Forensic and Investigative Science

Degrees Offered

- Master of Science
- Doctor of Philosophy

Nature of the Program

M.S. FORENSIC AND INVESTIGATIVE SCIENCE

The objective of the M.S. degree is to prepare students for employment in local, state, and federal forensic science laboratories in several forensic disciplines. The M.S. degree is a rigorous, quantitative, research oriented degree accredited by the Forensic Science Education Programs Accreditation Commission (FEPAC).

Students are required to complete a minimum of 40 credit hours. The coursework comprises a core of advanced chemistry, biology and pattern evidence courses, including laboratory-based instruction in microscopy, trace evidence, analytical chemistry, DNA, statistics and laboratory management.

Further specialization occurs through the student's research. The learning and research environments are supported by state-of-the-art instrumentation and laboratory facilities.

PH.D. FORENSIC SCIENCE

The objective of the Ph.D. program is to prepare students to work as professionals in academia, government laboratories, and private industry as laboratory specialists. Students will learn to critically assess the current state of knowledge within the field, and to solve complex problems at the frontier of the discipline. The major component of the program is research. The coursework is comprised of a core of advanced chemistry, biology and pattern evidence courses, including laboratory-based instruction in microscopy, trace evidence, analytical chemistry, DNA, statistics and laboratory management.

ADMINISTRATION

INTERIM CHAIR
- Casper Venter - M.Sc. (Northwest University)

GRADUATE STUDIES COORDINATOR
- Tina Moroose - M.S. (Marshall University)

PROFESSORS
- Glen Jackson - PhD (West Virginia University)
  Ming Hsieh Distinguished Professor, Forensic Chemistry and Mass Spectrometry
- Keith Morris - PhD (University of Port Elizabeth)
  Ming Hsieh Distinguished Professor, Impression Evidence, Evidence Interpretation

ASSOCIATE PROFESSORS
- Jaqueline Speir - PhD (Rochester Institute of Technology)
  Informatics, Pattern Analysis, Image Analysis
- Casper Venter - MS (Northwest University)
  Director, Undergraduate Coordinator, Seized Drugs, Latent Fingerprint Development and Comparison

ASSISTANT PROFESSORS
- Luis Arroyo - PhD (Florida International University)
  Toxicology, Environmental Forensics
- Robin Bowen - PhD (West Virginia University)
  Minor Coordinator, Ethics, Bloodstain Pattern Analysis
- Rachel Mohr - PhD (Texas A&M University)
  Forensic Entomology
- Tina Moroose - MS (Marshall University)
  Graduate Studies Coordinator, Forensic Biology, Quality Assurance
- Robert O'Brien - MS (St. Joseph's University)
  Internship Coordinator, Crime Scene Analysis
Admissions

The M.S. and the Ph.D. are separate degree programs and students should carefully consider which is the most appropriate for their career goals. The M.S. degree is ideal preparation for work in local, state, and federal forensic laboratory systems. The Ph.D. is geared toward preparing students for research-intensive positions, academic appointments, and laboratory management.

Students with a B.S. degree can be directly admitted to the Ph.D. program through the usual admission process. Current students in the FIS M.S. program that decide to pursue a Ph.D. must submit a completed application by the deadline to be considered for admission. Current enrollment in the FIS M.S. program does not guarantee acceptance into the Ph.D. program.

Placement in a specific research group or with a specific faculty member is not guaranteed. Students, particularly those applying to the Ph.D. program, are strongly encouraged to contact faculty ahead of time to discuss research interests and space availability in their research group. At least two potential research advisors must be identified as part of the admission process.

Applications are considered starting in January for admission for the following fall semester. Incomplete application packages are not considered. Priority is given to completed applications received by January 15th. Admissions for spring semester may be considered on a case-by-case basis; contact the Graduate Studies Coordinator before submitting.

Upon receipt and evaluation of the complete application package, suitable candidates will be invited for a final interview with the graduate committee.

