Motion re MS in Biomedical and Forensic Science

Referred by the Curriculum Committee

Motion:

The Faculty Senate approves the proposal for a MS in Biological and Forensic Science.

Rationale:

See below for proposal.
A Master of Science in Biomedical and Forensic Sciences (MSBFS) at Radford University is proposed as a new degree program. This program, planned for an initiation date of Fall, 2016, will serve students with Bachelor’s degrees in the natural or forensic sciences with an interest in the biomedical and forensic sciences. It will prepare them for high-demand professional careers in state and national forensic science crime labs, biomedical or pharmaceutical labs, as well as medical school, law school, doctoral studies in the natural or forensic sciences, and biomedical research. It will also serve medical students who are interested in obtaining a dual degree (e.g., M.D. and M.S.).

The M.S. in Biomedical and Forensic Sciences program is warranted because of the increasing need, nationally as well as locally, for well-trained biomedical and forensic scientists. There has been much demand for accredited training in the applied biomedical and forensic sciences, particularly at the post-undergraduate level. Graduate degrees are becoming necessary in order to obtain employment in these fields. An M.S. degree in Biomedical and Forensic Sciences mitigates this need by providing students with accredited graduate training and skills to gain a competitive edge in job placement in public or private forensic science or biomedical laboratories. The program will ultimately assist in adjudicating criminal cases by alleviating a portion of the backlog in forensic services (e.g., DNA) being faced by forensic laboratories due to their staffing limitations. It will also provide medical school students with research skills and experience and make them more competitive for successful careers in forensic pathology, forensic medicine, and biomedical research.

This Master’s program is designed to be both rigorous and academically challenging. It is a full-time, one to two-year program comprising 40 required hours, 33 of which are core (including thesis) hours. Remaining hours are chosen from restrictive electives in Forensic Anthropology/Pathology/Forensic Medicine, Forensic Biology, Forensic Chemistry, and Criminalistics, with an optional concentration available in Forensic Anthropology/Pathology/Forensic Medicine.

The program is unique and innovative in its approach to learning. Instruction within the graduate program will be a blend of classroom, laboratory-based, and online (web-based) delivery. Since forensic and biomedical science are applied laboratory sciences, the majority of courses in the program have laboratory components built in. A significant degree of learning will occur outside of class or lab in the form of student problem-based learning, casework, and research groups in collaborative learning spaces. Research is a vital and integral component of the degree program, facilitated through directed studies and the completion of a thesis of publishable quality. There will also be emphasis placed on experiential (high
impact) learning opportunities through required participation in either an on- and off-site internship or service learning project, with the ultimate goal of more fully preparing students for a professional career in the forensic or biomedical sciences. Thus, it is, in accordance with the RU Mission Statement (as well as upcoming trends in higher education\textsuperscript{1,2}) student-focused, providing ample opportunity for peer-directed and self-learning through small group discussions, problem-solving, and high-impact experiences. Portions of forensic science topics such as Ethics, Quality Assurance, and Professional Development will be delivered online, made available through the Radford University Forensic Science Institute (RUFSI) website.\textsuperscript{3}

The graduate program will be administered within the College of Science and Technology (CSAT) in collaboration with the Radford University Forensic Science Institute (RUFSI) and the Virginia Tech Carilion School of Medicine (VTCSOM). Located within CSAT, the RUFSI is ideally situated to work collaboratively with this Master’s program in that it is an interdisciplinary institute whose goal is to promote and support forensic science education, research, and public service. The institute faculty and affiliates are comprised of a wide range of specialists with expertise in forensic science. The Master’s program will also receive interdisciplinary and collaborative support from other RU departments (e.g., Departments of Anthropological Sciences, Biology, Criminal Justice) as well as allied health, law enforcement, and community partners outside RU.

In addition to a graduate degree, a nationally reputable academic program in forensic science must be accredited or must be working toward accreditation to ensure that its students gain acceptable credentials for employment in the forensic sciences. To address important issues regarding standardization of forensic science curricula to ensure comparability and quality control, in 2001, the National Institute of Justice (NIJ) in association with the American Academy of Forensic Sciences (AAFS), created FEPAC—the Forensic Science Education Programs Accreditation Commission. FEPAC ensures the quality of college-level academic programs in forensic science leading to baccalaureate or graduate degrees in Forensic Science through a formal evaluation and accreditation system. There are currently less than 25 graduate institutions offering FEPAC-accredited degrees in Forensic Science nationally.


\textsuperscript{3} \url{www.radford.edu/~rufsi/}. Accessed August, 2014.
This commission outlines specific and straightforward guidelines for accreditation of forensic science programs.\textsuperscript{4,5} For example, for the graduate major in forensic science, the curriculum should reflect the mission of the university or entity in which it is housed. It shall have clear learning objectives focused on the development of core forensic science knowledge and skills, professionalism, research, and court testimony. The M. S. in Biomedical and Forensic Sciences strictly follows FEPAC curricular guidelines, which are detailed in the section “Curriculum” below. Following FEPAC guidelines, programs are eligible for accreditation after graduation of at least two classes; therefore, the RU program would be eligible for accreditation after Spring, 2019.

**Mission**

Radford University’s Mission Statement\textsuperscript{6} is as follows:

“Radford University serves the Commonwealth of Virginia and the nation through a wide range of academic, cultural, human service and research programs. First and foremost, the university emphasizes teaching and learning and the process of learning in its commitment to the development of mature, responsible and well-educated citizens. RU develops students’ creative and critical thinking skills, teaches students to analyze problems and implement solutions, helps students discover their leadership styles and fosters their growth as leaders. Toward this end, the university is student-focused and promotes a sense of caring and meaningful interaction among all members of the university community. Research is viewed as a vital corollary to the teaching and learning transaction as it sustains and enhances the ability to teach effectively. Radford University believes in the dynamics of change and has a strong commitment to continual review, evaluation and improvement in the curriculum and all aspects of the university so as to meet the changing needs of society.”

The M. S. in Biomedical and Forensic Sciences program complements RU’s stated mission through its commitment to high-quality teaching and learning which promotes students’ critical thinking, leadership, and research skills. This program will showcase RU’s student-centered focus by offering a graduate program centered on teaching applied scientific research, leadership, and problem solving skills to pre-professional students interested in the forensic sciences.

