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### Reynolda Campus
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<td>November 23-27</td>
<td>Wednesday-Sunday</td>
<td>THANKSGIVING BREAK</td>
</tr>
<tr>
<td>December 1-4</td>
<td>Thursday-Sunday</td>
<td>Residency I (Cohort 12), Residency II (Cohort 9)</td>
</tr>
<tr>
<td>December 11</td>
<td>Sunday</td>
<td>Last Class Day</td>
</tr>
<tr>
<td>TBA</td>
<td>Wednesday</td>
<td>Deadline to meet December 30 graduation requirements</td>
</tr>
<tr>
<td>December 30</td>
<td>Friday</td>
<td>GRADUATION</td>
</tr>
</tbody>
</table>

**Spring Semester 2017**

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
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<tbody>
<tr>
<td>Dec. 16-Jan. 10</td>
<td>Monday-Sunday</td>
<td>ORIENTATION COURSE FOR NEW STUDENTS</td>
</tr>
<tr>
<td>January 9</td>
<td>Monday</td>
<td>First Class Day</td>
</tr>
<tr>
<td>January 26</td>
<td>Thursday</td>
<td>Last day to drop without academic penalty (part-of-term 1)</td>
</tr>
<tr>
<td>February 14</td>
<td>Tuesday</td>
<td>Last day to drop without academic penalty (full semester)</td>
</tr>
<tr>
<td>February 26</td>
<td>Sunday</td>
<td>Last Class Day (part-of-term 1)</td>
</tr>
<tr>
<td>February 27</td>
<td>Monday</td>
<td>First Class Day (part-of-term 2)</td>
</tr>
<tr>
<td>March 6-12</td>
<td>Monday-Sunday</td>
<td>SPRING BREAK</td>
</tr>
<tr>
<td>March 15</td>
<td>Wednesday</td>
<td>Last day to drop without academic penalty</td>
</tr>
<tr>
<td>TBA</td>
<td>Monday</td>
<td>Last day for withdrawal with pro rata refund</td>
</tr>
<tr>
<td>April 14</td>
<td>Friday</td>
<td>GOOD FRIDAY HOLIDAY</td>
</tr>
<tr>
<td>April/May TBA</td>
<td>Saturday</td>
<td>Deadline to meet May 15 graduation requirements</td>
</tr>
<tr>
<td>May 13</td>
<td>Saturday</td>
<td>HOODING AND AWARDS CEREMONY</td>
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<tr>
<td>May 15</td>
<td>Monday</td>
<td>COMMENCEMENT</td>
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**Summer Session 2017**

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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>TBA</td>
<td>Monday</td>
<td>ORIENTATION COURSE FOR NEW STUDENTS</td>
</tr>
<tr>
<td>TBA</td>
<td>First Class Day</td>
<td>First Class Day</td>
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<tr>
<td>TBA</td>
<td>Last day to drop without academic penalty (part-of-term 1)</td>
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<tr>
<td>TBA</td>
<td>Last day for withdrawal with pro rata refund</td>
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<tr>
<td>TBA</td>
<td>Last day to drop without academic penalty (full semester)</td>
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<tr>
<td>TBA</td>
<td>Last Class Day (part-of-term 1)</td>
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<tr>
<td>TBA</td>
<td>First Class Day (part-of-term 2)</td>
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<tr>
<td>TBA</td>
<td>Last day to drop without academic penalty</td>
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<tr>
<td>TBA</td>
<td>Last day for withdrawal with pro rata refund</td>
<td></td>
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<tr>
<td>TBA</td>
<td>Residency I (Cohort 11), Residency II (Cohort 8)</td>
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<tr>
<td>TBA</td>
<td>Last Class Day</td>
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<tr>
<td>TBA</td>
<td>GRADUATION</td>
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The Graduate School conducts programs on the Bowman Gray campus (location of the Wake Forest School of Medicine) and the Reynolda campus (undergraduate college and associated graduate programs). On the Bowman Gray and affiliated campuses of the medical school, the Graduate School offers 8 PhD programs in biomedical sciences, and master’s programs in biomedical engineering, biomedical informatics, biomedical science, comparative medicine, clinical and population translational sciences, health disparities in neurosurgery, and molecular medicine and translational science. The PhD programs in biology, chemistry, and physics, and Master’s-only programs in twenty-two disciplines, ranging from bioethics, education, mathematics, religion and sustainability, are located on the Reynolda campus. The Graduate School also offers twelve joint degree programs in conjunction with the Wake Forest School of Medicine, Schools of Business, School of Divinity, and School of Law; as well as thirteen certificate programs.

Contact information on all programs and certificates of study may be found on our website at [http://graduate.wfu.edu](http://graduate.wfu.edu).

**CERTIFICATES**

- Bioethics
- Biomedical Research Ethics
- Clinical Bioethics
- Clinical & Population Translational Sciences
- Interpreting and Translation Studies:
  - Audiovisual Translation and Interpreting
  - Intercultural Services in Healthcare
  - Interpreting Studies
  - Teaching of Interpreting (Postgraduate)
  - Translation Studies
- Medieval and Early Modern Studies
- Structural and Computational Biophysics
- Sustainability

**MASTER'S PROGRAMS**

- Bioethics (MA)
- Biology (MS)
- Biomedical Engineering (MS)
- Biomedical Informatics (MS)
- Biomedical Science (MS)
- Chemistry (MS)
- Clinical & Population Translational Sciences (MS)
- Communication (MA)
- Comparative Medicine (MS)
- Computer Science (MS)
- Counseling (MA)
- Counseling (MA - online)
- Counseling - Human Services (MAHS - online)
- Documentary Film (MA/MFA)
- Education (MAEd)
- English (MA)
- Health and Exercise Science (MS)
- Health Disparities in Neuroscience-related Disorders (MS)
- Interpreting and Translation Studies (MA):
  - Interpreting and Translation Studies
  - Intercultural Services: Healthcare
  - Teaching of Interpreting

**PHD PROGRAMS**

- Biology
- Biomedical Engineering
- Chemistry
- Integrative Physiology and Pharmacology
- Molecular and Cellular Biosciences: (comprising the following programs)
  - Biochemistry & Molecular Biology
  - Cancer Biology
  - Microbiology & Immunology
  - Molecular Genetics & Genomics
  - Molecular Medicine & Translational Science

**Neuroscience**

**Physics**

**JOINT DEGREE PROGRAMS**

- BS/BA & MA (Bioethics)
- BA-BS/MS (Neuroscience Minors only)
- JD/MA (Bioethics)
- JD/MA (Religious Studies)
- MD/MA (Bioethics)
- MD/MS (CPTS)
- MD/PhD
- MD/MA (Bioethics)
- MD/MA (Counseling)
- MD/MAED (Education)
- MD/MA (Sustainability)
- MM/PhD (PA & MATS)
- PhD/MBA

**Programs of Study**
The University

Wake Forest University is characterized by its devotion to liberal learning and professional preparation for men and women, its strong sense of community and fellowship, and its encouragement of free inquiry and expression.

Wake Forest Institute was founded in 1834 by the Baptist State Convention of North Carolina. The school opened its doors on February 3 with Samuel Wait as principal. Classes were first held in a farmhouse on the Calvin Jones plantation in Wake County, North Carolina, near which the village of Wake Forest later developed.

Rechartered in 1838 as Wake Forest College, Wake Forest is one of the oldest institutions of higher learning in the state. The School of Law was established in 1894, followed by a two-year medical school in 1902. Wake Forest was exclusively a college for men until World War II, when women were admitted for the first time.

In 1941 the medical school moved to Winston-Salem to become affiliated with North Carolina Baptist Hospital, which was renamed the Bowman Gray School of Medicine. In 1946 the trustees of Wake Forest and the Baptist State Convention of North Carolina accepted a proposal by the Z. Smith Reynolds Foundation to relocate the College to Winston-Salem.

The late Charles and Mary Reynolds Babcock donated much of their family estate as the site for the campus and building funds were received from many sources. From 1952 to 1956, the first fourteen buildings were constructed in Georgian style on the new campus. The move to Winston-Salem took place in the summer of 1956; the original, or “old” campus, is now home to Southeastern Baptist Theological Seminary.

Following the move, Wake Forest grew considerably in enrollment, programs, and stature and became a University in 1967. The School of Business Administration, first established in 1948, was named the Charles H. Babcock School of Business Administration in 1969 and admitted its first graduate students in 1971. In 1972 the school enrolled only graduate students and the name was changed to the Charles H. Babcock Graduate School of Management; departments of business and accountancy and economics were established in the College. In 1980 the Department of Business and Accountancy was renamed the School of Business and Accountancy.

In 1997 the medical school was renamed the Wake Forest University School of Medicine; its campus is now known as the Bowman Gray Campus. The School of Divinity was established in 1999.

Wake Forest honors its Baptist heritage in word and deed. The University will fulfill the opportunities for service arising out of that heritage. Governance is by an independent Board of Trustees; there are advisory boards of visitors for the College and each professional school. A joint board of University trustees and trustees of the North Carolina Baptist Hospital is responsible for Wake Forest University Baptist Medical Center, which includes the hospital and the medical school.

The College, Schools of Business, School of Law, the Graduate School, and the School of Divinity are located on the Reynolda Campus in northwest Winston-Salem and the Morrocroft Campus in Charlotte, NC. The Wake Forest School of Medicine is about five miles away, with locations in the city’s downtown and in the Baptist Medical Center. The University also offers instruction regularly at Casa Artom in Venice, at Worrell House in London, at Flow House in Vienna, and in other places around the world.

The College offers courses in more than forty fields of study leading to the baccalaureate degree. The School of Divinity offers the Master of Divinity degree.

The Wake Forest Schools of Business offer a four-year bachelor of science degree, with majors in accountancy, business and enterprise management, finance, and mathematical business (offered jointly with the Department of Mathematics); and three graduate degree programs, Master of Science in Accountancy (MSA), Master of Arts in Management (MA), and Master of Business Administration (MBA).

The School of Law offers the Juris Doctor and Master of Laws in American law degrees. The school also offers a joint JD/MBA degree with the Schools of Business.

The Wake Forest School of Medicine offers the Doctor of Medicine degree (MD) as well as the Master of Medical Science (MMS) through the Physician Assistant Program, and the Master of Science (MS) in Nurse Anesthesia. The School of Medicine and the Schools of Business offer a joint MD/MBA program.

The Graduate School confers the Master of Science of Arts in Education, Master of Arts in Human Services, Master of Arts in Liberal Studies, Master of Fine Arts, and Master of Science degrees in the arts and sciences and biomedical science...and the doctor of philosophy degree. The Graduate School also offers an MD/MS, MD/PhD, MMS/PhD, as well as an MD/MA in bioethics jointly with the School of Medicine, and a PhD/MBA program jointly with the Schools of Business. In addition, the Graduate School offers an MD/MA in bioethics, counseling, or sustainability as well as a MD/MA in bioethics; and a JD/MA in bioethics, religious studies or sustainability jointly with the School of Law. Certificates are offered in Bioethics, Clinical and Translational Science, Interpreting and Translation Studies, Medieval and Early Modern Studies, Science Management, Structural and Computational Biophysics, and Sustainability.

LIBRARIES

The libraries of Wake Forest University support instruction and research at the undergraduate level and in the disciplines awarding graduate degrees. The libraries of the University hold membership in the American Library Association and in the Association of Southeastern Research Libraries. They rank among the top libraries in the Southeast in expenditures per student.