SPECIFIC REQUIREMENTS: MASTER OF SCIENCE PROGRAM

• A bachelor’s degree in natural science, Forensic Science, or equivalent which includes at least one year of the following courses:

  1. Fundamentals of Chemistry (inclusive of laboratories),
  2. Organic Chemistry (inclusive of laboratories),
  3. Biology (inclusive of laboratories),
  4. Physics (inclusive of laboratories), and
  5. Calculus

• On-line graduate application
• Official transcripts from all institutions of higher education attended
• GRE taken within the last five years with a score of 300 or better (on combined verbal and quantitative reasoning)
• GPA of 3.0 or better on a 4.0 scale
• An original writing sample by the applicant of at least 1,500 words. The writing sample may be one or more of the following: a peer-reviewed publication where the applicant was the lead author an honors thesis, research report or capstone report in which the applicant is the sole author an essay (1.5 line spacing, Times New Roman, 12 point font) discussing one of the following statements:
  • “DNA will eventually replace trace evidence as a technique in forensic science”
  • “Forensic Science will survive criticism about its reliability”
• Two letters of recommendation from persons who can address potential for success in graduate study and research

SPECIFIC REQUIREMENTS: DOCTOR OF PHILOSOPHY PROGRAM

• B.S. or M.S. degree from accredited college or university (research-based) to include prerequisite coursework for the M.S. Program.
• On-line graduate application
• GPA of 3.0 or better on a 4.0 scale
• Official transcripts from all institutions of higher education attended
• GRE taken within the last five years with a score of 300 or better (on combined verbal and quantitative reasoning)
• Eight M.S. Program courses or equivalent with a grade of C or better
• Research writing example: (1) peer-reviewed publication where the student is the lead author, (2) thesis research converted to a publication-ready document - note that this document must conform to a pre-print to be submitted to a peer reviewed journal (such as JFS or FSI), including appropriate subsections and reasonable length, or (3) thesis research proposal converted to a white paper (maximum length of 6 pages, single-spaced)
• Three letters of recommendation (all three references must be able to comment on the applicant’s academic and/or research skills)
Master of Science

Degree Requirements

- **Credit Hours:** Students are required to complete a minimum of 40 graduate credit hours in Forensic and Investigative Science at the 500 and 600 level.

- **Grade Point Average:** Students must earn a minimum overall GPA of 3.0, and a minimum grade of C- in coursework applied to their graduate program.

- **Graduation Requirement:** Students are required to complete a thesis. Details, requirements, and timelines are provided in the department’s Graduate Student Handbook.

- **Benchmarks:** Ideally, the Plan of Study Form should be completed and submitted to the Coordinator of Graduate Studies before the end of the first semester. Failure to complete the Plan of Study by the end of the second semester will result in the student being placed on probation.

Curriculum Requirements

<table>
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<tr>
<th>Core Courses</th>
<th>24</th>
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<tbody>
<tr>
<td>FIS 501</td>
<td>Foundations of Criminalistics</td>
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<td>FIS 502</td>
<td>Forensic Laboratory Management</td>
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<td>FIS 602</td>
<td>Forensic Informatics</td>
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<td>FIS 614</td>
<td>Trace Evidence Examination</td>
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<td>FIS 620</td>
<td>Forensic Casework Practicum</td>
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<tr>
<td>FIS 632</td>
<td>Advanced Forensic Biology</td>
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<td>FIS 660</td>
<td>Analysis of Seized Drugs</td>
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<tr>
<td>STAT 512</td>
<td>Statistical Methods 2 *</td>
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<th>Seminar</th>
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<td>FIS 696</td>
<td>Graduate Seminar</td>
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<tr>
<th>Research</th>
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<tr>
<td>FIS 697</td>
<td>Research</td>
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<th>Electives *</th>
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<td>Any FIS course at the 400 level or above</td>
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Total Hours: 40

* Or equivalent graduate statistic class as approved by Graduate Studies Committee

Doctor of Philosophy

Degree Requirements

- **Credit Hours:** Graduate students in the Ph.D. program must successfully complete a minimum of 70 credit hours. Each student may apply a maximum of 31 credit hours of research toward the 70-hour requirement; the remaining 39 credit hours must be earned in graduate-level courses in Forensic Science.