RU’s 2013-14 Six-Year Plan also encourages the development of programs which will enhance student enrollment, retention, and graduation. Programs that will strengthen RU’s commitment to providing high quality academic training that attracts, challenges, retains, and graduates students from


diverse backgrounds are emphasized. Given the recent popularity of forensic science and the reputable foundation for Forensic Science training already established at RU through the Forensic Science Minor and the RUFSI, a unique graduate program such as the one proposed here has much potential to attract and retain outstanding students from diverse backgrounds.

The Six-Year Plan also clearly emphasizes the development of graduate, professional, and applied doctoral programs, particularly those in professional STEM-H collaborative programs which will enhance math and science education and encourage research-based education in the natural and health sciences. RU has already taken steps to develop professional degrees in the applied health sciences. These include the DPT (Doctor of Physical Therapy), MOT (Master’s of Occupational Therapy), and DNP (Doctor of Nursing Practice) degrees in the Waldron College of Health. The Master of Science in Biomedical Forensic Sciences will complement these STEM-H professional degrees. It will create a unique niche for Radford University as a regional leader in forensic and biomedical science professional programs and training and attract a high-caliber of students interested in STEM-H careers to the university for advanced professional education. It will also offer opportunities for collaborative research between these graduate programs, including their faculty and students, as well as between RU and VTCSOM.

The proposed M. S. in Biomedical and Forensic Sciences also fulfills the following RU College of Science and Technology’s annual goals (2014-2015):

1. Develop and deliver educational opportunities of the highest quality to RU students through innovative programs with high potential for recruitment, retention, and high-impact learning;
2. Support the development of graduate degree programs in STEM fields;
3. Pursue acquisition of new faculty hires in STEM fields;
4. Encourage new collaborative relationships with corporate and other partners external to RU;
5. Promote and enhance the overall academic excellence and reputation of Radford University.

In sum, an M. S. in Biomedical and Forensic Sciences fits well with the stated RU Mission and Six-Year Plan by becoming a nationally-renowned and accredited forensic science graduate program providing outstanding interdisciplinary training in biomedical forensic science based on applied research. This will enable students to have a competitive edge in obtaining forensic or biomedical employment and achieve successful professional careers in the forensic and biomedical sciences. It will also fulfill RU’s mission of creating meaningful, high-impact student-centered educational opportunities for its constituents.

Admissions Criteria
Minimum admissions criteria will follow those defined by the Forensic Educational Program Accreditation Committee (FEPAC), those established by the RU Graduate College, and those specific to the M. S. in Biomedical and Forensic Sciences program. RU Graduate College requirements are:

- a completed RU graduate application;
- a transcript from all institutions attended;
- a minimum 2.75 GPA for a student’s undergraduate courses;
- $50 non-refundable application fee.

The following are FEPAC guidelines for Graduate Admissions in forensic science programs:

“A bachelor’s degree in a forensic or natural science, computer science, computer electronic or electrical engineering, information systems or information technology (or its appropriate graduate forensic science program). Undergraduate work should be evaluated to determine if the applicant has sufficient scientific or technical background to successfully complete the graduate program.”

Specific admission criteria for enrollment in the M. S. program in Biomedical Forensic Sciences at Radford University will consist of the following:

- a bachelor’s degree in a forensic or natural science. If the bachelor’s degree is not in one of these fields, equivalent coursework may be considered. It must include coursework in the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Biology</td>
<td>1 year</td>
</tr>
<tr>
<td>Cell/Molecular Biology</td>
<td>1 semester</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>1 year</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>1 year</td>
</tr>
</tbody>
</table>

- a minimum 3.25 undergraduate GPA;
- general GRE or MCAT scores—a minimum of 70th percentile scores are recommended. A GRE subject test is not required;
- at least two letters of recommendation from professional sources such as professors, supervisors, employers (three are encouraged). At least one of these should be from an academic source;
• a curriculum vita or resume highlighting research and academic achievements as well as relevant work experience;
• a Personal Statement of Interest, addressed to the Director of the program, expressing interest in the program;
• successful clearance through an investigative background check*;
• fulfillment of the RU Graduate College requirements for admission to the graduate college.

Graduate applications will be available online through the RU College of Graduate and Professional Studies and will be considered annually. Deadline for submission of admission materials is March 15 to be considered for the following fall enrollment.

At VTCSOM, enrollment will be available to medical students between their second and third year. Acceptance into the RU MSBFS program requires that the medical student be in good academic standing in the medical curriculum throughout the MSBFS program; a letter of approval from their faculty advisor is also required.

*Note: Forensic science is a medico-legal discipline and career mandating honesty and integrity, particularly in a courtroom setting. Most federal and state agencies will not hire forensic scientists with criminal records. Thus, prospective students must pass a background check before admittance into this program. Students with criminal records or other indications of inappropriate conduct will not be admitted to the program. Students engaging in inappropriate conduct during the course of study in this program may be dropped from the program.

Target Population

This graduate program in biomedical forensic sciences will target individuals with Bachelor’s degrees in the forensic and natural sciences as well as current medical students seeking a dual degree. It will attract students who aspire to a professional career in the biomedical and forensic sciences. This includes students who desire employment in a crime or other forensic laboratory or medical research facility or who wish to gain preparation for advanced graduate study and research in biomedical disciplines. It will accommodate a maximum of 24 students annually who will comprise a fall semester cohort.

Curriculum
Accreditation stipulations necessitate a stringent and challenging interdisciplinary curriculum focused on course and laboratory work and research in the biomedical and natural sciences (e.g., Biology and Chemistry) but also allowing for input from other disciplines with forensic specializations (e.g., Anatomy, Anthropology, Criminal Justice). More specifically, it must include the following:

**FEPAC-Mandated Core Forensic Science Topics**

- Crime scene investigation
- Physical evidence concepts
- Law/science interface
- Ethics and professional responsibilities
- Quality assurance
- Analytical chemistry and instrumental methods of analysis
- Drug chemistry/toxicology
- Microscopy and materials analysis
- Forensic biology
- Pattern evidence.

A minimum of 10 instructional hours must be spent on each of these topics.

Additional FEPAC requirements include the following:

- graduate-level courses appropriate for specializations, tracks, or concentrations within the program;
- a required graduate seminar presenting original research, published work, and other topical forensic science considerations;
- an independent research project culminating in either a thesis or written report of publishable quality. Students shall have three committee members overseeing this research project (one of whom must be full-time faculty, and another of whom must be an external departmental member). The results of this research must be presented to the committee orally.

