FORENSIC SCIENCE, BACHELOR OF SCIENCE (B.S.) WITH A CONCENTRATION IN FORENSIC BIOLOGY

The forensic biology concentration requires an additional 24 credits in biology, forensic science and elective credits beyond the core requirements and is well-suited for students interested in graduate study or careers in the forensic biology section of forensic laboratories. Students also will be prepared for work in molecular biology laboratories in both the public and private sectors. Students completing the forensic biology concentration will be eligible for a minor in chemistry. Additionally, students who complete BIOL 317 or BIOL 318 will be eligible for a minor in biology.

Learning outcomes

Upon completing this program, students will know and know how to do the following:

• Demonstrate a basic understanding of the laws of criminal procedure and rules of evidence
• Demonstrate proper crime scene investigation and reconstruction
• Demonstrate ethical and professional duties and responsibilities of the forensic scientist
• Be able to apply basic principles and laboratory procedures of biology to forensic science
• Demonstrate capabilities, use and limitations of forensic laboratory techniques

Special requirements

The forensic science program requires a minimum of 120 credits including completion of the College of Humanities and Sciences general education requirements, 49-51 forensic science core program credits and 24 concentration-specific credits.

For the forensic biology concentration, a minimum of five elective credit hours of advanced biology, chemistry and/or forensic science course work (with lab, at the 300- to 500-level) must be taken. FRSC 202 is not applicable for the major.

Degree requirements for Forensic Science, Bachelor of Science (B.S.) with a forensic biology concentration

General education requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIV 111</td>
<td>Play course video for Focused Inquiry I</td>
<td>3</td>
</tr>
<tr>
<td>UNIV 112</td>
<td>Play course video for Focused Inquiry II</td>
<td>3</td>
</tr>
<tr>
<td>UNIV 200</td>
<td>Inquiry and the Craft of Argument</td>
<td>3</td>
</tr>
<tr>
<td>Approved humanities/fine arts</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Approved natural/physical sciences 3-4
Approved quantitative literacy 3-4
Approved social/behavioral sciences 3-4
Total Hours 21-24

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUMS 202</td>
<td>Choices in a Consumer Society</td>
<td>1</td>
</tr>
<tr>
<td>Approved H&amp;S diverse and global communities</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Approved H&amp;S human, social and political behavior (fulfills University Core social/behavioral sciences)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved H&amp;S literature and civilization (fulfills University Core humanities/fine arts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved H&amp;S science and technology (fulfills University Core natural/physical sciences)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved H&amp;S general education electives</td>
<td></td>
<td>6-8</td>
</tr>
<tr>
<td>Experiential fine arts</td>
<td></td>
<td>1-3</td>
</tr>
<tr>
<td>Foreign language through the 102 level (by course or placement)</td>
<td></td>
<td>0-8</td>
</tr>
</tbody>
</table>
Total Hours 11-23

Course offered by the School of the Arts

Collateral requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 200</td>
<td>Calculus with Analytic Geometry I (fulfills University Core quantitative literacy)</td>
<td>3-10</td>
</tr>
<tr>
<td>PHIL 201</td>
<td>Critical Thinking About Moral Problems (fulfills H&amp;S literature and civilization)</td>
<td></td>
</tr>
<tr>
<td>STAT 210</td>
<td>Basic Practice of Statistics</td>
<td></td>
</tr>
</tbody>
</table>

