taken masters level courses at a different institution prior to joining the pathology program) Equivalents must be approved by the Director of the Pathology Graduate Program and the Office of Graduate Studies: The program consists of coursework, research experience, and the successful completion of a doctoral dissertation. Dissertation research culminates in a final dissertation examination consisting of an oral presentation by the candidate and an examination by the faculty. Relevant prior graduate work is taken into consideration in setting up individual programs of study leading to the PhD.

Degree requirements:

- Degree requirements are normally completed within 5 years of admission to the program although a maximum of 8 years is allowed.
- Cumulative grade-point average (GPA) of at least a 3.0 for all KU graduate coursework.
- Successful completion of the University's Research Skills and Responsible Scholarship (<https://catalog.ku.edu/graduate-studies/kumc/#ResearchSkillsandResponsibleScholarship>) requirement prior to the semester the Oral Comprehensive Examination is scheduled.
 - Successful completion of GSMC 857 Biographics, GSMC 852 Introduction to Biomedical Research I and GSMC 855 Introduction to Biomedical Research II (or equivalent) meets the Research Skills requirement.
 - Successful completion of GSMC 856 Introduction to Research Ethics or Stowers Research Integrity course (or equivalent) meets the Responsible Scholarship requirement.

- Successful completion of the Residence Requirement ([https://catalog.ku.edu/graduate-studies/kumc/#Doctor%20of%20Philosophy%20\(PhD\)%20Degree%20Requirements](https://catalog.ku.edu/graduate-studies/kumc/#Doctor%20of%20Philosophy%20(PhD)%20Degree%20Requirements)) prior to the semester the Oral Comprehensive Examination is scheduled. The requirement is met by enrollment in full-time status a minimum of two semesters.
- Participation in faculty advisory committee meetings starting after 12 months in the program. Meetings at six-month intervals are recommended and required every 12 months with greater frequency as the student nears his/her oral comprehensive examination and dissertation defense.
- Successful completion of the Oral Comprehensive Examination (<https://catalog.ku.edu/graduate-studies/kumc/#ComprehensiveOralExamination>). The examination is expected to be undertaken after the student has completed all requisite and elective coursework and approximately half-way through the program (e.g., 30th month in a five-year program). The examination consists of both a written research proposal and oral presentation and is intended to delineate the student's current fund of knowledge, research skills and ability to progress to a terminal degree in the department. It may be undertaken only after the student's advisory committee has approved the research proposal and recommended examination. The student will then submit a final version of the written research proposal for approval to his or her mentor, oral comprehensive examination committee and director of Pathology's graduate program a minimum of three weeks in advance of the examination; only when the student has successfully completed this stage will the request for examination be submitted to Graduate Studies for approval to defend (must be at least two weeks in advance of the examination). Students are recognized as formal doctoral candidates after they have passed the comprehensive examination.
- Successful completion of the Post-Comprehensive Enrollment (<https://catalog.ku.edu/graduate-studies/kumc/#PostComprehensiveEnrollment>) requirement.
- Enrollment in a minimum of one (1) credit hour of PATH 999 Doctoral Dissertation the semester the student will defend dissertation and graduate.
- Successful completion of the Final Oral Examination (<https://catalog.ku.edu/graduate-studies/kumc/#FinalOralExamination>) (dissertation defense). The student will undertake this examination only after a preliminary draft and presentation of dissertation project has been successfully completed and accepted by the student's mentor and faculty advisory committee. A final draft is required to be submitted at least four weeks prior to defense and is to be presented to the student's mentor, dissertation defense committee and director of Pathology's graduate program. Only when the student has successfully completed this stage will the request for examination be submitted to Graduate Studies for consideration (must be at least three weeks in advance of the examination).
- Successful Dissertation Submission and Publication (<https://catalog.ku.edu/graduate-studies/kumc/#DissertationSubmissionandPublication>) (according to Office of Graduate Studies policy).
- Successful completion of the following Interdisciplinary Graduate Program in Biomedical Science (IGPBS) (<https://next.catalog.ku.edu/medicine/graduate-program-biomedical-sciences/>) courses (or their equivalent - specifically for students who have completed a master's degree or have taken masters level courses at a different institution prior to joining the pathology program) Equivalent must be approved

by the Director of the Pathology Graduate Program and the Office of Graduate Studies:

| Code | Title | Hours |
|----------|--|-------|
| GSMC 850 | Proteins and Metabolism | 2 |
| GSMC 851 | Molecular Genetics | 2 |
| GSMC 852 | Introduction to Biomedical Research I | 2 |
| GSMC 853 | Cellular Structure | 2 |
| GSMC 854 | Cell Communication | 2 |
| GSMC 855 | Introduction to Biomedical Research II | 2 |
| GSMC 856 | Introduction to Research Ethics | 1 |
| GSMC 857 | Biographics | 1 |
| GSMC 858 | Introduction to Faculty Research | 1 |
| GSMC 859 | Research Rotations | 1-4 |