A total of 40 hours is required for the RU M. S. in Biomedical Forensic Sciences degree. This will be composed of 33 core required hours (which include 6 thesis hours) and 7 hours chosen from restrictive electives:
### Core Requirements  (33 hours)

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forensic Archaeology, CSI, and Legal Evidence</td>
<td>4</td>
</tr>
<tr>
<td>Principles and Methods in Forensic Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>Principles and Methods in Forensic Analytical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Principles and Methods in Criminalistics</td>
<td>4</td>
</tr>
<tr>
<td>Forensic and Biomedical Sciences Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>Quantitative Methods in Biomedical and Forensic Science</td>
<td>3</td>
</tr>
<tr>
<td>Seminar: Professional Practice</td>
<td>2</td>
</tr>
<tr>
<td>Internship or Service Learning</td>
<td>3</td>
</tr>
<tr>
<td>Thesis</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

### Restrictive Electives  (7 hours)

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forensic Anthropology and Anatomy</td>
<td>4</td>
</tr>
<tr>
<td>Forensic Pathology and Forensic Medicine</td>
<td>4</td>
</tr>
<tr>
<td>Seminar in Forensic Anthropology, Pathology, and Forensic Medicine</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Techniques in Molecular DNA Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Advanced Research in Molecular DNA</td>
<td>4</td>
</tr>
<tr>
<td>Seminar in Forensic Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>Forensic Toxicology/Pharmacology</td>
<td>4</td>
</tr>
<tr>
<td>Advanced Techniques in Forensic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Seminar in Forensic Analytical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Techniques in Trace Evidence/Pattern Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>
Students interested in specializing in Forensic Anthropology, Pathology, and Forensic Medicine have the option of choosing this concentration, which prepares students for professional examination of human remains in a medico-legal context. To fulfill this concentration, students will complete the following:

**Forensic Anthropology/Pathology/Forensic Medicine**

<table>
<thead>
<tr>
<th>Concentration (40 hours total):</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forensic Archaeology, CSI, and Legal Evidence</td>
<td>4</td>
</tr>
<tr>
<td>Principles and Methods in Forensic Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>Principles and Methods in Forensic Analytical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>Forensic and Biomedical Sciences Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>Quantitative Methods in Biomedical and Forensic Science</td>
<td>3</td>
</tr>
<tr>
<td>Seminar: Professional Practice</td>
<td>2</td>
</tr>
<tr>
<td>Forensic Pathology and Forensic Medicine</td>
<td>4</td>
</tr>
<tr>
<td>Forensic Anthropology and Anatomy</td>
<td>4</td>
</tr>
<tr>
<td>Seminar in Forensic Anthropology and Forensic Medicine</td>
<td>3</td>
</tr>
<tr>
<td>Internship in Forensic Anthropology, Pathology, or Forensic Medicine</td>
<td>3</td>
</tr>
</tbody>
</table>

*Students who have not completed a Human Osteology course will need to take ANSC 320 (Human Osteology) or the equivalent;*

In addition, a dissection-based Anatomy course (such as BIO 410:411 or its equivalent) is required as a prerequisite to this concentration.

Total 40
Students must complete all core and elective courses with a minimum grade of “B.” Students who fail to meet this requirement will have an opportunity to take a remediation exam in the deficient area. If a minimum grade of “B” is still not reached with the remediation exam, the student will need to repeat the course. If a student repeats a course for credit in which a “B-” or lower was obtained, both the original grade and hours attempted and the subsequent grade and hours attempted will be used in the calculation of a grade point average. No more than six credits of coursework may be repeated in this way. Courses taken in which a “B” or higher was obtained may not be taken a second time for credit. Students who fail to obtain the minimum “B” in the repeated course will be dropped from the program.

In addition to the above core and elective courses, the following additional components are required for all students except medical school students:

- A Comprehensive Exam covering the Core Courses and Labs, taken after the first semester of the second year. Comprehensive exams are Pass/Fail. Students who fail to meet this requirement will have an opportunity to take a remediation Comprehensive Exam. Students who do not earn a “Pass” on the second Comprehensive Exam will be evaluated for dismissal from the program.

- A Thesis consisting of publishable-quality original research and overseen by a thesis committee. The graduate thesis committee must be chaired by a full graduate faculty member within the student’s discipline and must consist of at least two additional graduate faculty members. An oral defense of the thesis will be presented by the student at the completion of the research. Failure of completion of the thesis requirement for the program will result in dismissal from the program.

Virginia Tech Carilion medical students will receive transfer credits from their institution for equivalent coursework and will have the research and thesis hour requirements waived (since they are completing these at VTCSOM). This will enable these students to complete the program in one year.

See Appendix A for descriptions of both core and concentration courses in the program.
Justification for Proposed Program

Response to Current Needs
(Specific Demand)

In 2009, the National Academy of Sciences published a scathing critique of the Forensic Science system\(^7\) as it is practiced in the U. S. today. In its landmark congressionally-mandated publication “Strengthening Forensic Science in the United States: A Path Forward,” forensic laboratories, programs, and disciplines are characterized as understaffed, fragmented, and lacking in mandatory standards, protocols, and accreditation. Many are not based on a solid scientific foundation. Research is characterized as lacking in most programs and is replaced by subjective analysis of evidence. This report characterized forensic science as too often having “inadequate educational programs.” In addition, “forensic science and forensic pathology research, education, and training lack strong ties to our research universities and national science assets.” (p. 14). This report calls for major reforms in Forensic Science, including the establishment of a National Institute of Forensic Science (NIFS) to oversee mandatory laboratory accreditation and educational reform. Thirteen specific recommendations are made to Congress. Educational reform is addressed in Recommendation #10 (NAS 2009:27-28):

“To attract students in the physical and life sciences to pursue graduate studies in multidisciplinary fields critical to forensic science practice, Congress should authorize and appropriate funds to the National Institute of Forensic Science (NIFS) to work with appropriate organizations and educational institutions to improve and develop graduate education programs designed to cut across organizational, programmatic, and disciplinary boundaries. To make these programs appealing to potential students, they must include attractive scholarships and fellowship offerings. Emphasis should be placed on developing and improving research methods and methodologies applicable to forensic science practice and on funding research programs to attract research universities and students in fields relevant to forensic science.”