The Wake Forest University Libraries include the Z. Smith Reynolds Library, which is located on the Reynolda Campus and supports the undergraduate College, the Wake Forest School of Business programs, the Graduate School of Arts and Sciences, and the School of Divinity. The Professional Center Library, housed in the Worrell Professional Center on the Reynolda Campus, serves the School of Law. The Coy C. Carpenter Library serves the Graduate School of Arts and Sciences and the Wake Forest School of Medicine and is located on the Bowman Gray Campus.

The three library collections total over 2 million volumes. Subscriptions to more than 50,000 periodicals and serials, largely of scholarly content, are maintained at the libraries. The Z. Smith Reynolds Library holds over 1.4 million volumes in the general collection, complemented by over 200 research databases, over 400,000 e-books, and nearly 25,000 media items. As a congressionally designated selective federal depository and depository of North Carolina government information, the ZSR Library holds nearly 100,000 government documents. The Professional Center Library holds nearly 180,000 volumes and the Coy C. Carpenter Library holds nearly 150,000 volumes. The three libraries share an online catalog, which also provides access to electronic resources, journals and databases, all accessible via the campus network and on the Internet. Through interlibrary loan service, students, faculty and staff may obtain materials from other libraries.

BOWMAN GRAY CAMPUS

The Coy C. Carpenter Library is the principal learning resource serving the academic needs of the faculty, staff, and student body of the Wake Forest University School of Medicine. The Library contains extensive collections in all of the medical and surgical specialties and the basic sciences, as well as collections in nursing and allied health. Domestic and foreign periodicals, textbooks, audiovisuals, and computer software are included.

The Carpenter Library’s website, www.wakehealth.edu/library, offers access to PubMed, UpToDate, Journal Citation Reports, Micromedex, PsycINFO, and Web of Science, as well as over 70 other bibliographic and full-text databases. Nearly 5,000 electronic journals and 200 textbooks are also available. Specific collections deal with the written and oral history of the medical school, the history of surgery, and the Suzanne Meads Art in Medicine Collection. The library produces the Faculty Publications Database which contains over 25,000 citations to WFUSM-authored journal articles, books, and book chapters.

The Library provides assistance to graduate students as they complete the Graduate School’s requirement to archive an electronic full-text copy of their thesis or dissertation in Wake
Forest University's institutional repository, WakeSpace at etd.wfu.edu. Computer classroom facilities are available for individual and group instruction and online examinations. The library offers instruction in individual databases (e.g. PubMed Medline), software (Microsoft Outlook, Word, Excel and PowerPoint), and on other research and publishing resources. Multimedia workstations in the Information Commons have flatbed scanners, Adobe Photoshop and Acrobat Professional, Microsoft Movie Maker, SAS and SPSS statistical software. The library has wireless access to the production network throughout the Library. The Library's Xerox room provides printing, copying, faxing and scanning to email in black and white and in color. The Library is open 100 hours a week, all year.

REYNOLDA CAMPUS

The Z. Smith Reynolds Library holds over 1.7 million volumes in the general collection, research collections in digital, print and microfilm formats, and nearly 12,000 DVDs. The Library serves as a congressionally designated selective federal depository and depository of North Carolina government information. The Library provides comprehensive reference and research services including assistance with directed and independent research and online searching, discipline-related library instruction, general library orientation, and tours. Its many database subscriptions include the ability to set up journal alerts to help students stay up-to-date in their fields of interest. Reference tools are available in electronic and print formats. Special collections in the Z. Smith Reynolds Library include the Rare Books and Manuscripts Collection and the Ethel Taylor Crittenden Baptist Historical Collection. The Rare Books and Manuscripts Collection, greatly enhanced by the donation of rare and fine books of the late Charles H. Babcock, emphasizes American and British authors of the 19th and 20th centuries. Among the collections are works of Mark Twain, Gertrude Stein, William Butler Yeats, T.S. Eliot and the publications of the Hogarth Press. The extensive Anglo-Irish literature collection includes the Dolmen Press Archive. The archive of alumnus Harold Hayes, editor of Esquire magazine in the 1960s–70s, and the Maya Angelou works for theater, television and screen are maintained in the special collections. The Ethel Taylor Crittenden Baptist Historical Collection contains significant books, periodicals, manuscripts, and church records relating to North Carolina Baptists, as well as the personal papers of prominent ministers, missionaries, and government officials with ties to Wake Forest College/University. The Wake Forest College/University Archive is maintained in the library as well.

The libraries are equipped for wireless Internet access. Facilities in the Z. Smith Reynolds Library include "The Bridge," a collaborative service between Information Systems and the Library. Faculty, students and staff can bring their University issued laptops for repair. The space also offers a multimedia lab. The library has ten group study rooms that are equipped with SmartBoard technology. These rooms can be booked online at http://zsr.wfu.edu/studyrooms. In addition, 90 locking study carrels located throughout the Reynolds stacks may be reserved by graduate students. On the fourth floor of the Reynolds wing, a 120 seat auditorium hosts lectures and DVD viewings and the adjacent Media Center contains a browsable collection of nearly 10,000 DVDs and equipment to view them individually or in groups.

The libraries are open continuously during the fall and spring semesters, 24 hours a day, from 10 a.m., Sunday morning through Friday at 7 p.m. Saturday the library is open an additional 9 hours. There are two 24-hour study rooms located near the entrance to the library that may be accessed by keycard anytime, including when the library is closed. The Johnson Graduate Lounge is available for graduate students of the College of Arts and Sciences. Access is available to graduate students by placing the Deacon OneCard at the card reader at the left of the entrance door from the 24/7 Study Room or from the exterior west side building entrance. The study room on one side of the Z. Smith Reynolds Library houses a Starbucks.

For more information on the libraries visit:

Z. Smith Reynolds Library http://zsr.wfu.edu
Professional Center Library http://pcl.wfu.edu
Coy C. Carpenter Library http://www.wakehealth.edu/Library/

INFORMATION TECHNOLOGY / ACADEMIC COMPUTING

BOWMAN GRAY CAMPUS

The Office of Academic Computing is dedicated to the development and support of technology innovations in graduate education. Its mission is to provide the infrastructure for faculty and students to effectively utilize technologies to augment the lifelong learning process. A key role of the department is to facilitate basic understanding with regard to the uses of technology, not only within education but also within the workplace.

The department has developed a ubiquitous computing environment, focusing on technology standards in hardware, software, and networking. The main strategic initiative has been the development of a Web-based curriculum for the individual programs of the Graduate School. The Web-based curriculum provides an organization framework for the digitized lectures and course materials of each program, education-oriented Web sites, schedules, collaborative discussions, and links to specialty content application.

The Medical Center's Information Technology group provides contiguous technical support for faculty, staff and students 24 hours per day, each day of the year. Both hardware and software support are provided through various groups in this department. In addition to the technical support functions, the office also provides services to the faculty for the development of teaching applications and assistance with the digitization of curriculum content. Three software developers are employed for this specific purpose.

Wake Forest has a gigabit Ethernet connection to the Internet. Wake Forest is also a key member of Internet 2, which is focused on providing advanced network technologies, and the North Carolina Research and Education Network (NCREN), which provides statewide educational programs.

Information Systems supports the instruction, research, and administrative needs of the Reynolda Campus of Wake Forest University. The campus computer network offers high-speed wired and wireless connectivity from all campus buildings. Prior to the beginning of classes, Wake Forest University provides new full-time graduate students with Wake Forest-owned laptops. This practice does not include the Documentary Film Program (DFP). Information Systems provides service and support for the ThinkPad and the standard software that Wake Forest licenses for use by students. Maintenance warranty against manufacturer's defects is provided for the notebook computers for a limited time. Students are responsible for the care of the computer and will be subject to full replacement cost for loss or damage not covered by warranty.

These notebook computers contain a standard suite of powerful programs that allow students easy access to research and class materials and offer the ability to interact with faculty, staff, and other students through the campus network. Software programs include Microsoft Office, digital media tools, and e-mail and Internet applications like Mozilla. A large variety of instructional, classroom, and research resources are also available. These include online resources, databases, and electronic journals provided by the Z. Smith Reynolds Library. The Library's online resources can be accessed from all campus buildings via the campus network, or from anywhere via the internet.

Information Systems maintains an extensive array of online information systems that support University admissions, student registration, grade processing, payroll administration, accounting services, and many other administrative and academic applications. In addition, the Wake Forest Information Network (WIN) provides the University community with features like faculty, staff, and student directories; an alumni directory and career networking service; online class registration; electronic access to view payroll and tax information; and vehicle registration.

Students also have access to computing resources outside the University. The University is a member of the Inter-University Consortium for Political and Social Research (ICPSR), located at the University of Michigan. Membership in ICPSR provides faculty and students with access to a large library of data files, including public opinion surveys, cross-cultural data, financial data, and complete census data. The University is also a member of EDUCAUSE, a national consortium of colleges and universities concerned with computing issues.

The University has computing facilities that serve both academic and business needs. Wake Forest's network infrastructure includes

The University has computing facilities that serve both academic and business needs. Wake Forest's network infrastructure includes
a ten Gigabit per second Ethernet backbone, a mixture of 100 Megabit and 1 Gigabit per second switched connectivity to the desktop, and pervasive wireless connectivity in all campus buildings. LINUX and Windows-based servers provide for business computing needs and services. A mix of LINUX systems and Windows-based systems provide for messaging, systems management, Internet, intranet, courseware, various research needs, and file and print services. A LINUX supercomputing cluster provides supercomputing services for math, computer science, physics, and other scientific research applications. These systems are available to students, faculty, and staff 24 hours a day through the Wake Forest University network or over the Internet. All connections are protected by VPN and firewalls.

Information Systems provides assistance online at http://help.wfu.edu, by telephone at xHELP (4357), and supports walk-in customers in The Bridge located on the main floor of the Z. Smith Reynolds Library. The Bridge provides assistance with information technology services including multimedia, filming, computer repair, and equipment loans and purchases. For more information about The Bridge visit http://zsr.wfu.edu/services/technology/bridge.

RECOGNITION AND ACCREDITATION

Wake Forest University is accredited by the Southern Association of Colleges and Schools Commission on Colleges to award baccalaureate, masters, and doctorate degrees. Contact the Commission on Colleges at 1866 Southern Lane, Decatur, Georgia, 30033-4097 or call 404-679-4500 for questions about the accreditation of Wake Forest University.

The Wake Forest School of Medicine is a member of the Association of American Medical Colleges and is fully accredited by the Liaison Committee on Medical Education, the joint accrediting body of the Association of American Medical Colleges and the American Medical Association. The Wake Forest University Physician Assistant Program is accredited by the Accreditation Review Commission on Education for the Physician Assistant Inc. (ARC-PA). For more information on the accreditation status of the program, visit the ARC-PA website (www.arc-pa.org/Acc_Programs/acc_programs.htm) or the medical school website (www.wfubmc.edu/Academic-Programs/Physician-Assistant-Program/Accreditation.htm). The School of Law is a member of the Association of American Law Schools, the American Bar Association, and is listed as an approved school by the Council of the Section of Legal Education and Admissions to the Bar of the American Bar Association and by the Board of Law Examiners and the Council of the North Carolina State Bar. Wake Forest University Schools of Business are accredited by the Association to Advance Collegiate Schools of Business. The program in counseling leading to the Master of Arts in Education degree is accredited by the Council for the Accreditation of Counseling and Related Educational Programs. The Divinity School is accredited by the Association of Theological Schools in the United States and Canada (ATS).