- **Grade Point Average:** Students must earn a minimum cumulative GPA of 3.0, and a GPA of 3.0 in coursework applied to their graduate program.

- **Program of Study:** The program also includes an oral qualifying examination, a dissertation proposal presentation, and an oral defense of the dissertation.

- **Comprehensive Examination:** Doctoral students must pass a comprehensive oral examination in the field of criminalistics to demonstrate their competency in the discipline and successfully defend the topic of their dissertation research.

- **Dissertation:** Students are required to complete a dissertation. Additional information, expectations, requirements, and timeline information is found in the Department’s Graduate Student Handbook.

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<td>Forensic Laboratory Management</td>
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Degree Progress

All students should identify a faculty mentor and research topic as soon as possible. The faculty mentor will work with the student to develop a Plan of Study, constitute an advisory committee, and formulate research plans. Details on the composition and establishment of an advisory committee, timelines, and expectations are provided in the Department’s Graduate Student Handbook.

MASTER’S BENCHMARKS

The proposal must be successfully defended on or before the last day of class of the second semester of study in the program. For typical fall semester admits, this is the end of the spring semester (all others, please consult with the Coordinator of Graduate Studies regarding proposal defense deadlines). At the latest, the student must defend before the first day of the summer term, typically on or about May 15th. Failure to do so will result in academic probation, and the student will be ineligible for Departmental financial support. The student will be required to defend by the end of the summer. If this is not accomplished, steps will be initiated to dismiss the student from the program.

Once completed, the proposal defense is valid for a maximum of 4 academic semesters. If the student has not defended the research described by the proposal within 4 academic semesters of the successful proposal defense date, he or she must repeat the proposal defense process, unless given written permission to continue by his or her Chair and the Graduate Committee.

DOCTORAL BENCHMARKS

Doctoral students are allowed a maximum of 5 calendar years from admission to doctoral candidacy to complete all requirements of the PhD degree. Students become doctoral candidates once they have successfully completed their proposal defense and their oral qualifying examination.

The proposal defense should be conducted before the start of the second year of study, assuming completion of the core MS coursework. If the research proposal is not successfully defended, the student must reschedule the defense within one semester. Failure to successfully defend or schedule the second defense within one semester is grounds for dismissal from the program. Once completed, the proposal is valid for a maximum of 6 academic semesters. If the student has not defended the research described by the proposal within 6 academic semesters of the successful proposal defense date, he or she must repeat the proposal defense process, unless given written permission to continue by his or her Chair and the Graduate Committee.

Students should schedule their oral qualifying examination by the end of the fall of the second year (3 academic semesters and assuming successful completion of all core MS coursework). If unsuccessful in the first attempt of their oral examination, this examination must be repeated within one semester. Failure to successfully qualify or schedule the second oral examination within one semester is grounds for dismissal from the program.

Please refer to the Forensic and Investigative Science Graduate Handbook for more information.

Major Learning Outcomes

FORENSIC AND INVESTIGATIVE SCIENCE

1. Develop an understanding of the areas of knowledge that are essential to forensic science.
2. Acquire skills and expertise in the application of basic forensic science concepts and of specialty knowledge to problem solving.
3. Ensure the student is oriented in professional values, concepts, and ethics.
4. Demonstrate integration of knowledge and skills through independent research.
5. Educate and prepare fundamentally sound forensic scientists.

COURSES

FIS 501. Foundations of Criminalistics. 3 Hours.
This course reviews the core theories and fundamental principles of criminalistics. Particular attention will be dedicated to problems of interpreting physical evidence. Aspects on research, scientific method, and ethics will also be addressed.

FIS 502. Forensic Laboratory Management. 3 Hours.
This course provides an overview of management issues in forensic science laboratories, including personnel and human resources, project management, leadership, organization, communication, strategy and budgeting.

FIS 505. Biological and Chemical Evidence. 3 Hours.
PR: Acceptance to the Forensic Justice LL M. The course will enable legal professionals to have a basic understanding of Chemical and Biological evidence in legal proceedings. It is a cross link between science and law and will close the existing gap between the two disciplines. The course will enable legal professionals to prepare for examination or cross examination of expert witnesses in legal proceedings.