While the NIFS has not yet been funded by the Congressional budget, the push for educational reform in Forensic Science cannot wait for congressional appropriations. The need for highly-trained forensic scientists to recover, analyze, and interpret forensic evidence is in critical demand in the United States today and will become increasingly so in the future.\(^8\) Milio et al.,\(^9\) for example, note the growing

---


shortage of forensic biologists and chemists at the same time as backlogs of forensic evidence waiting to be processed have dramatically increased (the average DNA backlog wait time in many crime labs, for example, is 15 months). This need is ultimately met only with the development of high quality forensic science education programs, particularly at the graduate level\textsuperscript{10,11,12}.

Educational and other institutions with forensic interests have responded to this growing interest and need for forensic science education in many ways. Some have subsumed existing forensically-minded courses under labels such as “Forensic Studies” or “Forensic Science,” while others have modified their natural science programs in chemistry and biology by adding forensic science tracks. This has led to much variability in the quality and reputation of forensic programs nationally\textsuperscript{11}. Some are truly science-based and can be legitimately called “Forensic Science,” while many others are not and are more aptly termed “Forensic Studies.” There is no question that graduate programs in forensic science provide the most competitive training for students. Yet, the number of reputable accredited forensic science graduate programs nationally remains small—the total number is currently at 36, with only 20 of these graduate programs offering a fully accredited degree specifically in Forensic Science; the remainder are in related fields such as Forensic Chemistry\textsuperscript{4}.

At Radford University, interest in forensic science is strong (as evidence by a thriving RUFSI Forensic Science Undergraduate Minor). There exists already at RU an appreciable number of undergraduate forensic science courses but they are scattered across at least two colleges and five departments. Likewise, faculty with research and/or teaching expertise in forensic science or forensic studies are numerous but crosscut many disciplines, colleges (i.e., College of Science and Technology, College of Humanities and Social Sciences) and departments (Depts. of Anthropological Sciences, Biology, Chemistry, Criminal Justice, Information Technology, Psychology). There is no integrated, cohesive program in forensic science beyond a Forensic Science Minor administered through the RUFSI, a concentration in Forensic Chemistry through the Department of Chemistry, and a concentration in Forensic Anthropology through the Department of Anthropological Sciences.

Meeting the need for highly trained, competent, and competitive forensic and biomedical scientists necessitates a graduate program in forensic and biomedical sciences with a strong foundation in natural sciences (chemistry and biology) and applied research. This foundation must be blended with


\textsuperscript{10} Houck MM, Siegal JA. Fundamentals of forensic science, 2\textsuperscript{nd} ed. Amsterdam: Elsevier, 2011.

\textsuperscript{11} James SH, Nordby JJ. Forensic science: an introduction to scientific and investigative techniques, 2\textsuperscript{nd} ed. Boca Raton, Fla: CRC Press. 2005.

interdisciplinary training and experience in other forensic specialties like anthropology, anatomy, and criminalistics.

The increasing popularity of Biomedical and Forensic Sciences will undoubtedly soon see the development of competitive programs in other Virginia institutions. Because much of the groundwork is already in place at RU, much potential exists for the development of a high-caliber, nationally-recognized forensic science accredited graduate program here, concomitant with accreditation of forensic science laboratories.

The development of an accredited, nationally-credible and well-respected forensic and biomedical sciences graduate program at Radford University in collaboration with VTCSOM will provide students with an interest in forensic and biomedical science the skills and training needed to competitively obtain jobs in state and national crime labs, as well as private and public biomedical or pharmaceutical research laboratories, or pursue further graduate or professional studies in the biomedical or legal sciences.

**Employment Demand**

With a Biomedical and Forensic Sciences graduate degree from an accredited program, our students will be properly prepared and will have the appropriate credentials for their desired forensic and biomedical science careers.\(^\text{13}\) Job placement opportunities for students with a MSBFS degree include working in the following areas:

- forensic scientist in local, regional, state, or private crime laboratories or crime scene investigation units;
- chemist, biologist, biotechnologist or biochemist in virtually any other science-based public or private laboratory (e.g., Toxicology, Genomics, Quality Assurance, Industrial Hygiene, Environmental Sciences labs);
- biomedical scientist working in public or private laboratories such as the Food and Drug Administration, Drug Enforcement Agency, Environmental Protection Agency, or Homeland Security;
- forensic anthropologist or Medical Examiner working in a Medical Examiner’s or Coroner’s office;
- medicolegal death investigator;
- preparation for entering Law School, Medical School, or graduate programs in the Natural Sciences;

---

biomedical scientist conducting research and teaching in an academic institution, including medical school.

The U. S. Department of Labor’s Occupational Outlook Handbook\textsuperscript{14} from the Bureau of Labor Statistics (BLS) lists 12,900 jobs for forensic technicians in 2012. This handbook projects job growth of 19\% in forensic science from 2010-2020 (although the 2012-22 BLS version of the Occupational Outlook Handbook projects a growth of 6\%, related to competition for forensic science jobs due to the popularity of the field). The Virginia Employment Commission (VEC)\textsuperscript{15} projects job growth of 4.92\% for forensic science technicians over the next 10 years. However, this is only one of the many job placement options for graduates of the RU MSBFS program. Table 1 lists additional labor statistics data (from the most current BLS and VEC sources) for other job placement options.


<table>
<thead>
<tr>
<th>Employment Position</th>
<th>BLS 2012-22 projection (%)</th>
<th>VEC 2012-22 projection (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical and Clinical Laboratory Technology</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>Forensic Anthropologist</td>
<td>19</td>
<td>-</td>
</tr>
<tr>
<td>Biochemist</td>
<td>19</td>
<td>27</td>
</tr>
<tr>
<td>Biological Technician</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>Chemist</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Teaching</td>
<td>19</td>
<td>20-25 (depending on subject)</td>
</tr>
</tbody>
</table>

Student Demand


RUFSI has gauged interest in the creation of a graduate degree in Biomedical and Forensic Sciences and this interest is deemed to be strong. Evidence for this consists of the following:

1. A survey given at the conclusion of FOSC/ANSC 201 (Introduction to Forensic Science) in Fall Semester, 2013 at Radford University measured the degree of interest in a graduate forensic science program at RU. This survey was administered to approximately 33 RU students whose classification included incoming freshmen (1), sophomores (9), juniors (8), and seniors (15). Their majors varied, and included Anthropological Science (22), Criminal Justice (6), Biology (1), Geospatial Sciences (1), Psychology (1), Business (1), and Music Business (1).