Wake Forest University is a member of many of the major institutional organizations and associations at the national, regional, and statewide levels, including the following: The American Council on Education, the Association of American Colleges, the National Association of Independent Colleges and Universities, the Council of Graduate Schools in the United States, the Commission on Colleges of the Southern Association of Colleges and Schools, Oak Ridge Associated Universities, Southern Universities Conference, the North Carolina Conference of Graduate Schools, the North Carolina Association of Colleges and Universities, the North Carolina Department of Public Instruction, and the North Carolina Independent Colleges and Universities. In addition, many offices of the University are members of associations which focus on particular aspects of university administration.

OAK RIDGE ASSOCIATED UNIVERSITIES

Since 1993, students and faculty of Wake Forest University have benefited from its membership in Oak Ridge Associated Universities (ORAU). ORAU is a consortium of ninety-eight colleges and universities and a contractor for the U.S. Department of Energy (DOE) located in Oak Ridge, Tennessee. ORAU works with its member institutions to help their students and faculty gain access to federal research facilities throughout the country; to keep its members informed about opportunities for fellowship, scholarship, and research appointments; and to organize research alliances among its members.

Through the Oak Ridge Institute for Science and Education (ORISE), the DOE facility that ORAU operates, undergraduates, graduates, postgraduates, as well as faculty enjoy access to a multitude of opportunities for study and research. Students can participate in programs covering a wide variety of disciplines including business, earth sciences, epidemiology, engineering, physics, geological sciences, pharmacology, ocean sciences, biomedical sciences, nuclear chemistry, and mathematics. Appointment and program length range from one month to four years. Many of these programs are especially designed to increase the numbers of under-represented minority students pursuing degrees in science- and engineering-related disciplines. A comprehensive listing of these programs and other opportunities, their disciplines, and details on locations and benefits can be found at www.orau.gov/orise/educ.htm, or by calling the contact below.

ORAU’s Office of Partnership Development seeks opportunities for partnerships and alliances among ORAU’s members, private industry, and major federal facilities. Activities include faculty development programs, such as the Ralph E. Powe Junior Faculty Enhancement Awards, the Visiting Industrial Scholars Program, consortium research funding initiatives, faculty research, and support programs as well as services to chief research officers.

For more information about ORAU and its programs, contact Monnie E. Champion, ORAU corporate secretary, at 865.576.3306; or visit the ORAU at www.orau.org.
The Graduate School

In accord with the prevailing custom among American colleges during the antebellum period, Wake Forest granted honorary master's degrees to selected alumni.

By 1862, when the College closed temporarily because of the Civil War, twenty-nine such degrees had been awarded. The first announcement of a program of study leading to an earned graduate degree at Wake Forest was made in 1866. Between 1871, when the first degrees earned under the plan were awarded to John Bruce Brewer (grandson of Samuel Wait) and Franklin Hobgood, and 1951, 383 Master of Arts and Master of Science degrees were granted. In 1949 the School of Arts and Sciences discontinued admitting applicants for the Master of Arts degree because the rapid increase in the size of the undergraduate student body following World War II had overloaded the faculty. The School of Medicine did not interrupt its graduate program. The first Master of Science degree conferred by the school after it moved to Winston-Salem was awarded in 1943, and the degree was offered regularly thereafter by the departments of Anatomy, Biochemistry, Microbiology, Pharmacology, and Physiology.

During the fifteen years the College and the School of Medicine were located in different towns, the study of graduate education continued on both campuses. The self-study report adopted by the faculty of the School of Arts and Sciences immediately prior to its move to Winston-Salem recommended that graduate study leading to the Master's degree be resumed as soon as practicable. In 1958 the administration of the School of Medicine, in view of an increasing demand for graduate instruction in basic medical and clinical sciences, appointed a Committee on Graduate Studies for the purpose of reorganizing the graduate program.

As a result of these two parallel studies and in recognition of the need for an institution-wide approach to graduate education, the trustees, on January 13, 1961, established the Division of Graduate Studies and authorized it to grant the Master of Arts degree in the School of Arts and Sciences and the Master of Science and Doctor of Philosophy degrees in the School of Medicine. The first PhD degree was awarded in 1964. In 1967 the Master of Arts in Education degree was added to the graduate program in arts and sciences. A program, leading to the Master of Arts in Liberal Studies, was begun in the summer of 1987. The first PhD program on the Reynolda campus was begun in 1970.

STATEMENT OF PURPOSE OF THE UNIVERSITY

Following is the official statement of the purposes and objectives of the University:

Wake Forest University is committed to the pursuit of excellence in the liberal arts and in graduate and professional education. It seeks to maintain the quality and distinctive character in its pursuit of its mission derived from its private, coeducational, and residential character; its size and location; and its Baptist affiliation. Each of these factors constitutes a significant aspect of the unique character of the institution.

The University is comprised of Wake Forest College, the Graduate School, the School of Law, the Wake Forest University School of Medicine, the School of Divinity and the School of Business. It seeks to honor the ideals of liberal learning, which entail commitment to transmission of cultural heritages; teaching the modes of learning in the basic disciplines of human knowledge; developing the critical appreciation of moral, aesthetic, and religious values; advancing the frontiers of knowledge through in-depth study and research; and applying and using knowledge in the service of humanity.

Wake Forest has been dedicated to the liberal arts for over a century and a half; this means education in the fundamental fields of human knowledge and achievement, as distinguished from education that is technical or narrowly vocational. It seeks to encourage habits of mind that ask "why," that evaluate evidence, that are open to new ideas, that attempt to understand and appreciate the perspectives of others, that accept complexity and grapple with it, that admit error, and that pursue truth. Wake Forest College has by far the largest student body in the University, and its function is central to the University's larger life. The College and the Graduate School are most singularly focused on learning for its own sake; they, therefore, serve as exemplars of specific academic values in the life of the University.

Beginning as early as 1894, Wake Forest accepted an obligation to provide professional training in a number of fields as a complement to its primary mission of liberal arts education. This responsibility is fulfilled in the conviction that the humane values embodied in the liberal arts are also centrally relevant to the professions. Professional education at Wake Forest is characterized by a commitment to ethical and other professional ideals that transcend technical skills. Like the Graduate School, the professional schools are dedicated to the advancement of learning in their fields. In addition, they are specifically committed to the application of knowledge to solving concrete problems of human beings. They are strengthened by values and goals which they share with the College and Graduate School, and they enhance the work of these schools and the University as a whole by serving as models of service to humanity.

Wake Forest was founded by private initiative, and ultimate decision-making authority lies in a privately appointed Board of Trustees rather than in a public body. Funded to a large extent from private sources of support, Wake Forest is determined to chart its own course in the pursuit of its goals. As a coeducational institution it seeks to "educate together" persons of both sexes and from a wide range of backgrounds—racial, ethnic, religious, geographical, socioeconomic, and cultural. Its residential features are conducive to learning and to the pursuit of a wide range of co-curricular activities. It has made a conscious choice to remain small in overall size; it takes pride in being able to function as a community rather than a conglomerate. Its location in the Piedmont area of North Carolina engenders an ethos that is distinctively Southern, and more specifically North Carolinian. As it seeks to broaden further its constituency and to receive national recognition, it is also finding ways to maintain the ethos associated with its regional roots.

Wake Forest is proud of its Baptist and Christian heritage. For more than a century and a half, it has provided the University an indispensable basis for its mission and purpose, enabling Wake Forest to educate thousands of ministers and lay people for enlightened leadership in their churches and communities. Far from being exclusive and parochial, this religious tradition gives the University roots that ensure its lasting identity and branches that provide a supportive environment for a wide variety of faiths. The Baptist insistence on both the separation of church and state and local autonomy has helped to protect the University from interference and domination by outside interests, whether these be commercial, governmental, or ecclesiastical. The Baptist emphasis upon revealed truth enables a strong religious critique of human reason, even as the claims of revelation are put under the scrutiny of reason. The character of intellectual life at Wake Forest encourages open and frank dialogue and provides assurance that the University will be ecumenical and not provincial in scope, and that it must encompass perspectives other than the Christian. Wake Forest thus seeks to maintain and invigorate what is noblest in its religious heritage.

MISSION OF THE GRADUATE SCHOOL

The mission of the WFU Graduate School of Arts and Sciences is to train and mentor future leaders in research, teaching and innovation for serving humanity. This embodies the Graduate School’s vital role as an engine of discovery that fuels the nation’s scholarly and creative enterprise. The Graduate School contributes to the academic reputation of the University by educating the next generation of teachers, scholars and by providing mentors and role models for educating undergraduates. A strong graduate program also helps support faculty research and is critical for faculty recruitment and retention.

We seek to instill in our students a sense of professionalism, which includes the ethical behavior inherent in their professional role, as well as respect for their colleagues, their field, and for society as a whole. We want our students to be critical, independent thinkers and good citizens. They should be motivated to apply their scholastic efforts to enlighten and improve the wellbeing of society. Thus the Graduate School is a key link for collaboration between departments and schools and for achieving WFU’s goal of becoming a collegiate university and major academic medical center.

Our values are steadfast and consist of critical thinking, service, diversity, discovery, mentoring, and ethics. These are integral to all our activities in the classroom, the laboratory or other research environments, the broader communities of which we are a part.

Our vision is for the Graduate School to be a diverse community of excellence. We achieve our vision and fulfill our mission through strategic activities that build pillars of excellence
in:

• Student experience, to create an optimized learning and mentoring experience that prepares students to lead in any career path.
• Research, to provide high-quality research partnerships for promoting innovation, discovery and creation of value to the community.
• Faculty and staff support, to enable seamless, effective, aligned services for maximizing time and resources for instruction and research.
• Internal and external communication that celebrates the prominence and value of the Graduate School and the University.

ADMINISTRATION
The Graduate School is administered by two Deans (one on each campus), and a Graduate Council composed of ex-officio administrative officials, twelve faculty members elected by the Graduate School faculty, and two graduate students elected by the Graduate Student Association. Six of the twelve are members of the College of Arts and Sciences (Reynolda campus) and six are members of the Wake Forest School of Medicine faculty (Bowman Gray campus).

ADMISSIONS
How to Apply
Information on the application process, as well as a link to the online application may be found on the Graduate School’s website at http://graduate.wfu.edu/admissions.

ELIGIBILITY
Undergraduate seniors and graduates of accredited U.S. colleges and universities or recognized foreign institutions may apply for admission to the Graduate School for study on the Reynolda campus or the Bowman Gray campus. Undergraduates must complete their degree requirements prior to entering the Graduate School. The Graduate School also accepts applications from holders of the MD, DDS, or DVM degrees, or from candidates for these degrees who will have satisfactorily completed the prescribed medical curriculum prior to matriculation in the Graduate School.

Whatever their previous academic training may have been, all applicants should have superior records. This requirement is usually interpreted as at least a B average or standing in the upper quarter of the class or both.

STUDENTS WITH DISABILITIES
Wake Forest University will consider the application of any qualified student, regardless of disability, on the basis of the selection criteria established by the University which includes personal and academic merit. Upon matriculation, all students will be required to meet the same standards for graduation.

The University endeavors to provide facilities which are in compliance with all laws and regulations regarding access for individuals with disabilities. Additionally, special services are available to reasonably accommodate students with disabilities. For more information on assistance for graduate students, please contact Van D. Westervelt, director of the Learning Assistance Center at 336.758.5929 or refer to Disability Services under Campus Life at the Wake Forest website.

Procedures
All students are responsible for familiarizing themselves with the portions of this bulletin that pertain to their course of study. Statements concerning courses and expenses are not to be regarded as irrevocable contracts between the student and the institution. The university reserves the right to change the schedule of classes and the cost of instruction at any time within the student’s term of residence.