FIS 514. Forensic Impression & Trace Evidence. 3 Hours.
PR: Admission to the Master of Laws (LLM) in Forensic Justice and FIS 480 with a minimum grade of C-. Introduction to the analysis and interpretation of forensic impression and trace evidence. Critical analysis skills for data collection methods, data interpretation, reporting structures, current challenges, and anticipated advances. Topics include: fingerprints, firearms, footwear, microscopy, hair, glass, and bloodstain pattern analysis.

FIS 592. Directed Study. 1-6 Hours.
PR: Consent. Directed study, reading, and or research.

FIS 602. Forensic Informatics. 3 Hours.
This course will introduce the student to mathematical methods of forensic data analysis, including (1) digital imaging theory, (2) data pre-processing and exploitation methodologies (e.g., principle component analysis, frequency filtering, etc.) and (3) classical and post classical decision metrics. Theoretical concepts will be supplemented by practical laboratory exercises. Basic algorithm development will also be discussed.

FIS 604. Forensic Fingerprint Examination. 3 Hours.
This course presents the fundamental and advanced aspects of fingerprint comparisons using ACE-V methodology. Specific topics such as Daubert requirements, friction ridge identification; poroscopy, palm prints will be covered. This course includes a laboratory component.

FIS 610. Firearms Examination. 3 Hours.
This course presents the fundamentals and advanced aspects of firearms related to evidence. Topics include the design, mechanism, and manufacture of firearms as well as interior, exterior and terminal ballistics. This course includes laboratory component.

FIS 614. Trace Evidence Examination. 3 Hours.
PR: CHEM 314 or FIS 314. This course will develop the theories of transfer (such as hairs, fibers, paints, gunshot residues and glass). Topics such as microscopy, spectroscopy, and chromatography will be applied. This course includes a laboratory component.

FIS 615. Questioned Document Examination. 3 Hours.
This course will focus on handwriting comparisons, signatures, typewriting, and typescripts. Topics include erasures, additions and alterations, printed and photocopied documents and ink analysis. This course includes a laboratory component.

FIS 620. Forensic Casework Practicum. 3 Hours.
Students will manage mock cases involving multiple types of evidence. They will collect, analyze and interpret the evidence. Written reports on the case will be submitted to evaluation during a mock trial.

FIS 632. Advanced Forensic Biology. 3 Hours.
This course will provide students with the knowledge and skills to perform forensic DNA analyses. Topics include analytical methods and procedures, result interpretation and evidence assessment. This course includes a laboratory component.

FIS 660. Advanced Forensic Chemistry. 3 Hours.
This course covers the chemical analysis of a wide variety of forensic evidence types. Topics include statistics, sampling, data quality, calibration, sample preparation, instrumentation; drug analysis, toxicology and explosives. This course includes a laboratory component.

FIS 695. Independent Study. 1-6 Hours.
Faculty Supervised study of topics not available through regular class offerings.

FIS 696. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

FIS 697. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).
FIS 702. Advanced Forensic Science. 3 Hours.
This course develops competency in two main areas: 1) the ability to evaluate the admissibility of forensic science techniques in legal casework, and 2) the ability to identify gaps in present-day scientific principles, policies and technologies within the core sub-disciplines of forensic science, including, but not limited to, forensic chemistry, biology, trace evidence and pattern sciences.

FIS 703. Research Design in Forensic Science. 3 Hours.
PR: Admission to the FIS Doctor of Philosophy program. Research Design in Forensic Science is an applied research and statistics based course established specifically for students in the FIS Doctor of Philosophy program. The course will prepare students for data analysis related to sampling, regression, outlier detection, univariate significance testing, propagation of uncertainty, multivariate classification, classifier evaluation, Bayesian reasoning, data standardization and significance reporting.

FIS 792. Directed Study. 1-6 Hours.

FIS 796. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

FIS 797. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation.

FIS 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use of the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.