- Successful completion of the following Pathology courses:

| Code | Title | Hours |
|----------|--|-------|
| PATH 804 | Selected Topics in Signal Transduction | 1 |
| PATH 805 | Seminars in Pathology | 1 |
| PATH 890 | Research in Pathology | 1-10 |
| PATH 990 | Doctoral Research in Pathology | 1-10 |
| PATH 999 | Doctoral Dissertation | 1-7 |

- Successful completion of a minimum of four (4) credit hours of advanced graduate coursework in fields related to molecular and cellular biology and experimental pathology. Specific courses determined in consultation with the student's graduate advisory committee. Recommended courses include but are not limited to:

| Code | Title | Hours |
|--------------------------|--|-------|
| Pathology courses | | |
| PATH 803 | Stem Cell Biology | 2 |
| PATH 806 | Epigenetics | 2 |
| PATH 912 | Advanced Topics | 1-3 |
| PATH 913 | Introduction to Grant Proposal Writing (or equivalent) | 1 |

Other Department courses

| | | |
|----------|-----------------------------------|---|
| ANAT 868 | Advanced Developmental Biology | 2 |
| BCHM 922 | Advanced Molecular Genetics | 3 |
| CBIO 900 | Carcinogenesis and Cancer Biology | 3 |
| PHSL 834 | Reproductive Physiology | 5 |

- Successful publication or submission under review as a first author in a peer-reviewed scientific journal before completion of the degree. The journal and its impact factor are subject to the approval of the student's advisor and the Director of the Pathology Graduate Program.

Students enrolled in the MD-PhD Physician Scientist Training Program should review the Degree Requirements (<https://catalog.ku.edu/medicine/combined-md-phd/#degreerequirementstext>) section of this catalog for that program.

Degree requirements and course descriptions are subject to change. Any courses taken as an equivalent must be approved by the Director of the Pathology Graduate Program and the Office of Graduate Studies. In most cases, the catalog of the year a student entered the program is used as a reference. *Other years' catalogs*.

Typical Plan of Study

| Year 1 | | | |
|--------------|--------------|--|------------|
| Fall | Hours Spring | Hours Summer | Hours |
| GSMC 850 | 2 GSMC 853 | 2 GSMC 859 | 1-4 |
| GSMC 851 | 2 GSMC 854 | 2 May take an elective course from the student's chosen degree program in consultation with the student's advisor. | 1-3 |
| GSMC 852 | 2 GSMC 855 | 2 | |
| GSMC 856 | 1 GSMC 859 | 1-4 | |
| GSMC 857 | 1 | | |
| GSMC 858 | 1 | | |
| GSMC 859 | 1-4 | | |
| 10-13 | | 7-10 | 2-7 |

Total Hours 19-30

| Year 2 | | | |
|---------------------|--------------------------|-----------------------|-------------|
| Fall | Hours Spring | Hours Summer | Hours |
| PATH 804 (required) | 1 PATH 805 (required) | 1 PATH 890 (required) | 1-10 |
| PATH 890 (required) | 1-10 PATH 890 (required) | 1-10 | |
| Elective coursework | 1-3 Elective coursework | 1-3 | |
| 3-14 | | 3-14 | 1-10 |

| Year 3 | | | |
|---------------------|--------------------------|-----------------------|-------------|
| Fall | Hours Spring | Hours Summer | Hours |
| PATH 804 (required) | 1 PATH 805 (required) | 1 PATH 990 (required) | 1-10 |
| PATH 890 (required) | 1-10 PATH 890 (required) | 1-10 | |
| Elective coursework | 1-3 Elective coursework | 1-3 | |
| 3-14 | | 3-14 | 1-10 |

Comprehensive Oral Examination may be taken during the third year with the approval and recommendation of the student's advisory committee (normally after the 30th month in the program.)