ADMISSION CATEGORIES
Regular Status in a Degree Program. A person with a superior undergraduate record (at least a B average or upper quarter of the class and with the appropriate courses), satisfactory GRE scores, TOEFL or IELTS scores (for international students), and good recommendations may apply for regular admission.

 Provisional Status in a Degree Program. Provisional admission may be granted in certain circumstances and is limited to not more than 1 semester of full time study or its equivalent in part-time study.

 Unclassified Non-Degree Graduate Status. Applicants seeking courses for graduate credit, but not wishing to formally seek a graduate degree, may apply for admission as an unclassified or non-degree seeking student. Applicants are required to complete an application, submit the application fee, meet the immunization requirements, complete a demographic form for Employee Health Services (Bowman Gray Campus only), and submit an official transcript showing a baccalaureate degree at least one month prior to matriculation. Instructor approval is required for each course prior to enrollment.

CLASSIFICATION OF ADMITTED STUDENTS
Full-Time Status. A student who devotes full-time effort to a graduate program as outlined by his or her faculty committee and is in full-time geographic residence with a minimum of nine semester hours of coursework in fall and spring terms, including thesis research, is considered a full-time student. During summer terms, six semester hours of coursework is considered full-time. Students registered as “thesis only” or “graduate fee only” may be considered full-time. Half-time status on the Bowman Gray campus is defined as 5 hours in fall/spring terms and 3 hours in summer terms.

 Part-Time Status. A student registered for less than the above amount of coursework is considered a part-time student. Each program
will determine whether it is possible to pursue a degree on a part-time basis.

Reynolda Campus graduate students enrolled for full-time and part-time status are entitled to full privileges regarding libraries, laboratories, athletic events, student publications, the Student Union, the University Theatre, the Secret Artists Series of Wake Forest University, and the Student Health Service. Bowman Gray Campus graduate students enrolled for full-time or part-time study are entitled to full privileges regarding libraries and laboratories, and may have access to Reynolda campus extra-curriculum activities. Please consult with the Bowman Gray Graduate School office for further information.

**Continuous Enrollment**

Degree-seeking students must have continuous enrollment through the semester in which they graduate. Enrollment may be achieved by registering for courses, including research, or by registering as Thesis-Only or Graduate Fee. Bowman Gray PhD students must be registered for at least half-time in order to be considered continuously enrolled. Bowman Gray MS students should consult the Part-time Registration Policy for Continuing Master's Students in the section on Academics & Coursework Policies for additional information on ensuring continuous enrollment.

**Cost of Attendance**


**Tuition Schedule**

<table>
<thead>
<tr>
<th>Fall 2016/Spring 2017 Sessions</th>
<th>$37,520</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Full-time tuition (minimum 9 hours)</td>
<td>$37,520</td>
</tr>
<tr>
<td>- Part-time tuition (per credit hour)</td>
<td>$1,340</td>
</tr>
</tbody>
</table>

**Summer Sessions**

| Reynolda (per hour) | $1,000 |
| Bowman Gray (full-time, 6 hours) | $1,030 |
| On-line Campus (all semesters) | $1,300 |

**Tuition Concession**

There is a tuition concession plan for faculty and staff of the University and for the spouses of faculty and eligible staff members. For further information, contact the appropriate Human Resources office.

**Tuition for Courses Taken Across Campuses**

During both the academic year and the summer session, full-time graduate students on either campus may take graduate courses on the other campus without additional tuition.

**Student Graduation Fees**

All students pay a fee of $55 during the term in which the student files an intent to graduate with their appropriate Graduate School office. This is a non-refundable fee and is charged once per degree.

**University Fees**

A student health fee of $376 is charged for all full-time Reynolda campus students. A student activity fee of $100 is charged once per degree.

**Fees**

| Application Fee | $75 |
| Audit Fee | $110 |
| Thesis only (per term) | $40 |
| Graduation Fee | $55 |
| Late Registration Fee | $40 |
| Bowman Gray only | |
| Student Activity Fee (Reynolda only, per term, excludes On-line programs) | $50 |

**Tuition Refunds**

A student who withdraws from the University during a term or who drops a course before completing it may be entitled to a refund. It is important to note that a withdrawal/course drop may affect financial aid eligibility. Online Counseling and Human Services Programs are refunded according to the Refund Policy for Online Counseling & Human Services Programs. For more information please go to http://finance.wfu.edu/fs/student-refund. For all other programs, refer to the Return of Financial Aid Funds Policy and the Schedule of Adjustments for Withdrawal shown below.

**Schedule of Adjustments for Withdrawal or Continuous Enrollment Start Date**

**Fall & Spring Semesters**

<table>
<thead>
<tr>
<th>Official Date</th>
<th>Tuition Refunded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before classes begin</td>
<td>100% less deposit</td>
</tr>
<tr>
<td>First week of classes</td>
<td>90%</td>
</tr>
<tr>
<td>Second week of classes</td>
<td>75%</td>
</tr>
<tr>
<td>Third week of classes</td>
<td>50%</td>
</tr>
<tr>
<td>Fourth week of classes</td>
<td>30%</td>
</tr>
<tr>
<td>Fifth week of classes</td>
<td>20%</td>
</tr>
<tr>
<td>After fifth week of classes</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Summer Sessions**

<table>
<thead>
<tr>
<th>Class Days</th>
<th>Tuition Refunded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days 1 - 3</td>
<td>100% less deposit</td>
</tr>
<tr>
<td>Days 4</td>
<td>75%</td>
</tr>
<tr>
<td>Days 5</td>
<td>50%</td>
</tr>
<tr>
<td>Days 6</td>
<td>25%</td>
</tr>
<tr>
<td>After Days 6</td>
<td>0%</td>
</tr>
</tbody>
</table>

A student using scholarships, grants, or loans to help pay educational expenses, whose account was paid-in-full prior to withdrawal, is likely to owe the University after withdrawal. Return of Title IV funds are handled in accordance with federal law. Please refer to Wake Forest’s official Refund of Charges and Return of Financial Aid Funds Policy. Students should consult the Office of Financial Aid for more information.

If the University deems it necessary to engage the services of a collection agency or attorney to collect or to settle any dispute in connection with an unpaid balance on a student account, the student will be liable for all collection agency and/or attorney's fees, reasonable expenses, and costs incurred.

The University reserves the right to drop a student who has failed to complete these assigned duties or to perform duties assigned by the student's department. Unsatisfactory performance or failure to complete these assigned duties will result in the withdrawal of all financial aid. In this case, students may be allowed to continue in the program by paying the remainder of their own tuition on a pro-rata basis, provided they are in good academic standing, or they may be dropped from the program. Exceptions to this regulation may be made on an individual basis involving extraordinary circumstances and with the recommendation of the student's department.

**Financial Aid**

**Reynolda Campus**

On the Reynolda campus, full-tuition scholarships, partial-tuition scholarships, fellowships, graduate assistantships, teaching assistantships, and research assistantships are available to qualified students. Assistantships and fellowships include tuition scholarships as part of the grant. An assistantship includes tuition scholarship plus compensation for services rendered. Assistants work from 12 to 15 hours per week and carry a normal course load.

Acceptance of a teaching or research assistantship carries with it the obligation to perform duties assigned by the student's department. Un satisfactory performance or failure to complete these assigned duties will result in the withdrawal of all financial aid. In this case, students may be allowed to continue in the program by paying the remainder of their own tuition on a pro-rata basis, provided they are in good academic standing, or they may be dropped from the program. Exceptions to this regulation may be made on an individual basis involving extraordinary circumstances and with the recommendation of the student's department.

Assistantships and fellowships are potentially renewable, but the total number of years a student working toward the master's degree may receive support may not exceed two. Information on financial aid awards will be included in the offer of admissions letter.

Some students who receive graduate assistantships may be assigned duties outside the department of study.

The residence life and housing office on the Reynolda Campus has a limited number of hall director and compliance advisor positions available to qualified graduate students. Interested students are urged to contact the Office of Residence Life and Housing for more information by calling 336.758.5185; e-mailing housing@wfu.edu; or visiting the employment section of www.wfu.edu/housing.

The Barn, a venue for student gatherings of a social nature, has a small number of positions.
available for graduate students to assist with event and program management. Interested students are encouraged to contact campus life at 336.716.4070 or campuslife@wfu.edu.

The Graduate School may award educators teaching full-time in public schools or state-approved, non-public schools a one-half scholarship of the cost of part-time tuition. This policy covers only educators who have a current contract and teach either in grades kindergarten through 12th or in community college institutions.

Bowman Gray Campus

Financial support for students on the Bowman Gray campus may be provided from a combination of sources, including Dean’s fellowships, graduate fellowships, and tuition scholarships. In addition, many students are supported as graduate research assistants or associates from externally funded sources, typically from federal grants. Fellowships typically include some form of tuition scholarship.

Student Loans

Reynolds graduate students may submit a FAFSA to determine eligibility for the Federal Direct Unsubsidized loan program. A graduate student must be enrolled at least half-time as a degree seeking student to be considered for federal student aid.

Bowman Gray campus students may contact the Office of Financial Aid for information on federal student loans by phone: 336-716-4264; by email: finaid@wakehealth.edu; or in person: Bowman Gray Center for Medical Education (Building 60N), 1st floor, Enrollment Services, Monday-Friday, 7:30 AM – 4:30 PM. North Carolinians may receive applications from College Foundation Inc., P.O. Box 12100, Raleigh, NC 27605-2100.

A student must be in good academic standing and must be making satisfactory academic progress toward the degree to be eligible for a student loan. Unclassified (non-degree seeking), certificate program students, and provisionally accepted students are not eligible for financial aid.

Policy on External Remuneration

A student supported on a stipend from the Graduate School, faculty grant, student fellowship, or other sources may be allowed to engage in additional remunerative work with written permission from his or her advisor, provided the work does not delay or interfere with the duties required for timely completion of the degree. Students with experience to support beyond a partial tuition scholarship may engage in outside remunerative work without approval from the Graduate School. All students will be monitored for satisfactory academic progress. Failure to make satisfactory academic progress may result in dismissal from the Graduate School as detailed in the section on Satisfactory Academic Progress.

Graduate School Scholarship Awards

A limited number of merit-based scholarships are available for highly qualified students. Any student interested in the awards listed below should contact their program director for additional information.

- Gordon A. Melson Outstanding Doctoral Student Award provides a cash award to a student for being outstanding in research, productivity, and quality. Other factors which are considered in conferring this award are academic record, activity in the discipline, as well as university and departmental citizenship.

- The Louis Argenta Physician-Scientists Scholar Award Scholarship seeks to develop leaders in translational science by providing funds to support MD/PhD students during their research years. The new calling for the physician-scientist is to lead these diverse teams. This scholarship will be awarded to MD/PhD students that have outstanding interpersonal skills, superior communication, and the potential to develop into a leader in translational science.

- The Norman M. Sulkin Scholarship Fund provides scholarship assistance to students in the neurobiology and anatomy PhD program.

- The Camillo Artom Scholarship provides annual scholarship grants to one or more students enrolled in programs leading to the MD or PhD degrees with special preference given to students seeking a degree in biochemistry and molecular biology.

- Herbert C. Cheung PhD Award provides a cash award to recognize an outstanding graduate student in the Department of Biochemistry and to promote excellence in research in the broad field of biochemistry.

- The Sandy Lee Cowgill Memorial Scholarship Fund provides scholarships to at least two students, the first of whom shall be enrolled in the MD program and the second of whom may be enrolled in the MD or PhD program, with preference given to a student in biochemistry and molecular biology.

- The Mike and Lucy Robbins Fellowship Fund provides a stipend for a current graduate student conducting cancer-related research.