Twenty-five of the 33 respondents (75.8%) expressed interest, moderate interest, or strong interest in enrolling in the proposed program. Original data are listed below:

Table 2. Survey Data for Interest in the Forensic Science Graduate Degree.

<table>
<thead>
<tr>
<th>Strongly interested</th>
<th>Somewhat interested</th>
<th>Interested</th>
<th>Somewhat interested</th>
<th>Strongly interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (9.1%)</td>
<td>5 (15.15%)</td>
<td>3 (9.1%)</td>
<td>3 (9.1%)</td>
<td>19 (57.6%)</td>
</tr>
</tbody>
</table>

It should be noted that this is a remarkable number of students expressing interest in enrolling in a Forensic Science graduate program, given that nearly a third of the survey population did not even have an undergraduate major in the natural or forensic sciences.

2. The number of students who have corresponded with the RUFSI expressing interest in a graduate forensic and biomedical science program has been appreciable. There are a significant number of both traditional and non-traditional (working adults) students with an interest in forensic and biomedical science in the southwest Virginia region and beyond.

3. Enrollment at the undergraduate level in forensic courses of study at RU clearly shows interest in the discipline. Table 3 summarizes enrollment data over the past three years from the RU Forensic Science Minor (through the RUFSI), Forensic Studies Minor (through the Department of Criminal Justice), Forensic Anthropology Concentration (through the Department of Anthropological Sciences), and Forensic Chemistry Concentration (through the Department of Chemistry), showing consistent and continuing engagement in and completion of forensic science programs at RU.

Table 3. Enrollment and graduation data for 2009-2014 for forensic science programs at RU.

<table>
<thead>
<tr>
<th>Forensic Program</th>
<th>Enrollment</th>
<th>Number of Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor/Concentration</td>
<td>2009-2014</td>
<td>2009-2014</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Forensic Science Minor</td>
<td>46</td>
<td>33</td>
</tr>
<tr>
<td>Forensic Studies Minor</td>
<td>60</td>
<td>29</td>
</tr>
<tr>
<td>Forensic Anthropology</td>
<td>50</td>
<td>9</td>
</tr>
<tr>
<td>Concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forensic Chemistry Concentration</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>174</td>
<td>68</td>
</tr>
</tbody>
</table>

Projected enrollments for the MS in Biomedical and Forensic Sciences are presented in Table 4.

**Table 4. Projected enrollment:**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Target Year (2-year institutions)</td>
<td>Target Year (4-year institutions)</td>
</tr>
<tr>
<td>HDCT</td>
<td>FTES</td>
<td>HDCT</td>
<td>FTES</td>
<td>HDCT</td>
</tr>
<tr>
<td>20</td>
<td>19.17</td>
<td>41</td>
<td>37.17</td>
<td>45</td>
</tr>
</tbody>
</table>

**Note:** VCCS institutions only complete Years 1 through 4. Graduation rates must be included in Year 4, Target year for the VCCS. Four-year institutions are not to complete the GRAD rate for Year 4.
Definitions:

HDCT—fall headcount enrollment

FTES—annual full-time equated student enrollment

GRADS—annual number of graduates of the proposed program

Existing Programs

Current Program

Currently, forensic science is available to Radford University students as an undergraduate Forensic Science Minor supervised by the RUFSI. The successful FS Minor is supported by several undergraduate courses in forensic science (e.g., FOSC 201—Introduction to Forensic Science; FOSC 401—Advanced Forensic Science Research).

Aside from the Forensic Science undergraduate minor, there are numerous forensic science interests offered through several different RU departments and colleges, including an undergraduate concentration in Forensic Anthropology within the Department of Anthropological Sciences, a concentration in Forensic Chemistry in the Department of Chemistry, a Forensic Biology course within the Biology Department, a Forensic Studies Minor within the Department of Criminal Justice, and a Cybersecurity Certificate program within the Department of Information Technology. A forensic science professional program would help to consolidate forensic science interests and efforts at RU, increase the efficacy of interdisciplinary collaboration between these different interests, and provide advanced professional training to students wishing to continue their forensic science studies.

In addition, the new RU Center for the Sciences, due for completion in early fall, 2015, will house forensic and biomedical science laboratories ideally suited to accommodate the MSBFS program. State-of-the-art laboratory facilities and collaborative student meeting and research space within and outside the RUFSI suite will facilitate the type of engaged, hands-on, student-led learning that is the hallmark of this program.
**Effect on Existing Curricula and Programs**

It is not anticipated that this program will significantly take away from any other existing undergraduate program or majors. In contrast, it will likely complement these programs by recruiting graduates from these programs with an interest in continuing graduate study in forensic and biomedical science.

**Collaboration or Standalone**

The MSBFS is a collaborative program between Radford University and the Virginia Tech Carilion School of Medicine. At RU, it will be closely affiliated with the RU Forensic Science Institute. The RUFSI is ideally poised to collaboratively support this program because:

1. MSBFS graduate students will have numerous opportunities for student-professional collaborative partnerships, clinical experience, casework, and internships, due to the RUFSI faculty affiliation and close working relationship with regional law enforcement and medico-legal agencies. RUFSI Laboratories perform invaluable services to the Commonwealth in terms of forensic analysis and recovery of unidentified human remains and routinely engage advanced students in these experiential learning opportunities;
2. MSBFS graduate students will have exposure to and opportunity to engage in professional-quality research with RUFSI faculty, who engage in year-round academic forensic science research and regularly involve students in faculty-student collaborative efforts, culminating in professional publications and presentations. RUFSI faculty have brought in over $1 million in external grant funding related to research and contractual projects and regularly involve students in this grant work;
3. MSBFS graduate students will have numerous opportunities to participate in service learning through RUFSI projects. For example, RUFSI regularly present forensic science education and training to the medico-legal community (e.g., law enforcement, medical examiners). And since forensic science is an excellent example of an applied STEM field, RUFSI faculty are also engaged in many opportunities to promote science education at the secondary and higher education levels, including Science Days at RU, Summer Bridge STEM program for high school girls, and STEAM Academy for outstanding rising 6th, 7th, and 8th graders from throughout the Commonwealth;
4. MSBFS graduate students will have the opportunity to work in newly designed forensic and biomedical science laboratories containing state-of-the-art equipment. RUFSI laboratories under construction in the new RU Center for the Sciences have been designed with the required laboratories for the MSBFS curriculum in mind (accreditation of these Forensic Science laboratories through ASCLD/LAB [American Society of Crime
Lab Directors/Laboratory Accreditation Board,\textsuperscript{16} following ISO 17025 will be sought upon completion of these new labs). In addition, RUFSI houses over one-half million dollars in professional-grade forensic instrumentation and equipment, including a Keyence VHX-1000 Digital Microscope, Leica Polarized Light Comparison Microscope, Leica Ballistic Comparison Microscope, Portable X-Ray Unit, PAC (Picture Archiving System), and two XRF (X-Ray Fluorescence) Analyzers as well as numerous casts, models, skeletal and anatomical collections, and forensic archaeological survey and excavation equipment for graduate students to use in training, casework, and research.