Total Hours 3-10

Major requirements

Students must receive a minimum grade of C in all of the following courses. If a course is a prerequisite for another course, a minimum grade of C must be obtained in the prerequisite course before proceeding to the subsequent course.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 151</td>
<td>Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 152</td>
<td>Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 300</td>
<td>Cellular and Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 310</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOZ 476</td>
<td>Molecular Capstone Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 101  &amp; CHEZ 101</td>
<td>General Chemistry I and General Chemistry Laboratory I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 102  &amp; CHEZ 102</td>
<td>General Chemistry II and General Chemistry Laboratory II</td>
<td>4</td>
</tr>
</tbody>
</table>
Forensic Science, Bachelor of Science (B.S.) with a concentration in forensic biology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 301 &amp; CHEZ 301</td>
<td>Organic Chemistry and Organic Chemistry Laboratory I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 302 &amp; CHEZ 302</td>
<td>Organic Chemistry and Organic Chemistry Laboratory II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 403</td>
<td>Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>FRSC 300</td>
<td>Survey of Forensic Science</td>
<td>3</td>
</tr>
<tr>
<td>FRSC 309</td>
<td>Scientific Crime Scene Investigation</td>
<td>3</td>
</tr>
<tr>
<td>FRSC 365</td>
<td>Forensic Microscopy</td>
<td>3</td>
</tr>
<tr>
<td>FRSC 375</td>
<td>Forensic Evidence, Law and Criminal Procedure</td>
<td>3</td>
</tr>
<tr>
<td>FRSC 385</td>
<td>Forensic Serology</td>
<td>3</td>
</tr>
<tr>
<td>FRSC/BIOZ 438</td>
<td>Forensic Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>FRSZ/BIOZ 438</td>
<td>Forensic Molecular Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>FRSC 490</td>
<td>Professional Practices in Forensic Science</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 201</td>
<td>General Physics I</td>
<td>4-5</td>
</tr>
<tr>
<td>PHYS 202</td>
<td>General Physics II</td>
<td>4-5</td>
</tr>
</tbody>
</table>

Total Hours 68-70

Concentration electives

Students must receive a minimum grade of C in all concentration electives. If a course is a prerequisite for another course, a minimum grade of C must be obtained in the prerequisite course before proceeding to the subsequent course.

Course Title Hours
Select five credits of 300- to 500-level courses with a laboratory from BIOL/BIOZ, CHEM/CHEZ or the FRSC/FRSZ courses listed below:

- FRSC 400 Forensic Chemistry 1
- FRSC 445 Forensic Toxicology and Drugs 1
- FRSC 505 Forensic Entomology 1
- FRSC 510 Developmental Osteology 1
- FRSC 515 Advanced Forensic Anthropology 1

Total Hours 5

Open electives

Course Title Hours
Select zero to 12 credits 0-12

Total Hours 0-12

The minimum total of credit hours required for this degree is 120.

What follows is a sample plan that meets the prescribed requirements within a four-year course of study at VCU. Please contact your adviser before beginning course work toward a degree.

Note: This plan of study assumes that the student:

- Scored well enough on the VCU Mathematics Placement Test to place into MATH 200 or that the student has completed MATH 151 with a minimum grade of C (a pre- or corequisite for BIOL 151, BIOZ 151 and CHEM 101; a prerequisite for CHEM 102).

**Freshman year**

**Fall semester**

- BIOL 151 & BIOZ 151 Introduction to Biological Sciences I 1 4
- CHEM 101 & CHEZ 101 General Chemistry I 1 and General Chemistry Laboratory I 1 4
- UNIV 111 Focused Inquiry I 1 3

Approved H&S science and technology 3-4

Experiential fine arts 1-3

Term Hours: 15-18

**Spring semester**

- BIOL 152 & BIOZ 152 Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II 4
- CHEM 102 & CHEZ 102 General Chemistry II 1 and General Chemistry Laboratory II 1 4
- HUMS 202 Choices in a Consumer Society 1
- MATH 200 Calculus with Analytic Geometry I 4
- UNIV 112 Focused Inquiry II 1 3

Term Hours: 16

**Sophomore year**

**Fall semester**

- BIOL 300 Cellular and Molecular Biology 3
- CHEM 301 & CHEZ 301 Organic Chemistry I 1 and Organic Chemistry Laboratory I 1 5
- STAT 210 Basic Practice of Statistics 3
- UNIV 200 Inquiry and the Craft of Argument I 1 3

Term Hours: 14

**Spring semester**

- CHEM 302 & CHEZ 302 Organic Chemistry II and Organic Chemistry Laboratory II 5
- FRSC 300 Survey of Forensic Science 3
- FRSC 375 Forensic Evidence, Law and Criminal Procedure 3
- PHIL 201 Critical Thinking About Moral Problems (fulfills H&S literature and civilization course) 3

Term Hours: 14

**Junior year**

**Fall semester**

- BIOL 310 Genetics 3
- FRSC 309 Scientific Crime Scene Investigation 3
PHYS 201 General Physics I or University Physics I
PHYS 207
BIOL/BIOZ, CHEM/CHEZ or FRSC/FRSZ (with lab, 300- to 500-level)
Foreign language (101-level) or open electives
Term Hours: 16-17