- David K Sundberg Award provides a cash award to recognize a PhD student with outstanding academic proficiency and professionalism as well as exemplary character as citizens and colleagues in the Department of Physiology and Pharmacology.

Satisfactory Academic Progress

To determine continuing financial aid eligibility, the financial aid committee evaluates the student’s satisfactory academic progress at the end of each term. The receipt of federally-controlled aid requires half-time enrollment (4.5 or more hours on the Reynolds Campus and 5.0 or more hours on the Bowman Gray Campus) in a degree seeking program during the fall and spring semesters. On the Bowman Gray Campus, 3.0 or more hours in the summer term constitutes half-time enrollment. In addition to the enrollment requirements, a minimum cumulative grade point average of 2.5 on work attempted in the Wake Forest University Graduate School of Arts and Sciences is required. Certain programs have higher academic requirements, which are communicated directly to the students by the programs. The Dean may revoke institutionally-controlled financial aid for violation of University regulations, including its Honor Code, or for violation of federal, state, or local laws. The full policy may be found on the Graduate School’s website (http://graduate.wfu.edu/students/).

ACADEMIC & COURSEWORK POLICIES

Statement on Student Rights and Responsibilities

The graduate faculty has adopted a formal Honor Code to provide guidance for student conduct with respect to academic pursuits. This policy may be accessed at the Graduate School website (http://graduate.wfu.edu/students/).

Faculty are appointed as liaisons on both campuses to facilitate faculty or students who seek to file a grievance. Graduate students interested in filing a grievance are also encouraged to speak with the chair(s) of the Graduate Student Association or other of its officers to seek advice regarding the grievance procedure. The names and e-mail addresses of the faculty liaisons and GSA co-chairs can be obtained from the Graduate School office on either campus or the Graduate School website (http://graduate.wfu.edu/faculty/graduate-council.html).

Patents Policy

Inventions and Patents. During a student’s course of study, he or she may participate in research or other work which leads to an invention or discovery. These inventions or discoveries are the property of the University. The University’s Inventions and Patent Policy is applicable to student inventions with respect to the definition of inventions covered, resolution of disputes, and the division of proceeds, including the determination of the inventor(s) share of any proceeds. Under this policy, a program exists to determine patentability and commercial value of each invention. Advice and guidance regarding this policy are available from the Office of Technology Asset Management.

Copyright Policy

The Copyright Policy of Wake Forest University is intended to:

1. Encourage research and teaching by rewarding the authors of intellectual works, assisting them in implementing their ideas, and by providing a system for the encouragement of
scholarship and creative activity;
2. Serve the public interest by providing means through which intellectual works may be made available to the public; and
3. Protect the rights of the University, its faculty, its staff, and its students with regard to intellectual works developed at the University.

REGISTRATION POLICIES

TERM REGISTRATION

Thesis-only Registration Policy (Bowman Gray Campus). Registration for the thesis-only course is restricted and requires permission from the Director of the Graduate School. In order to register for the thesis-only course, one of two conditions must be met: 1) the student defends the thesis at a point in time that precludes them from being able to have their degree conferred with the current term, or 2) the student has advanced to candidacy and leaves the institution with their faculty advisor. In both cases, thesis-only is used to allow a student to continue their relationship with the Graduate School, and will be considered continuously enrolled, until their degree can be conferred.

Part-time Registration Policy for Continuing Master’s Students (Bowman Gray Campus). Master’s students on a thesis, project, or internship plan on the Bowman Gray campus who have completed 25 (out of the required 36) credit hours, of which 3 (out of the required 6) are research, project, or internship hours, and have a GPA ≥ 3.0, are allowed to register for a total of 5 credit hours per spring and fall terms, or 3 total hours per summer term, and will be reported as an at least half-time enrollment. The student, Master’s students on a coursework-only plan on the Bowman Gray campus who have completed 31 (out of the required 36) credit hours, and have a GPA ≥ 3.0 are also subject to this policy. Continuing Master’s students reaching these benchmarks will be charged tuition per credit hour as published in the Cost of Attendance section. Continuing Master’s students who fail to complete the described benchmarks, or if the GPA drops below 3.0, will register full-time and are subject to the financial terms described in their original letter of acceptance.

Late Registration (Bowman Gray Campus). A continuing student who fails to register for any courses by the first day of classes will be charged a late registration fee.

COURSE REGISTRATION

Repeating a Course. As of the fall 1999 term, a graduate student may repeat a course in which a B- or lower grade has been received. The course may be counted only one time for credit. The higher grade earned will be counted in calculation of grade point average. Both grades will appear on the transcript. In addition, federal financial aid rules dictate that federal aid can only be used twice for the same graded course.

Dropping a Course. During the Add/Drop period, a student may drop a course without penalty or notation on the transcript. After the Add/Drop period, a student may drop a course with the approval of the Dean of the Graduate School, the program, and the student’s faculty advisor. The student is assigned a Drop (DRP). Courses marked Drop are not counted in determining the grade point average. Reynolda students may access Add/Drop forms on the Graduate School website. Bowman Gray students should reach out to Graduate Student Records to request a course drop. Students are responsible for officially dropping courses to be eligible for a refund of tuition. Nonpayment for classes for which a student is registered or non-attendance in a registered class does not release the student from financial obligation, nor does not result in a withdrawal from the course.

Auditing a Course. Auditing a course consists of participating in a course without receiving a letter grade or credit hours. When space is available after registration of students enrolled for credit, others may request permission of the instructor to enter the course as auditors. In no case may anyone register to audit a course before the first meeting of the class. No add/drop charge is made to full-time students in the Graduate School of Arts and Sciences; for unclassified or non-degree seeking students, an audit fee is assessed. In addition to the permission of the course instructor, permission of the advisor is required for degree-seeking students. An auditor is subject to attendance regulations and to other requirements of performance established by the instructor. Although an auditor receives no credit, a notation of audit is made on the final grade report and entered on the record of enrolled students who have met the instructor’s requirements.

Transfer of Credit

Transfer of graduate credits earned at other universities.

A course that was completed at another college or university may be considered for transfer to a Master’s program provided that: a) the course is considered as a graduate course; b) the course was not taken as part of a previous Master’s degree program at another institution; c) the grade in the course is B or better. The maximum number of hours that may be transferred toward a Master’s degree is 6. Transfer of courses for PhD degree candidates are held to the same standards for transfer credits, but are not limited in terms of the count of credit hours.

Transfer of graduate credits earned while enrolled in a previous graduate degree program at Wake Forest University.

A graduate course that was completed while the student was enrolled in a previous graduate program at Wake Forest University may be considered for transfer to a second program provided that the course was not counted toward the first degree and a grade is B or better was earned. The maximum number of hours that may be transferred to a different program within the University toward a Master’s degree in another program is 6.

GRADING POLICIES

Records of progress are kept by the institution on all students enrolled. Grade reports are furnished to students at the end of each semester or summer term.

Grade of I. The grade of I (Incomplete) may be assigned only when a student fails to complete the work of a course because of illness or some other emergency. If the work recorded as I is not completed within thirty days after the student enters for his or her next semester, not counting the summer session, the grade automatically becomes F. The instructor must report the final grade to the registrar within forty-five days after the beginning of that semester. In no case is a graduate degree awarded to a student who has an I record. Incomplete grade forms are available on the Graduate School website.

Grade of NR. The grade of NR (Not Reported) must be resolved within forty-five days after the beginning of the next semester or the grade automatically becomes F or Unsatisfactory. In no case is a graduate degree awarded to a student who has an NR on record.

Grade of U (Unsatisfactory) in Thesis/Dissertation Research. A student who receives a U in research may be placed on academic probation even if the student’s cumulative GPA is above 2.5. A student who receives a grade of U in research in two semesters may be dismissed from the Graduate School by the Dean upon recommendation of the program.

Minimum Grade Requirements. A student whose cumulative grade point average (GPA) falls below 2.5, or below the program's GPA standard, may be placed on academic probation. The student will have one semester to bring his/ her GPA to 2.5 or greater; otherwise, the student may be dismissed from the Graduate School by the Dean. The grade point average is obtained by dividing the total number of grade points earned by the total number of hours attempted for a grade, including hours for courses in which the grade is F. Satisfactory/unsatisfactory grades do not factor into the GPA calculation.

Grades Assigned

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>A-</td>
<td>3.67</td>
</tr>
<tr>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>B</td>
<td>3.00</td>
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<td>B-</td>
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<td>C+</td>
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<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

AUD Audit

DRP Official Drop (not counted as hours attempted)

NC No credit

NR Grade not reported (becomes passing grade or F)

RPT Course repeated (see repeating a course)

WD Withdraw (not counted as hours attempted)

WP Withdraw passing (not counted as hours attempted)

WF Withdraw failing (not counted as hours attempted)

Individual programs may require a higher grade point average than 2.5 for ongoing enrollment. If there is such a requirement, it is stated in the program policies. A student may be dismissed from the Graduate School by the Dean upon recommendation of the program if
the student is failing to make adequate progress in research. Adequate progress is determined by the standards of the program in which the student is enrolled.

The minimum grade point average required for graduation is 3.0. PhD candidates must have a grade point average of 3.0 in graduate courses at the time of the preliminary examination. A 3.0 grade point average is also required to earn a graduate certificate.

**Changes in Status**

**Leave of Absence.** Students who are in good academic standing and wish to take a leave of absence must receive approval from their advisor and program director along with the Dean of the Graduate School. A student who goes on an approved leave must turn in their badge, laptop, and keys prior to officially starting their leave. Reynolda students can access the necessary form at http://graduate.wfu.edu/students/ under 'Student Forms.' Bowman Gray students should contact Graduate Student Records. The Records team will provide the form and instructions for completion. The maximum time for a leave of absence is one academic year. Details on returning from leave are outlined in the section below on Reinstatement. If a student on an approved leave has not requested reinstatement after a year, the student will be administratively withdrawn from Graduate School.

Wake Forest University does not have a leave of absence policy that would either exempt any student from the requirements of the Return of Title IV Funds policy, or extend federal student loan deferment benefits.

**Transferring to a Different Program.** This policy applies to students in the biomedical sciences (Bowman Gray Campus) ONLY.

A student who wishes to transfer from one program to another are allowed to do so provided the standards of the new program are met. The student should contact the program director of the program to which the student wishes to transfer. After consultation with the program director, the student should interview with one or more prospective advisors. If a prospective advisor is identified, the student's transfer request may be considered further.

Upon receipt of a written request from the student, the Graduate School will forward credentials from the student's file to the program director for evaluation and consideration of financial aid. At the conclusion of this process, the program director sends a transfer recommendation to the Dean of the Graduate School for approval. The student is required to withdraw from an existing program until the transfer request to the new program has been approved.

It is understood that the program from which the student is transferring would have no further financial responsibility for the student. The student must, however, complete the formal process of withdrawing from the original program by the end of the current semester.

**Accommodation for Students of Faculty Who Leave the Institution.** In the case where a student has advanced to candidacy, and their faculty advisor leaves the institution prior to completion of the degree by his or her student(s), the Dissertation Committee (or Department Graduate Committee if there is no Dissertation Committee) is responsible for recommending an appropriate plan for the completion of the degree. The plan should address the following: support of stipend and research funding (including lab space), designation of a primary mentor, and designation of a manager to carry out the plan. This plan must be submitted within six weeks of the faculty member's resignation and approved by the Dean.

In the case where a student has advanced to candidacy and chooses to leave the institution with their faculty advisor, the student will be required to continue register for Thesis-only for the remainder of their course of study.