Collaboration with VTCSOM will consist of the following: VTCSOM will encourage their rising third year medical students to enroll in RU’s MSBFS program as dual degree-seeking students. These students will be primarily interested in the Forensic Anthropology/Pathology/Forensic Medicine concentration. This collaborative agreement will enhance the professional training opportunities and scholarly interchange for both parties and their students. A letter of support from VTCSOM can be found in Appendix B.

Collaboration with other RU departments and allied health, medico-legal, and criminal justice fields are requisite. The RU Department of Anthropological Sciences, Biology, Criminal Justice as well as other departments at RU have expressed an interest in this collaboration, as have regional law enforcement, allied health, and community partners.

**Duplication**

The American Academy of Forensic Sciences maintains a comprehensive list of all forensic science programs both within\textsuperscript{17} and outside\textsuperscript{18} the United States. Thirty-six programs offer some form of Master’s Degree in Forensic Science in the United States. The majority have an emphasis or concentration in Forensic DNA analysis or Forensic Chemistry or Biochemistry. Of these 36, 20 are fully FEPAC-accredited. There is only one accredited Master of Science in Forensic Science accredited program with a Digital Evidence focus area (Marshall University).

Only one of the 36 graduate programs (Boston University) has a direct affiliation or collaboration with a Medical School (Boston University School of Medicine). Two others (Oklahoma State University

\textsuperscript{16} American Society of Crime Lab Directors/Laboratory Accreditation Board. \url{http://www.ascld-lab.org/}. Accessed September, 2014.

\textsuperscript{17} American Academy of Forensic Sciences programs within the United States, 8/2014. \url{http://www.aafs.org/students/programs-within-united-states}. Accessed August, 2014.

and George Washington University) offer more indirect associations (for example, in the form of internships) with Medical Schools or Centers for Health Sciences.

Only two forensic science graduate programs exist in the Commonwealth—Virginia Commonwealth University and George Mason University. Only one of these is an accredited program (VCU). A comparison of the RU MSBFS with these two programs follows (also see Table 5).

Table 5. Enrollments and Degrees Awarded at Comparable Programs in the Commonwealth.

<table>
<thead>
<tr>
<th>Enrollments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia Commonwealth University</td>
</tr>
<tr>
<td>George Mason University</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degrees Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia Commonwealth University</td>
</tr>
<tr>
<td>George Mason University</td>
</tr>
</tbody>
</table>

VCU offers an M. S. in Forensic Science based on completion of 42 hours (27 core hours, 15 elective hours). This program is similar to the one proposed here in that it is a rigorous two-year full-time graduate program in forensic science. Students must choose between forensic biology or forensic chemistry (drugs and toxicology, or trace and forensic physical evidence) tracks and complete a thesis. The proposed MSBFS graduate degree is different in the following ways:

• In the proposed MSBFS program, there is a significant emphasis on the biomedical aspect of forensic science as well as biomedical research, reflected in the collaborative association with allied health and medicine partners (e.g., VTCSOM) and conferring of a graduate degree in Biomedical and Forensic Sciences; the proposed MSBFS offers a specialized concentration in Forensic Anthropology/Pathology/Forensic Medicine and is one of the few graduate programs in the nation to do so.

• The close association of the graduate program with the RUFSI and its affiliated professional faculty and their law enforcement and medico-legal relationships provides unparalleled opportunities for direct graduate student participation in medico-legal research and casework for the Commonwealth;

• The BSBSF program is also unique in that it emphasizes innovative self-directed and peer-directed instruction and high impact experiential learning through internship and service learning requirements;

• The collaborative nature of the Radford University MSBFS program with other departments and entities and both within and outside RU, particularly the Virginia Tech Carilion School of Medicine, provides opportunity for high-impact interdisciplinary learning from a variety of sources;

• The VCU program is 250 miles away from the Radford University and is already operating at full or over-capacity.

In contrast to the proposed MSBFS degree program, the George Mason program in Forensic Science consists of 33 required hours (17 core hours, 12 hours electives, 4 research or thesis hours). There are no tracks or concentrations and most of the core classes have no significant laboratory component. A thesis is not mandatory—students can choose a research project option.

Both the VCU and George Mason programs operate under a CIP code of 40.0106, Forensic Science, within the umbrella category of Criminal Justice. The RU M. S. in Biomedical Forensic Science differs from these programs in its CIP code of 40.0510—Forensic Chemistry. The rationale for this designation is the closer alignment of the current program with laboratory-based physical science rather than the social sciences. Fradella et al.⁸ caution against confusing Forensic Science (typically focused on the physical sciences) with Forensic Studies (centered on Criminal Justice). The current program is strongly science and laboratory-based, within the College of Science and Technology.

Projected Resource Needs

Projected resources needed to initiate and sustain this program are as follows:
**Full-time faculty**

One full-time faculty (new hire) in Forensic Science will be needed to support this program, at the rank of Assistant Professor, to teach the core classes:

1. Forensic (Molecular) Biologist;
2. Forensic (Analytical) Chemist.

**Special Purpose faculty:**

One special purpose faculty (new hire) in Forensic Anthropology/Pathology/Forensic Medicine will be requested to teach core classes and the concentration.

**Part-time faculty**

One-quarter time faculty (0.25 FTE) is projected to support the core and the Forensic Anthropology/Pathology/Forensic Medicine concentration of this program and is already in place at RU.

