BIOSTATISTICS, MASTER OF SCIENCE (M.S.)

Program goal
The mission of the VCU Department of Biostatistics is to improve human health through methodological research, the education of graduate students and health science researchers in biostatistical methods and applications, and collaborative health sciences research. Faculty members conduct methodological research motivated by collaborative alliances, which in turn contributes to and enhances the department’s educational mission. By focusing on the integration of methodological and collaborative research, students develop strong biostatistical and communication skills, enabling them to assume leadership positions in academia, government and industry.

Student learning outcomes
1. Experimental design: The candidate will demonstrate the achievement of an appropriate level of competence in the ability to appraise, modify and/or create, and implement experimental protocols and to design and develop experiments as measured by rubric.
2. Integrated knowledge of mathematics and bioscience: The candidate will demonstrate an appropriate level of knowledge of the current elements of mathematics as related to bioscience and a more detailed understanding of the individual area of scholarship, including an appropriate familiarity with the research literature and the ability to evaluate and critique publications as measured by rubric.
3. Oral communication skills: The candidate will demonstrate the achievement of an appropriate level of oral communication skills with respect to the content, organization, logical flow, presentation and appropriate use of language incorporating the use of visual aids, as measured by rubric.
4. Problem-solving skills: The candidate will demonstrate an appropriate level of skill in the identification and selection of meaningful problems to be addressed in bioscience research, including the ability to defend said identifications and to design and develop appropriate methods to solve said problems as measured by rubric.
5. Written communication skills: The candidate will demonstrate the achievement of an appropriate level of written communication skill with respect to grammar, syntax, spelling and use of vocabulary to effectively present information including the use of figures, tables and citations as measured by rubric.

VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs
The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

Visit the Graduate study section for additional information on academic regulations for graduate students.

Degree candidacy requirements
A graduate student admitted to a program or concentration requiring a final research project, work of art, thesis or dissertation, must qualify for continuing master’s or doctoral status according to the degree candidacy requirements of the student’s graduate program. Admission to degree candidacy, if applicable, is a formal statement by the graduate student’s faculty regarding the student’s academic achievements and the student’s readiness to proceed to the final research phase of the degree program.

Graduate students and program directors should refer to the following degree candidacy policy as published in the VCU Graduate Bulletin for complete information and instructions.

Visit the Graduate study section for additional information on degree candidacy requirements.

Graduation requirements
As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the Graduate study section for additional information on graduation requirements.

Other information
School of Medicine graduate program policies
The School of Medicine provides policies applicable to all programs administratively housed in the school. Information on master’s programs is available elsewhere in this chapter of the Graduate Bulletin.

Apply online at graduate.admissions.vcu.edu (http://www.graduate.admissions.vcu.edu).

Admission requirements

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<tr>
<th>Degree:</th>
<th>Semester(s) of entry:</th>
<th>Deadline dates:</th>
<th>Test requirements:</th>
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<td>M.S.</td>
<td>Fall preferred</td>
<td>Applications received prior to Jan 15</td>
<td>GRE</td>
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In addition to the general admission requirements of the VCU Graduate School (http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements), applicants for the M.S. in Biostatistics must complete the verbal, quantitative and analytical writing sections of the Graduate Record Exam.
Additionally, the following mathematics courses or their equivalents are required for admission:

- **MATH 307** Multivariate Calculus 4
- **MATH 310** Linear Algebra 3
- **STAT 212** Concepts of Statistics 3
- **STAT 309** Introduction to Probability Theory 3

Although not required, prior course work in additional mathematics, statistics or computer science is helpful.

**Degree requirements**

In addition to the general VCU Graduate School graduation requirements (http://bulletin.vcu.edu/graduate/study/general-academic-regulations-graduate-students/graduation-requirements), M.S. students must complete a minimum total of 42 graduate credit hours of course work. Students are required to take:

- **BIOS 513** Mathematical Statistics I & **BIOS 514** Mathematical Statistics II 6
- **BIOS 524** Biostatistical Computing 3
- **BIOS 546** Theory of Linear Models 3
- **BIOS 553** Biostatistical Methods I 3
- **BIOS 554** Biostatistical Methods II 3
- **BIOS 571** Clinical Trials 3
- **BIOS 572** Analysis of Biomedical Data I 3

Select one of the following: 3-4

- **BIOS 615** Advanced Inference
- **BIOS 625** Categorical Data Analysis and Generalized Linear Models
- **BIOS 631** Mixed Models and Longitudinal Data Analysis
- **BIOS 647** Survival Analysis

Additional course

- Select one of the following (minimum three credits):
  - **BIOS 615** Advanced Inference 4
  - **BIOS 616** Advanced Inference 4
  - **BIOS 625** Categorical Data Analysis and Generalized Linear Models 4
  - **BIOS 631** Mixed Models and Longitudinal Data Analysis 4
  - **BIOS 647** Survival Analysis 3

Additional combination

- Select one or two (with program director approval) of the following (minimum three credits):
  - **BIOS 632** Multivariate Analysis
  - **BIOS 638** Statistical Design and Analysis in Toxicology
  - **BIOS 639** Statistical Design and Analysis in Toxicology
  - **BIOS/STAT 650** Design and Analysis of Response Surface Experiments
  - **BIOS 667** Statistical Learning and Data Mining
  - **BIOS 688** Applied Bayesian Biostatistics
  - **STAT 613** Stochastic Processes
  - **STAT 614** Stochastic Processes
  - **STAT 625** Applied Multivariate Analysis 6

Total Hours: 24

**Thesis**

M.S. in Biostatistics students must write a thesis that reports the results of data analysis, or a review or survey. An original research topic is not required.

**Final examination**

M.S. in Biostatistics candidates must defend their theses at a final oral examination. While questions are restricted to the topic of the dissertation for the Ph.D. candidate, no such restriction applies for the thesis defense for M.S. candidates.

**Curriculum requirements**

**Core courses**

- **BIOS/STAT 513** Mathematical Statistics I 3
- **BIOS/STAT 514** Mathematical Statistics II 3
- **BIOS 524** Biostatistical Computing 3
- **BIOS 546** Theory of Linear Models 3
- **BIOS 553** Biostatistical Methods I 3
- **BIOS 554** Biostatistical Methods II 3
- **BIOS 571** Clinical Trials 3
- **BIOS 572** Analysis of Biomedical Data I 3

Total Hours: 24

**Consulting and seminar**

Take the following one-credit course for four semesters:

- **BIOS 516** Biostatistical Consulting 4

Take the following one-credit course for four semesters:

- **BIOS 516** Biostatistical Consulting 4
<table>
<thead>
<tr>
<th>BIOS 690</th>
<th>Biostatistical Research Seminar</th>
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<tr>
<td></td>
<td>Total Hours</td>
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</table>

**Summer student research program**

| BIOS 697 | Directed Research in Biostatistics (minimum one credit) | 1 |

**Total graduate credit hours required (minimum) 42**

**Typical plan of study**

Many students often end up taking more than the minimum number of hours required for a degree program. The total number of hours may vary depending upon the program, nature of research being conducted by a study or in the enrollment or funding status of the student. Students should refer to their program websites and talk with their graduate program directors or advisers for information about typical plans of study and registration requirements.

**Graduate program director**

Roy T. Sabo, Ph.D.
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**Additional contact (admissions and prospective students)**

Russell M. Boyle
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(804) 827-2049

**Program website**: biostatistics.vcu.edu (http://www.biostatistics.vcu.edu)