In the case where a student has not yet advanced to candidacy and chooses to leave the institute with their faculty advisor, the student will be required to transfer to the new institution.

**Withdrawal from the University.** Students who wish to withdraw from the Graduate School must complete the appropriate form, which requires approval from the program and the Dean of the Graduate School. Students who leave without following this procedure will receive a grade of F in each course in progress. Students on the Reynolda campus who were issued a Graduate School laptop computer are required to return it to Information Systems. Students on the Bowman Gray campus are required to return their laptop computers to the Academic Computing office. During the academic year, all students, full- and part-time, receive tuition refunds according to the stated schedule. This policy applies to students dropping courses as well as to those withdrawing. Withdrawals must be official and students must send in their identification cards and laptop computer before claiming refunds. Graduate students who are recipients of Title IV federal financial aid ( Pell Grants, SEOG, FWS, Perkins Loans, Stafford Loans and PLUS Loans) should refer to the Return of Financial Aid Funds Policy and the Schedule of Adjustments for Withdrawal.

A student who withdraws by the drop date for the degree, as established by the academic calendar, will not have a grade recorded for courses in progress. A student who withdraws after the drop deadline will be assigned a grade of withdraw-passing or withdraw-failing for each course in progress. The withdrawal date for a student enrolled in an on-line program will be determined by the last time the student participated in an online discussion or made contact with a faculty member. Simply logging in to a course is not determinative of participation in the course.

**Reinstatement.** A student who has withdrawn from the Graduate School and wishes to return within one academic year must request reinstatement to the Dean of the Graduate School at least one month prior to the semester in which they wish to re-enter. To be reinstated the student must be in good academic standing and receive approval from the graduate program and the Dean of the Graduate School. The time spent during an approved leave or withdrawal will not count in the maximum time allotted for the degree. Students who have withdrawn from the Graduate School and who wish to re-enter after one academic year must reapply for admission as stated in the Graduate Bulletin by the application deadline, and must be recommended by the program and accepted by the Dean of the Graduate School.

If a student is approved for readmission to the Graduate School within a five-year period, previous coursework may count towards the degree requirements at the discretion of the Dean of the Graduate School on the recommendation of the program. If the student re-enters Graduate School after a five-year period, previous courses will not count toward the degree requirements.

**Dismissal.** A student who is failing to make satisfactory academic progress, determined on the basis of the GPA, multiple Unsatisfactory research grades, or as determined by the program, may be dismissed from the Graduate School.

**STUDENT WELLNESS**

**STUDENT HEALTH SERVICE**

**Bowman Gray Campus.** Students are required to have adequate health insurance. Any charges generated that are not covered by the student's insurance policy will be the personal responsibility of the student. Students may enroll in the student injury and sickness insurance plan. Information on this plan will be provided by the Graduate School office.

Prior to matriculation, each student is required to complete a health assessment questionnaire, have a complete physical exam, and have updated immunizations at his/her expense.

The Medical Center Employee Health Services will have the responsibility for monitoring compliance with the below mentioned immunization requirements as well as being responsible for ongoing tuberculosis screening done on a yearly basis. Employee Health Services also will manage any blood and body fluid exposures, as well as provide acute care clinics at no charge.

Students requiring care may be seen in the Department of Family and Community Medicine for provision of primary care services. Spouses and dependents' children may request the services of the assigned physician.

Members of the medical faculty serve as student's physicians. Clinics are held Monday through Friday, by appointment, for preventive and therapeutic services. Physicians are available for emergencies twenty-four hours a day, seven days a week, through an answering service. The student's medical insurance company will be billed for all visits. A co-pay must be submitted at the time of service.

**Immunizations.** Wake Forest University and North Carolina State law require that all new, transfer, re-admit, unclassified, or visiting students, except those with a valid exemption, submit certification of certain immunizations PRIOR TO MATRICULATION. Documentation should be on or attached to the completed immunization form provided by the Medical Center Employee Health Services. Acceptable documentation is (1) the signature of the appropriate official(s) having custody of the immunization records, such as a physician or county health department official, or (2)
a certificate from the student's former school containing the approved dates of immunizations, or (3) photocopies of the original records. The current Immunization Policy and the requirements therein can be reviewed at: http://www.wakehealth.edu/uploadedFiles/User_Content/SchoolOfMedicine/Student_Records_Policies%20on%20Immunizations.pdf. This form includes documentation of immunizations required by the University and the State of North Carolina.

Confidentiality. Student medical records are confidential. Medical records and information contained in the records may be shared with therapists and physicians who are involved in the student's care, and otherwise will not be released without the student's permission except as allowed by law. Students who wish to have their medical records or information released to other parties should complete a release of information form at the time of each office visit or service.

Class Excuses. The responsibility of excusing students from class rests with the faculty. Consequently the Student Health Service does not issue "excuses" for students. Students who are evaluated at the Student Health Service are encouraged to discuss their medical situations with their professors. A receipt documenting visits is available to students at checkout. Information concerning hospitalization and prolonged illnesses is sent, with the student's permission, to the appropriate dean.

Student Insurance Program Information. Beginning in the fall of 2010, health insurance will be required as a condition of enrollment for full-time students. Students who demonstrate comparable coverage may waive the coverage provided by Wake Forest University. Information about the policy plan and process instructions can be found at http://www.wfu.edu/services/vaccine/pdf).

Inclement Weather. When the University is closed due to inclement weather, the Student Health Service will have limited staff and will be able to provide care only for injuries and urgent illnesses. Appointments will be rescheduled.

Retention of Medical Records. Student medical records are retained for ten years after the last treatment, after which time they are destroyed. Immunization records are kept longer.

Immunization Policy. Wake Forest University and North Carolina State law (G.S. 130A-152) requires documentation of certain immunizations for students attending a North Carolina college or university. Students must submit certification of these immunizations PRIOR TO REGISTRATION. Documentation should be on or attached to the completed WFU

Student Health Service Information Summary Form in order to assure correct identification of the student. This form can be downloaded from the Wake Forest University Student Health Service website (www.wfu.edu/shs/docs/HIS.pdf). Acceptable documentation is a statement signed by the appropriate official(s) having custody of the records of immunization, such as a physician, county health department director or a certificate from a student's high school containing the approved dates of immunizations. The State statute applies to all students except those registered in off-campus courses only, attending night or weekend classes only, or taking a course load of four credit hours or less.

The American College Health Association recommendations and North Carolina State law require certification in accordance with the following:

Required and Recommended Immunizations

A list of all REQUIRED and recommended immunizations can be found at http://shs.wfu.edu/services/vaccines/.

Immunizations required under North Carolina law must be documented within thirty days following registration. After that time, students with incomplete documentation of immunizations will not be permitted to attend classes. Please note that some series require several months for completion.

Counseling Centers

Bowman Gray Campus. Counseling & Wellness Services (CWS) is located on the 1st floor of the Bowman Gray Center for Medical Education (Building 60N), Room 1213. Paige Greason, PhD, MAEd., LPC-S, RYT is the Director of Counseling & Wellness Services and Ryan MacLeod, MA, LMFT is a Senior Mental Health Counselor. Both Dr. Greason and Mr. MacLeod provide counseling and consultation, and oversee wellness activities to currently enrolled students on the Bowman Gray campus. All counseling and consultation services are confidential, and are free of charge to students.

Counseling & Wellness Services offers counseling for a variety of concerns including depression, anxiety, personal adjustment, disordered eating, managing stress, sexuality, and relationship issues. The Center is open Monday-Friday from 8:30 a.m. to 5 p.m. During the academic year when the undergraduate school is in session (excluding summer), and Student Health Service is open, after-hours psychological crises are handled by calling Student Health Service to reach the on-call counselor.
Degree Requirements

DEGREES OFFERED
The Graduate School of Arts and Sciences offers graduate programs leading to the Master of Arts (MA), Master of Arts in Education (MAEd), Master of Arts in Human Services (MAHS), Master of Arts in Liberal Studies (MALS), Master of Fine Arts (MFA), Master of Science (MS), and Doctor of Philosophy (PhD) degrees.

The following pages contain information on the three major degree requirements: MA, MS and PhD. Degree requirements for dual degree programs, certificate programs, and individual degrees (i.e. education, human services, liberal arts, and fine arts) are found in the Programs & Certificates section of this publication.

For both the MA and MS degrees, the Graduate School requires a minimum of 24 hours of coursework; however, the coursework requirements for the PhD degree are set by the individual graduate program committees or student advisory committees. The MFA is only offered in Documentary Film.

THESIS/DISSERTATION COMMITTEE COMPOSITION & REVIEW GUIDELINES

For Master’s degrees: When required by the degree or program, a thesis is written under the supervision of the student’s advisory committee. The committee must have no fewer than 3 members, including the advisor from the program, a second reader from within the program, and a third reader from outside the department or from the student’s area of concentration.

For the PhD degree: The examining committee for the dissertation must have no fewer than 5 members, including the program director, a representative from within the program, a second reader from within the program, and a third reader from outside the department or from the student’s area of concentration.

For all degrees: All members of the student’s advisory or examining committee should be members of the graduate faculty. With the approval of his or her advisor, a student may recommend a person who is not on the graduate faculty to serve on the examining committee as a voting member; however, the committee must have a minimum of two members from the graduate faculty. The thesis advisor must justify the participation of this person on the basis of research, publications, and/or professional activities in a letter to the Dean of the Graduate School requesting approval. The responsibility to confirm the committee and its members rest with the Dean of the Graduate School.

FINAL EXAMINATION ASSESSMENT

Requirements for thesis submission and format are posted on the Graduate School of Arts and Sciences website, found at http://graduate.wfu.edu. The examination verifies the work stated in the thesis and knowledge in related areas. The possible committee decision is: unconditional pass, pass upon rectifying minor deficiencies, pass upon rectifying major deficiencies, and fail. If a student fails, the student may be reexamined only once. The defense must take place by the stated graduation deadlines on the academic calendar, or the student will be required to register for a subsequent semester in order to have their degree conferred.

UNCONDITIONAL PASS

If all committee members agree that the student has passed unconditionally, there is consensus to pass the examination. The committee chair will sign the ballot, submit the ballot to the Graduate School, and the student shall be recommended for award of the degree.

PASS UPON RECTIFYING MINOR DEFICIENCIES

If reservations are expressed by committee members, the chair of the committee will ensure that the reservations are communicated to the student and the Dean of the Graduate School by signing and submitting the ballot to the Graduate School. The student and the advisor are jointly responsible for ensuring that the thesis is modified to address the committee’s reservations. Once the thesis has been modified, the student passes the examination, and the student will be recommended for award of the degree.

PASS UPON RECTIFYING MAJOR DEFICIENCIES

If reservations are expressed by committee members, the chair of the committee will ensure that the reservations are communicated to the student and the Dean of the Graduate School by signing and submitting the ballot to the Graduate School. The student and the advisor are jointly responsible for ensuring that the thesis is modified to address the committee’s reservations. Once the thesis has been modified, the student passes the examination, and the student will be recommended for award of the degree.

FAIL

If, in the opinion of more than one member of the thesis committee, the student has failed the examination, there is no consensus to pass. The chair of the committee will advise the student that the thesis fails to meet the requirements of the Graduate School. The chair will ensure that the student knows the reason(s) for failure and will submit the ballot to the Graduate School. If the student resubmits a new thesis for consideration by the Graduate School, at least three members of the thesis will be drawn from the original committee. If the modified or new thesis fails to meet the requirements of the Graduate School, the student shall be dismissed.