**Adjunct faculty**

One adjunct faculty (0.25 FTE) to support the FEPAC-mandated teaching of one course in pattern analysis (Principles and Methods of Criminalistics) is needed for this program.

**Graduate Assistantships**

At least two Graduate Assistantships will be offered to incoming and returning students to assist faculty with laboratory instruction each academic year.

**Targeted Financial Aid**

No targeted financial aid will be offered for the program at its inception.

**Classified positions**

The program will require 0.5 FTE of classified support to initiate and support the program.

**Telecommunications**
New faculty hires will be provided with telecommunication access (phone lines).

**Equipment and Supplies**

State-of-the-art forensic laboratory equipment already exists at RU to maintain forensic science laboratories. Aside from office furniture and computers for new hires, no additional equipment is anticipated at this time to initiate or maintain this program. It is anticipated that funds will required to partially support maintenance agreements, repair costs, and supplies for shared equipment with other departments.

**Library**

Given the existence of Forensic Science undergraduate programs at RU, the RU McConnell Library already contains a significant number of forensic science resources. Additional library resources are not required to either initiate or support this program.

**Space**

Laboratory and classroom space within the Center for the Sciences will be adequate to house this program and its faculty.

**Other**

A Program Coordinator who will serve as director of the program. FEPAC requirements for this position are as follows:

```
“The program director shall be a full-time faculty member at the academic institution appropriately qualified by academic experience, research qualifications, and background in program administration to meet the program’s stated mission, goals, and objectives, and to provide leadership in forensic science education, research, and other scholarly activities so that students are adequately prepared for forensic science practice. The program director shall meet the following requirements:

1. Minimum of an earned Doctorate degree appropriate for a forensic science program, AND at least five years relevant experience as an academic forensic scientist that includes appropriate educational, research and service contributions to forensic science; OR at least five years relevant experience as a forensic-science practitioner; not including any training time in an operational forensic science laboratory setting;
```
2. Documented research experience in a forensic science discipline or in methods and techniques adapted, validated and implemented by the forensic science community;

3. Documented management experience appropriate to the duties assigned to the position.”

In addition to directing the program, the Program Coordinator will also teach a small number of the core classes and direct student research.

It is anticipated that one of the Co-Directors of the RUFSI will serve as Program Coordinator of this program.
Appendix A—Course Descriptions

Description of Required Common Core Courses

FOSC 601: Forensic Archaeology, CSI, and Legal Evidence (new course)  
(4 hours credit)  
This class focuses on the basics of search and recovery of forensic evidence (including human remains), with applications to forensic science casework. Students will master the appropriate methods for locating the crime scene and securing forensic evidence. They will also study the forensic science/legal interface mandating standard legal (chain of custody) protocols for recovering and transferring forensic evidence, with applications to forensic casework. Fieldwork is a significant component of this course. This course also considers the scientific basis for forensic science and the forensic science-legal interface by discussing major legal decisions and issues which direct recovery, transfer, and analysis of forensic science evidence. Students will become familiar with the judiciary process as it relates to forensic science.

FOSC 602: Principles and Methods in Forensic Molecular Biology (new course)  
(4 hours credit)  
This class focuses on the application of principles of molecular biology and population genetics to forensic and biomedical science. It also includes a discussion of serology and its use in forensic and biomedical science. Students gain an understanding of the foundation and methodology of DNA and other biologically-based testing of forensic evidence and samples, with applications to forensic science casework and biomedical research.

FOSC 603: Principles and Methods in Forensic Analytical Chemistry (new course)  
(4 hours credit)  
The focus of this course is on the fundamentals of forensic and analytical chemistry, including the application of instrumentation (e.g., chromatography, mass spectroscopy) to analysis of chemical and trace evidence. Students will gain first-hand experience in using mass
spectroscopy, chromatography, as well as other chemical methods, with practical applications to forensic casework and biomedical research.

FOSC 604: Forensic and Biomedical Sciences Instrumentation (new course)  
(3 hours credit)  
This class is an overview of the use of instrumentation in a wide range of forensic analyses, including biological fluid, tissue, firearm, toolmark, and trace evidence examinations. It also examines major instrumentation in biomedical science. Students will gain hands-on experience using these instruments in the analysis and interpretation of forensic and biomedical samples.

FOSC 605: Quantitative Methods in Biomedical and Forensic Science (new course)  
(3 hours credit)  
The statistical basis for biomedical and forensic science quantitative analyses is considered. Topics include univariate and multivariate data analysis, sampling and probability statistics, and Bayesian methods. Students will be able to evaluate and critique data-driven analytical research as well as use appropriate statistical methods in their own research.

FOSC 610: Forensic Anthropology and Anatomy (new course)  
(4 hours credit)  
Intensive study of forensic osteology and anthropology are supplemented with perspectives from gross anatomy and medicine and applied to casework in forensic anthropology and forensic medicine. Students will apply their knowledge of advanced osteology, gross human anatomy, and radiology toward determining an unknown individual’s biological profile. They will also learn to identify and differentiate the antemortem, perimortem, and postmortem processes which affect these remains. Prerequisite: Human Osteology (ANSC 320 or equivalent) and Gross Anatomy.

FOSC 611: Forensic Pathology and Forensic Medicine (new course)  
(4 hours credit)  
This course focuses on innovations in the application of knowledge of forensic pathology and anatomy to forensic medicine. Presented in casework format, topics considered include methods for determination of cause, manner, and time of death as well as identification of unknown decedents. Identification and differentiation of antemortem, perimortem, and postmortem trauma are also considered. The role of the Medical Examiner in death investigations is examined. The goal of the class is to promote student understanding and mastery of the latest procedures in forensic pathology as it is applied to the practice of forensic medicine.

FOSC 612: Seminar in Forensic Anthropology, Pathology, and Forensic Medicine (new course)  
(3 hours credit)  
Opportunities for in-depth discussion of current research trends and issues in Forensic Anthropology, Pathology, and Forensic Medicine with industry experts are offered in this seminar. Students will read,
discuss, interpret, and critique the primary research literature in Forensic Anthropology and Forensic Medicine, with the goal of understanding the scientific controversies and foundation for research in the disciplines.