Spring semester
FRSC 356 Forensic Microscopy
PHYS 202 General Physics II or University Physics II
PHYS 208
Approved H&S diverse and global communities
Foreign language (102-level) or open electives
Open electives
Term Hours: 15-16

Senior year
Fall semester
BIOZ 476 Molecular Capstone Laboratory
CHEM 403 Biochemistry I
FRSC 385 Forensic Serology
FRSC 490 Professional Practices in Forensic Science
BIOL/BIOZ, CHEM/CHEZ or FRSC/FRSZ (with lab, 300- to 500-level)
Open electives
Term Hours: 16

Spring semester
FRSC 438 Forensic Molecular Biology & FRSC 438 and Forensic Molecular Biology Laboratory
Approved H&S general education electives
Approved H&S human, social and political behavior
Term Hours: 14-17
Total Hours: 120-128

There is little, if any, flexibility regarding when to take these courses in order to enroll in FRSC 300 during spring semester of sophomore year.

The minimum total of credit hours required for this degree is 120.

FRSC 202. Crime and Science. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Introduces the scientific theory, concepts and practices used in any physical science by relating them to the analysis of physical evidence performed in forensic laboratories and the fundamentals of crime scene investigation, and their relationship to the criminal justice system and criminal investigations. Not applicable for credit toward B.S. in Forensic Science.

FRSC 291. Topics in Forensic Science. 1-3 Hours.
Semester course; 1-3 lecture hours. 1-3 credits. May be repeated with different topics for a maximum of six credits. A study of selected topics in forensic science. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

FRSC 300. Survey of Forensic Science. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 151, BIOZ 151, CHEM 102, CHEZ 102 and UNIV 112, each with a minimum grade of C. Pre- or corequisites: CHEM 301 and CHEZ 301, and UNIV 200 or HONR 200. Enrollment is restricted to forensic science majors or by permission of instructor. Introduces the theory, concepts and practices used in the analysis of physical evidence performed in crime laboratories, and the fundamentals of crime scene investigation. Also introduces ethical and quality assurance issues of crucial importance in modern crime laboratories.

FRSC 309. Scientific Crime Scene Investigation. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: CHEM 301 and FRSC 300, each with a minimum grade of C. Enrollment is restricted to forensic science majors or by permission of the instructor. Provides scientific theory of crime scene investigation and crime scene reconstruction and basic knowledge of proper crime scene protocol and evidence processing techniques. Includes the processes for documentation, collecting and preserving physical evidence.

FRSC 310. Forensic Anthropology. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: ANTH 210 or FRSC 300 with a minimum grade of C. A comprehensive overview of forensic anthropology including its development and the theory and methodology on which it is based. Crosslisted as: ANTH 310.

FRSC 325. Forensic Medicine. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: FRSC 300, CHEM 301 and CHEZ 301, each with a minimum grade of C. Enrollment restricted to forensic science majors or by permission of instructor. An investigation of topics in death scene investigations as well as autopsy findings associated with natural and unnatural deaths.

FRSC 351. Forensic Science Service-learning. 2 Hours.
Semester course; 2 lecture hours. 2 credits. May be repeated for a maximum of 4 credits. Prerequisites: FRSC 300 and at least one additional FRSC/Z course, each with a minimum grade of C. Enrollment restricted to forensic science majors or by permission of instructor. Provides an opportunity to learn about the community's schools and how to teach forensic science concepts to school-aged students. Each week, VCU students will provide hands-on lab activities in community-based programs to reinforce lessons learned through their school curricula. Reflective writing, partner assignments and a final presentation are required, in addition to 20 community partner hours. VCU students will improve their ability to explain forensic concepts to those with differing scientific backgrounds, have increased confidence when addressing audiences and deepen their understanding of civic responsibility.

FRSC 365. Forensic Microscopy. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: CHEM 301 and FRSC 300, each with a minimum grade of C. An in-depth course in the theory and practical application of microscopy to the examination, identification and individualization of physical evidence submitted to forensic laboratories.

FRSC 375. Forensic Evidence, Law and Criminal Procedure. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prere- or co-requisites: FRSC 300 or FRSC 350. Open only to forensic science majors or by permission of instructor. The law of criminal procedure and rules of evidence as applied to forensic science. Topics will include scientific versus legal burdens of proof, legal terminology and trial procedure.
FRSC 385. Forensic Serology. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits.
Prerequisites: CHEM 301 and either FRSC 300 or FRSC 350, each with a minimum grade of C. Examines the application of basic chemical, biological, immunological and microscopic laboratory techniques to the examination and identification of body-fluid stains, including both presumptive and/or confirmatory identification of blood, semen, saliva, urine and feces. Applies methods that are used in forensic laboratories to identify the species of origin and includes a review of advanced methods for automated serological analysis. Laboratory exercises will supplement lectures to give students practical knowledge of the laboratory procedures.