REQUIREMENTS FOR THE MASTER OF ARTS

Programs of study leading to the Master of Arts degree are offered in Bioethics, Communication, English, Liberal Studies, Mathematics and Statistics, Psychology, Religious Studies, and Sustainability. The degree is awarded to candidates who complete a minimum of 24 semester-hours of faculty-approved coursework with an average grade of B or above on all courses completed, meet any foreign language or special skills requirement, and write an acceptable thesis (if required) for which six hours of credit toward the 30 required for graduation are allotted. Students may earn additional credit for thesis research, but such hours may not be substituted for the 24 hours of coursework required. Some programs require more than 30 hours for graduation. These requirements are listed in the Degree Requirements for the individual program; see the program listings elsewhere in the Bulletin.

RESIDENCE REQUIREMENTS

The minimum residence requirement is one academic year or three summer sessions. The total allowable time for completion of the degree must not exceed six years.

COURSE REQUIREMENTS

At least 12 of the 24 hours in coursework (not counting thesis research) required for the degree must be in courses numbered 700 or above. The remaining 12 hours may be in either 600-level, 700-level, or 800-level courses. All of the required 24 hours of coursework must be taken for a grade, although additional courses may be taken Pass/Fail, if offered in that mode. Credit may be allowed for as many as six hours of graduate work transferred from another institution at the discretion of the Program Director and Dean of the Graduate School, but the minimum residence requirement is not thereby reduced.

FOREIGN LANGUAGE OR SPECIAL SKILLS REQUIREMENT

Some programs may require students to demonstrate a reading knowledge of an appropriate foreign language or competency in one or more special skills. Refer to each program’s statement to see if there is such a requirement and how it may be satisfied.

ADMISSION TO DEGREE CANDIDACY

A student is admitted to degree candidacy by the Dean of the Graduate School after recommendation by the program. The student must have satisfactorily met any foreign language or special skills requirement and is expected to complete the Master’s degree requirements within one semester.

THESIS REQUIREMENT

Some of the programs granting an MA require a thesis; the student should verify whether a thesis is required with the individual program. If required, 6 of the 30 hours required for the MA degree are allocated to thesis research. Thesis research courses are graded S (Satisfactory) or U (Unsatisfactory). If a U is assigned, the course must be repeated and an S
earned before the degree can be awarded. See the section on Thesis/Dissertation Committee Composition & Review Guidelines for details on the assessment of the Thesis.

**REQUIREMENTS FOR MASTER OF FINE ARTS**

**Requirements**

The Master of Fine Arts degree requires 57 hours of coursework. Students take four courses in documentary storytelling that address the core principles of research, theory, non-fiction writing, direction, and production design as well as courses in cinematography and sound and editing. Students receive nine credit hours for their creative thesis film, which they defend in the fall semester of their third year. The opportunity to create transmedia work is offered through The Imagination Project and courses in entrepreneurship and pedagogy prepare students for careers as entrepreneurial artists and academicians. Students may also take elective courses in an area of special interest.

**REQUIREMENTS FOR THE MASTER OF SCIENCE**

The Master of Science degree is offered on the Reynolda campus in Biology, Chemistry, Computer Science, Health and Exercise Science, and Physics. On the Bowman Gray campus, Master of Science degree is offered in Biomedical Engineering, Biomedical Informatics, Biomedical Science, Comparative Medicine, Clinical and Population Translational Sciences, Health Disparities in Neuroscience-related Disorders, Molecular Medicine and Translational Science, and Neuroscience.

**Residence Requirement**

In general, a minimum of 12 months of full-time work or its equivalent in residence is required for the Master's degree. The total allowable time for completion of the degree must not exceed six years.

**Course Requirements**

An MS candidate must have a minimum of 30 semester-hours of graduate credit. When a thesis is required, six hours of thesis research is the minimum requirement. For the Reynolda Campus, at least 12 of the 24 hours in coursework (not counting thesis research or GRD classes) required for the degree must be in courses numbered 700 or above. The remaining 12 hours may be in either 600-level, 700-level or 800-level courses. All of the required 24 hours of coursework must be taken for a grade, although additional courses may be taken Pass/Fail if offered in that mode. Some programs require more than 30 hours for graduation. Additional degree requirements are listed at the beginning of the applicable program section.

The course of study consisting of classes, seminars, and research is compiled by the student, the student's advisor, and the director of the program. It is recommended that, when possible, the course of study include courses in fields other than that of major interest. Credit may be allowed for as many as six hours of graduate work transferred from another institution at the discretion of the program director and Dean of the Graduate School, but the minimum residence requirement is not thereby reduced.

**Foreign Language or Special Skills Requirement**

Some programs may require students to demonstrate either a reading knowledge of an appropriate foreign language, or competence in one or more special skills. See the additional degree requirements for the applicable program.

**Scientific Integrity and Responsible Conduct of Research**

The successful completion of a program in scientific ethics is required prior to admission to degree candidacy. This requirement is fulfilled either by participating in the courses designated by the Graduate School or by satisfactory completion of approved program electives that incorporate extensive discussion of scientific ethics and responsible conduct in research.

**Admission to Degree Candidacy**

A student is admitted to degree candidacy by the Dean of the Graduate School after recommendation by the program director. The student must have satisfactorily met any foreign language, special skills, or ethics requirement and is expected to complete the MS degree requirements within one semester.

**Thesis Requirement**

Some of the departments granting an MS require a thesis; the student should verify whether a thesis is required with the individual program. If a thesis is required, 6 of the 30 hours required for the MS degree are allocated to thesis research. Thesis research courses are graded S (Satisfactory) or U (Unsatisfactory). If a U is assigned, the course must be repeated and an S earned before the degree can be awarded. See the section on Thesis/Dissertation Committee Composition & Review Guidelines for details on the assessment of the Thesis.

**Requirements for the Doctor of Philosophy**

Programs of study leading to the Doctor of Philosophy (PhD) degree are offered in Biochemistry and Molecular Biology, Biology, Biomedical Engineering, Cancer Biology, Chemistry, Integrative Physiology and Pharmacology Microbiology and Immunology, Molecular Genetics and Genomics, Molecular Medicine and Translational Science, Neuroscience, and Physics.

**Residence Requirement**

A minimum of three years of full-time study, of which at least two must be in full-time residence at the University. The total allowable time for completion of the degree must not exceed seven years.

**Course Requirements and Advisory Committee**

The number of required courses is not prescribed by the Graduate School for PhD study. Certain programs have required courses; students should consult individual programs for specific course requirements. Coursework plans are typically arranged by the student's adviser with the approval of the program graduate committee, with the goal of assessing mastery of appropriate fields of concentration. Courses required by programs cannot be taken as Pass/Fail, and graduate committees may designate that certain courses may not be taken Pass/Fail. The advisory committee is appointed by the program director and consists of the student's advisor and a minimum of two other members of the graduate faculty as described above in the Thesis/Dissertation Review Requirements.

**Foreign Language or Special Skills Requirement**

Some programs may require students to demonstrate either a reading knowledge of one or more appropriate foreign languages, or competence in one or more special skills. See the additional degree requirements for the applicable program.

**Scientific Integrity and Responsible Conduct of Research**

The successful completion of a program in professional development is required prior to admission to degree candidacy. This requirement is fulfilled by participating in the course Introduction to Professional Development in the Biomedical Sciences which is taken during the first year.

**Preliminary Examination**

This examination is conducted by the program. The examining committee selected by the program includes at least three members, one of whom represents a related concentration area. A single written examination or a series of written examinations should cover all areas of concentration and collateral studies. There may also be an oral examination in which any faculty member invited by the examining committee may participate. The examining committee passes or fails the student and notifies the Graduate School of the results. In the event of failure, the committee may recommend that the candidate be dropped from the program. A reexamination may be allowed no earlier than six months from the date of the first examination. A student may be reexamined only once. The preliminary examination is normally given near the end of the student's second year of graduate study and must be passed at least twelve months prior to the date of the awarding of the PhD.

**Admission to Degree Candidacy**

A student is admitted to degree candidacy by the Dean of the Graduate School after recommendation by the program director. The student must have passed the preliminary examination, satisfactorily meet any foreign language, special skills, ethics, and professional development requirements, and is expected to complete the degree requirements within one semester.
Dissertation Requirement
Under the supervision of an advisor committee, the candidate prepares a dissertation embodying the results of investigative efforts in the field of concentration. Students on the Bowman Gray campus must submit a copy of the dissertation to the Dean of the Graduate School at least four weeks prior to the proposed date of the final examination and copies distributed to the examining committee at least three weeks before the final examination. The committee is polled by the chair of the examining committee at least ten days before the proposed date of the examination to determine the acceptability of the dissertation. Other faculty members may attend the final examination and participate in the questioning. Dissertation research courses are graded S (Satisfactory) or U (Unsatisfactory). If a U is assigned, the course must be repeated and an S earned before the degree can be awarded. See the section on Thesis/Dissertation Committee Composition & Review Guidelines for details on the assessment of the Dissertation.

Degree Programs & Certificates
Semester hours of credit are shown by numerals immediately after the course title—for example, (3) or (3, 3). Some laboratory courses have numerals after the course descriptions showing hours of recitation and laboratory per week—for example, (2-4). The symbols P— and C— followed by course numbers or titles are used to show prerequisites and corequisites in the department. POI indicates permission of instructor is required. Because graduate study occurs at a level of complexity and specialization exceeding that of undergraduate education, the work required of graduate students in any course in which instruction is combined with undergraduate students will reflect this difference.

General Studies (GRAD)
Overview
The Graduate School offers several courses for students in graduate programs. Some courses are required by the degree or program, while others serve as general electives. Please consult the degree requirements and the individual program requirements to determine which courses are mandatory.

Degree Requirements: please see "Requirements for Degrees” beginning on page 26.

Courses of Instruction
701. Seminars in Professional and Career Development. A bimonthly seminar course, primarily for first-year graduate students, in which invited speakers give presentations on the training and career development that led them to their current professions. Typically, there are four speakers per semester from a variety of organizations, such as undergraduate colleges, research institutions, biotechnology and pharmaceutical companies, law firms, and scientific journal editorial offices among others. In addition to the formal presentations, students also have the opportunity to interact with speakers in smaller groups over lunch and in other informal settings. Each student is required to write a short paper at the end of the semester describing a career track, other than the one for which they are currently training, and their plan for becoming a competitive job applicant in that area.

702, 703. Internship. (1-9) Internships are available for a student who has completed one year of graduate study and desires experience working in the private sector or a nonprofit or government agency. Internships typically take place during the summer months and last for three months, although the timing and duration may be adjusted to satisfy each student's needs and the type of internship available. Credit hours are adjusted based on the length of the internship. The student receives a written evaluation from the host organization mentor and is required to submit a written report describing the work performed. May be repeated. Maximum hours not to exceed 54. Satisfactory/Unsatisfactory

704. Principles of Intellectual Property Development. (2) Designed for late-stage graduate students to supplement their scientific background with a greater understanding of intellectual property protection, commercialization, and start-up company formation. Numerous aspects of our knowledge-based economy will be covered including an overview of the diverse types of intellectual property protection available to protect inventions (with a focus on patents), the technology transfer process in an academic setting, a primer of company formation and organization, and an analysis of the different agreements (including confidential disclosure agreements, material transfer agreements, and license agreements) necessary to move a technology from the bench to the bedside. P—Scientific graduate students only.

705. Problem Based Learning (PBL). (1-3) Small group sessions with post-baccalaureate premedical program students to facilitate the development of clinical reasoning skills and basic and clinical science knowledge. Topics on ethics and professionalism and the doctor-patient relationship are discussed. A combination of case studies, reading assignments, course notes and group discussion will be used.