FOSC 620: Advanced Techniques in Molecular DNA Analysis (new course)
(4 hours credit)
This course focuses on innovations in the application of human genetics and molecular biology to forensic science. Presented in casework format, topics considered include advanced methods of nuclear and mitochondrial DNA analysis and their application to biological evidence testing. The goal of the class is to promote student understanding and mastery of the latest procedures in forensic DNA instrumentation, analysis, and interpretation.

FOSC 621: Advanced Research in Molecular DNA (new course)
(4 hours credit)
In this laboratory, students will engage in hands-on application of the principles of molecular biology to techniques of nuclear and mtDNA analysis. Techniques employed include DNA Extraction, PCR amplification of STR loci, and DNA profile analysis as used in forensic casework and biomedical research.

FOSC 622: Seminar in Forensic Molecular Biology (new course)
(3 hours credit)
Opportunities for in-depth discussion of current research trends and issues in Forensic and Molecular Biology with industry experts are presented in this seminar. Students will read, discuss, interpret, and critique the primary research literature in Forensic Biology, with the goal of understanding the scientific controversies and foundation for research in the disciplines.

FOSC 630: Toxicology/Pharmacology (new course)
(4 hours credit)
This lecture and laboratory course focuses on drug chemistry and its use in biomedical and forensic science. It includes a consideration of forensic pharmacology and forensic toxicology, pharmacokinetics, and pharmacodynamics. The laboratory portion of the course provides hands-on application of principles of drug identification and the use of these techniques in forensic casework and biomedical research.

FOSC 631: Advanced Techniques in Forensic Analytical Chemistry (new course)
Innovations in the application of toxicology and trace evidence to forensic science are considered. Presented in casework format, topics considered include advanced methods of separation, characterization, imaging, and quantification of trace and chemical (controlled) substances. The goal of the class is to promote student understanding and mastery of the latest procedures in Forensic and Analytical Chemistry instrumentation, analysis, and interpretation as used in forensic chemistry casework and biomedical research.

FOSC 632: Seminar in Forensic Analytical Chemistry (new course)
(3 hours credit)
Opportunities for in-depth discussion of current research trends and issues in Forensic and Analytical Chemistry with industry experts are presented in this seminar. Students will read, discuss, interpret, and critique the primary research literature in Forensic and Analytical Chemistry, with the goal of understanding the scientific controversies and foundation for research in the disciplines.

FOSC 640: Principles and Methods in Criminalistics (new course)
(4 hours credit)
This class focuses on the use of chemical and other methods to analyze trace and material forensic evidence including hair, firearm and explosive residues, paint, and glass. Ballistic and tool mark pattern comparisons are also considered, with practical applications to forensic casework.

FOSC 641: Advanced Techniques in Trace Evidence/Pattern Analysis (new course)
(4 hours credit)
In this laboratory, students will engage in hands-on application of the principles of criminalistics to trace evidence analysis. Identification of glass, paint, hairs, fibers, and other material evidence will be made through comparisons of known with unknown (questioned) samples.

FOSC 642: Seminar in Criminalistics (new course)
(3 hours credit)
Opportunities for in-depth discussion of current research trends and issues in Criminalistics with industry experts are presented in this seminar. Students will read, discuss, interpret, and critique the primary research literature in Criminalistics, with the goal of understanding the scientific controversies and foundation for research in the disciplines.
FOSC 682: Seminar: Professional Practice (new course)
(2 hours credit)
Professional standards in biomedical and forensic science practice are highlighted, including discussions of ethics, professional and legal duties and responsibilities, and professional conduct. Students receive training in laboratory accreditation, safety, and quality assurance protocol, as well as research ethics. They also receive experience in courtroom testimony (through participation in mock trials) and other professional presentations of their research. The goal of the course is to promote professional conduct in emerging forensic and biomedical specialists.

FOSC 693: Service Learning (new course)
(3 hours credit)
Students engage in community-based outreach activities whose goal is to promote forensic science or biomedical education and training. Students must consult with their faculty advisor in advance of registering for this course.

FOSC 694: Internship in Biomedical and Forensic Sciences (new course)
(up to 3 hours credit)
This course is designed to serve as either on-site or off-site work experience with a biomedical or forensic science public or private agency. Students must consult with their faculty advisor in advance of registering for this course.

FOSC 698: Directed Study (new course)
(up to 3 hours credit)
This course is available to students who are conducting an independent laboratory research project on a biomedical or forensic science topic. The research project should complement a student’s chosen track. Students must consult with their faculty advisor in advance of conducting this study.

FOSC 699: Thesis (new course)
(up to 6 hours credit)
Students register for up to 6 hours of thesis research hours while conducting thesis-related research. Students must consult with their faculty thesis advisor in advance of conducting this study.
Appendix B—External Collaborative Partners

Virginia Tech Carilion School of Medicine (see letter of support following)
March 12, 2015

Donna C. Boyd, Ph. D., D-ABFA
Eminent Professor of Anthropological Sciences
Co-Director, RU Forensic Science Institute
Radford University
Radford VA 24142

Dear Dr. Boyd:

We are excited to offer collaborative support for your Master of Science in Biomedical Forensic Science (M.S. in BFS) program at Radford University. We feel this collaboration, particularly the concentration in Forensic Anthropology, Pathology, and Forensic Medicine, will benefit both our medical students and Radford University students in obtaining advanced professional training in the forensic sciences.

Virginia Tech Carillon School of Medicine (VTC SOM) students would be seeking this Radford University degree as a dual-degree between their second and third years of medical school. VTC SOM anticipates an enrollment of up to five students per year in the M.S. in BFS program. VTC SOM students in the Forensic Anthropology, Pathology, and Forensic Medicine concentration will be able to enroll in an accelerated track in this concentration allowing them to transfer credits in classes already taken at VTC SOM (e.g., Anatomy, Quantitative Methods).

VTC SOM is unique in its focus on research and interprofessionalism—only 5 percent of medical schools in the country have such a requirement. Because research and interprofessionalism comprise two of our four value domains (foundational elements) at VTC SOM, our students would already have the thesis and community service equivalents and would have these requirements waived at RU. This will allow our students to complete an M.S. in BFS in approximately one year.

We look forward to collaborating with Radford University in this unique and innovative program. We feel that our interested students will greatly benefit from this professional training in the forensic sciences and the application of these areas to their medical study and research. We look forward to a productive and successful association. Thank you.

Sincerely,

Cynda A. Johnson, M.D., M.B.A.
President and Founding Dean