| Year 4 | | | |
|---|--------------------------|-----------------------|-------------|
| Fall | Hours Spring | Hours Summer | Hours |
| PATH 804 (not required but recommended) | 1 PATH 805 (required) | 1 PATH 990 (required) | 1-10 |
| PATH 990 (required) | 1-10 PATH 990 (required) | 1-10 | |
| 2-11 | | 2-11 | 1-10 |

| Year 5 | | | |
|---|-------------------------|-----------------------|-------|
| Fall | Hours Spring | Hours Summer | Hours |
| PATH 804 (not required but recommended) | 1 PATH 805 (required) | 1 PATH 999 (required) | 1-6 |
| PATH 999 (required) | 1-6 PATH 999 (required) | 1-6 | |

| | | | |
|---|--|------------|------------|
| Final Oral Exam (dissertation defense) scheduled as early as this semester if approved by committee to defend and graduate. Continued enrollment required until graduate. | | | |
| 2-7 | | 2-7 | 1-6 |

Total Hours 24-128

TECHNICAL STANDARDS AND REQUIREMENTS FOR GRADUATE PROGRAMS IN PATHOLOGY & LABORATORY MEDICINE

The PhD degree signifies that the holder is prepared for entry into research and/or teaching in postgraduate training and faculty positions. It follows that graduates must have the knowledge and skills to function in a broad variety of academic situations in the classroom and laboratory. Therefore all students admitted for graduate study must meet the following abilities and expectations.

- 1. Observation:** The candidate must be able to observe demonstrations and experiences in the basic sciences, including but not limited to biology demonstrations in animals, cultures, and microscopic studies of tissues in normal and pathologic states. A candidate must be able to observe and analyze experimental detail. Observation necessitates the functional use of the sense of vision and somatic sensation.
- 2. Communication:** A candidate should be able to communicate, to understand, and to observe lectures and laboratory instruction. A candidate must be able to communicate effectively in order to present and analyze research data. Communication includes not only speech, but also reading and writing. The candidate must be able to communicate effectively and efficiently in oral and written form with students, staff, and faculty.
- 3. Motor:** Candidates should have sufficient motor function to carry out lab techniques. A candidate should be physically able to do laboratory procedures and analyze data. Such actions require coordination of

both gross and fine muscular movements, equilibrium, and functional use of the senses of touch and vision.

4. Intellectual-Conceptual, Integrative, and Quantitative Abilities: The abilities include measurement, calculation, reasoning, analysis, and synthesis. Problem solving, the critical skill demanded of scientists, requires all of these intellectual abilities. In addition, the candidate should be able to comprehend three-dimensional relationships and to understand the spatial relationships of structures.
5. Behavioral and Social Attributes: A candidate must possess the emotional health required for full utilization of his/her intellectual abilities, the exercise of good judgment and the prompt completion of all responsibilities attendant to the completion of research and teaching responsibilities. Integrity and motivation are personal qualities, which are required for success in science.

Disabled individuals are encouraged to apply. Applicants whose response indicates that they cannot meet the expectations will be reviewed by the Graduate Committee and Technical Support staff of KUMC to assess the extent of the student's difficulties. At this review, the provisions for reasonable accommodation will be determined.

For further information, contact either Soumen Paul, PhD, Pathology & Laboratory Medicine Graduate Program Director, spaul2@kumc.edu, Phone: 913.588.7236 or Tamara Osborn, Graduate Studies Program Coordinator, (lyonkey@kumc.edu)tosborn@kumc.edu, Phone: 913.588.7192, Fax: 913.588.7073.

STUDENT POLICY ON INFECTIOUS DISEASE

Due to the need to assure the health and safety of students, faculty, and staff, the fact that an applicant for admission has an infectious disease or is the carrier of an infectious disease may be a factor in determining eligibility for academic program admission at the University of Kansas Medical Center. Determination of eligibility for admission in such cases will be made on an individual basis in consultation with the applicant's physician, taking into consideration (among other factors), legal requirements and the current best medical information available to determine whether the applicant could complete the normal course of study with reasonable accommodation and without risk to him/herself or to others. Therefore, applicants having an infectious disease or who are carriers of an infectious disease must advise the Graduate Committee of this fact and may be required to provide medical records for review by the Student Health Physician in order to determine eligibility for admission.

DRUG FREE WORKPLACE POLICY OF THE UNIVERSITY OF KANSAS

It is the policy of the University of Kansas that unlawful manufacture, distribution, dispensing, possession, or use of controlled substances or alcohol is prohibited in buildings, facilities, or grounds controlled by the University. Any student found to be illegally manufacturing, distributing, dispensing, possessing, or using controlled substances or alcohol at the University or any of its affiliated educational sites, shall be subject to disciplinary action in accordance with applicable policies as outlined in the Graduate Student Handbook (<http://www.kumc.edu/student-handbook.html>). Students are reminded that illegal manufacture, distribution, dispensing, possession, or use of controlled substances may also subject individuals to criminal prosecution.