FRSC 391. Topics in Forensic Science. 1-3 Hours.
Semester course; 1-3 lecture hours. 1-3 credits. Maximum total of 6 credits for all forensic science topics courses may be applied to the major. Prerequisites: CHEM 301 and either FRSC 300 or FRSC 350, each with a minimum grade of C. A study in selected topics in forensic science. See the Schedule of Classes for specific topics to be offered each semester and additional prerequisites.

FRSC 400. Forensic Chemistry. 4 Hours.
Semester course; 2 lecture and 4 laboratory hours. 4 credits.
Prerequisites: CHEM 409 and CHEZ 409, each with a minimum grade of C. Examines core principles and instrumentation used in forensic chemistry applications to include microchemical tests, gas chromatography, liquid chromatography, spectroscopy and mass spectrometry, with emphasis on forensic casework. These topics may include accelerants, explosives, paints, polymers and drug analysis. Students will gain experience in experimental design, operation and troubleshooting of instrumentation, as well as the analysis and interpretation of chromatographic and spectroscopic data sets.

FRSC 410. Forensic Pattern Evidence. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: FRSC 309 with a minimum grade of C. Enrollment is restricted to forensic science majors or by permission of the instructor. Covers topics in pattern evidence analysis including analysis of latent prints and impression evidence of footwear and tire treadmarks as applied to forensic casework. Covers both the theoretical and practical aspects using lectures and laboratory exercises focusing on the visualization, examination and interpretation of pattern evidence.

FRSC 412. Forensic Analysis of Firearms and Toolmarks. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: FRSC 365 with a minimum grade of C. Enrollment is restricted to forensic science majors or by permission of the instructor. An investigation of topics in firearms and toolmark examination for forensic applications. Covers both theoretical and practical aspects using lectures and laboratory exercises.

FRSC 438. Forensic Molecular Biology. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 310 with a minimum grade of C. Provides an understanding of molecular biology testing methodologies as applied to analysis of forensic samples. Current topics in forensic DNA analysis will include quality assurance, DNA databanking, contemporary research and population genetics. Crosslisted as: BIOL 438.

FRSC 445. Forensic Toxicology and Drugs. 4 Hours.
Semester course; 2 lecture and 4 laboratory hours. 4 credits.
Prerequisites: CHEM 409 and CHEZ 409, each with a minimum grade of C. Provides a comprehensive overview of the basic principles of drug analysis and forensic toxicology. Students will perform hands-on lab exercises in these areas. Students will learn to identify the controlled substances and toxic agents most commonly abused and/or encountered in criminal investigations, including issues of interpretation and impairment.

FRSC 490. Professional Practices in Forensic Science. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: CHEM 301; FRSC 300 or FRSC 350; and one additional forensic science course, each with a minimum grade of C. Enrollment restricted to seniors in forensic science with at least 85 credit hours toward the degree. An examination and evaluation of historical and current issues in the scientific analysis of physical evidence in criminal investigations. Individual and group activities relating to professional practices (ethics, quality control and testimony) of forensic scientists.

FRSC 492. Forensic Science Independent Study. 1-3 Hours.
Semester course; 1-3 independent study hours. 1-3 credits. May be repeated for a maximum of 6 credits. Prerequisites: CHEM 301; and FRSC 300 or FRSC 350, each with a minimum grade of C. Enrollment restricted to forensic science majors with at least sophomore standing and a minimum GPA of 2.5. A determination of the amount of credit and the written permission of both the instructor and the program director must be procured prior to registration for the course.

FRSC 493. Forensic Science Internship. 1-3 Hours.
Semester course; 1-3 field experience hours. 1-3 credits. Prerequisite: FRSC 300 with a minimum grade of C. Enrollment is restricted to forensic science majors with a minimum GPA of 2.75. An application is required in advance of admission with permission of the internship coordinator. Through placement in an approved organization, the student will obtain a broader, more practical knowledge of forensic science and its applications. Written progress and final reports are required. Graded as pass/fail.