707. Professional Responsibilities and Conduct I. (1) Students learn to identify general and
discipline-specific professional norms and obligations for the responsible practice of science. Emphasizes development of professional decision-making skills. This course or equivalent is required for Reynolda campus Master's students who will be supported on federal grants. Pass/Fail

708. Professional Responsibilities and Conduct II. (2) Students learn to identify general and discipline-specific professional norms and obligations for the responsible practice of science. Emphasizes development of professional decision-making skills. Required of all Reynolda campus Doctoral students. Pass/Fail

709, 710. Scientific Outreach. (1) This course provides hands-on engagement with teaching and educational opportunities directed at the lay public or other, non-university groups. Planning outreach events and communicating scientific concepts to the lay public are essential skills for any scientist-in-training, especially those who may be involved in academic lecturing or public policy. The scope of such activities will derive from the scientific disciplines of the students involved, but will include activities involving the informal teaching of basic and translational science concepts in the biomedical sciences and other STEM-related disciplines. Examples of such engagement include K-12 school visits, involvement in public symposia related to science for lay audiences, or any similar activity performed under faculty guidance. May be repeated for credit not to exceed 6 hours each. Satisfactory/Unsatisfactory

711. Introduction to College Teaching. (1) Prepares graduate teaching assistants for teaching roles. Coursework includes a 1-2 day orientation introducing students to the role and responsibility of being a teaching assistant, departmental orientation to teaching in the discipline, a series of educational workshops conducted by the Teaching and Learning Center, and classroom observation. Satisfactory/Unsatisfactory

713, 714. Scientific Professionalism and Integrity. (1) The Problem-Based Learning Method (PBL) is used to teach students in small groups to identify discipline-specific and broad professional norms and obligations for the ethical practice of science. Content will include the norms and principles for the responsible conduct of scientific research such as data acquisition, management, sharing and ownership, publication practices, and responsible authorship. Emphasis will be placed on learning the tenets of responsible conduct of research, the current regulatory and legal climate, as well as the underlying norms and principles that shaped these concepts. Topics will include the student and advisor relationship, laboratory dynamics, collaborations in science, appropriate handling of data and appropriation of credit, plagiarism, conflicts of interest and financial responsibility. Students will acquire skills to recognize ethical issues in the practice of science, identify role obligations, and develop sound ethical reasoning to address these issues. The courses also include plenary session presentations by experts on topics of professional development, such as preparing manuscripts and grant applications and policies regarding conduct of animal and human subject research. Satisfactory/Unsatisfactory

715. Career Planning for Graduate Students. (1.5) This course is designed to provide graduate students with experience with all three of the components of the career planning process: 1) self-assessment of work-related values, interests and skills; 2) exploration and research of career options; and 3) development of job-search materials relevant to their field of study. The course is structured so that graduate students can complete most if not all of the projects/assignments during class meetings so as not to interfere with academic progress in current programs. This course will only be offered once a semester for half the semester.

720. Topics in College-Level Teaching. (1-3) Students participate in the preparation and delivery of one or more lectures, homework assignments, and examinations, and facilitate small group learning sessions. Students attend at least two professional development workshops on a variety of aspects of the educational process. P—Successful completion of the first year of coursework in a biomedical graduate training program and POI. Satisfactory/Unsatisfactory

722. Teaching Skills and Strategies Seminar. (2) Designed to provide students with formal training and development in teaching strategies and teaching scholarship. A variety of theories and pedagogies are reviewed and discussed. Students receive some practical experience in developing and delivering instructional materials and assessment tools. Meets weekly for two hours throughout the spring semester.

724. Biosafety in Research Laboratories. (3) This one-term course provides an overview of the types of biohazards that may be encountered while conducting scientific research, with emphasis on laboratories, and effective methods to minimize the risks associated with those hazards. P—At least one microbiology course and laboratory experience.

Biochemistry and Molecular Biology (BICM)
Bowman Gray Campus

Program Director
Thomas Hollis

Chair
Douglas S. Lyles

Professors
Rebecca Alexander, Donald W. Bowden, H. Alexander Claiborne, Larry W. Daniel, Thomas Hollis, Douglas S. Lyles, John Parks, Fred W. Perrino, Leslie Poole, Lawrence L. Rudel

Associate Professors
Cristina Furdui, Todd Lowther, Jed Macosko

Assistant Professors
Nichollete Allred, Peter Antinoozi, Derek Parsonage, Susan Sergeant

Overview
The graduate training program in Biochemistry and Molecular Biology of the Department of Biochemistry is designed to prepare students for careers of investigation and teaching in biochemistry, molecular biology, and in related sciences that involve biochemical, structural and molecular approaches and techniques. Although the programs of study are individually planned, all students are expected to possess competence in certain basic areas of biochemistry and related sciences. Programs leading to the PhD degree in biochemistry and molecular biology are offered.

Students enter the program through the Molecular and Cellular Biosciences Track and participate in the MCB common curriculum in the first year. Curriculum in subsequent years includes participation in Scientific Communication, Topics in Biochemical Literature and electives of the student's choice. The student also participates in the department's program of research seminars.

Dissertation research under the supervision of a faculty member may be pursued in various areas of biochemistry, including enzymology, NMR and X-ray structure determination of macromolecules, virus assembly, relation of lipid and protein metabolism and of protein-lipid association to membrane structure and function, biological oxidations and bioenergetics, molecular genetics and nucleic acid function, biophysics, biochemical pharmacology of anticancer agents, leukocyte metabolism and function, signal transduction mechanisms in normal and cancerous cells, and molecular mechanisms of blood coagulation. The department has specialized equipment and facilities to support training and investigation in these areas.

The biochemistry program participates in the Interdisciplinary Graduate Track in Structural and Computational Biophysics. For more information, refer to the pages in this bulletin regarding the program. The graduate program was begun in 1941, and the PhD degree has been offered since 1962.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.

MCB Track Electives

MCB 711. Biological Systems and Structures. (2) In depth study of macromolecular assembly and interactions, as well as the application of structural biology and proteomics technology. Contemporary concepts of the principles of protein and nucleic acid structure are discussed. Other topics include methods for structure determination such as X-ray diffraction, NMR spectrometry, and molecular modeling. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

MCB 712. Biological Spectroscopy. (2) Principles and practicalities of the study of biomolecules using spectoscopic techniques such as absorbance, fluorescence and circular dichroism analyses.
Other biophysical approaches such as mass spectrometry and sedimentation analysis will be included. Topics in the study of enzymes utilizing these techniques will be discussed. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

**MCB 713. Large Experimental Datasets and Analysis.** (2) Conducted as a combination of lectures, reading assignments, and student-led discussions. Lectures detail experimental methods that generate large-scale datasets. Topics include genotyping, expression profiling, metabolomics, high-content cellular imaging techniques and practical examples of bioinformatic software and statistical analyses. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

**MCB 714. Experimental Approaches to Cell Biology and Disease.** (2) Conducted as a combination of lectures, reading assignments, and student-led discussions. With an emphasis on cellular functions involved in disease, lectures detail common techniques used in cell biology experimentation. Practical examples and issues of functional genomic approaches are discussed, including design of appropriate cell biology models. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

**BICM Advanced Courses**

**700, 701. Scientific Communication.** (1, 1) Instruction and practice in oral and written scientific communication. Meets weekly.

**704. Preparatory Biochemistry.** (3) Conducted as a combination of lectures, case studies, reading assignments, course notes, and group conferences. The sequence of topics is: a. protein structure, b. enzyme mechanisms, c. bioenergetics, d. signal transduction, e. intermediary metabolism and f. interorganel metabolism. The principles of each topic are discussed in relation to clinical disease entities, e.g. protein structure: hemoglobin/sickle cell anemia/sickle cell hemoglobin/sickle cell disease due to abnormal hemoglobin structure. Typically offered in summer and fall terms. P—POI

**706. Intracellular Signaling.** (3) Advanced study of the biochemical mechanisms involved in intracellular signaling of normal and malignant cells, including growth factor and G protein-coupled receptors. Emphasizes methods for modern structure determination using X-ray crystallographic methods. Students are exposed to practical techniques in growth of protein crystals, collection and processing of X-ray diffraction data, phase determination, model building and refinement. Students are also expected to develop an in-depth understanding of the latest instrumentation and programs used in protein structure determination.

**717, 718. Principles and Practice of teaching Biochemistry.** (2) Structured participation of students as mentors in existing biochemistry classes. Under the supervision of biochemistry faculty, students create laboratory demonstrations, field questions, write and grade exam questions, conduct review sessions and participate in one-on-one instruction.

**719, 720. Research.** The department offers opportunities for investigation in a wide variety of biochemical subjects under the guidance of staff members. Satisfactory/Unsatisfactory

**734. Human Molecular Genetics.** (2) Combined lecture/seminar course providing an overview of current theoretical and technical approaches for locating, identifying, and cloning human genes using molecular genetic methods. Emphasis is on the search for genes that contribute to simple single-gene disorders and common complex diseases. Topics include genetic mapping in humans, construction of physical maps of chromosomes, identification of coding sequences and disease susceptibility genes, and functional analysis of gene products.

**740. Drug Discovery, Design, and Development—Molecules to Medicines.** (3) Conducted as a combination of lectures, reading assignments, and student-led discussions. Examines drug discovery and development pathways from target and lead compound identification through metabolic and toxicology studies, clinical trials, FDA approval, and marketing. Regulatory processes, intellectual property, and ethical issues are also considered. Taught by WFU faculty from both the Reynolds and Bowman Gray campuses and colleagues in the pharmaceutical and biotechnology industries, students work in teams to present case studies on the discovery, development, and marketing of recently approved pharmaceuticals. Also listed as CHM 740. P—Organic chemistry and biochemistry.

**745. Drug Discovery Virtuallaboratory.** (1) Interactive laboratory course complements Seminars in Drug Discovery, Design, and Development—Molecules to Medicines by providing students with hands-on experience with state-of-the-art software used by the pharmaceutical industry to discover new drugs and refine their target interactions in silico. Following an introduction to structure-based drug design principles, students will complete tutorials; guided by WFU faculty from both the Reynolda and Bowman Gray campuses, they will develop and present exercises that examine how structure-based drug design has contributed to recently approved pharmaceuticals. C—BICM 740

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**Bioethics (BIE)**

**Bowman Gray and Reynolda Campuses**

**Program Co-Directors**

Nancy King and Mark Hall

**Overview**

The Master of Arts (MA) in Bioethics provides an educational opportunity at the graduate level for current and future professionals and others throughout the country interested in bioethics, including health care providers, researchers in biomedicine and the life sciences, lawyers, and professionals in religion, health and research administration, and the biotechnology industry. The goal of the MA in Bioethics is to equip graduates to practice and teach about bioethics as integral to the work of medicine and biotechnology, health care, and the basic sciences, and to undertake exemplary bioethics-related research and scholarship. The program encompasses clinical ethics, research ethics, and health policy and administration.

The program has two characteristic emphases: bioethics in social context, and bioethics and biotechnology. First, a general emphasis on the social, cultural, and policy contexts that shape all bioethics questions and issues is visible throughout the curriculum. Although the importance of incorporating the humanities, the social sciences, and even the arts may seem obvious, this is not a component of most bioethics education elsewhere. Second, a focus on bioethics and biotechnology takes advantage of Wake Forest University’s strong and growing presence in this area. Research and clinical practice in nanomedicine, genomics, pharmacogenetics, molecular and cell therapies, and
the like is ongoing not only here at Wake Forest University but elsewhere in North Carolina.

The program has particular emphases without declaring particular specializations. This is in part because bioethics education is by its nature fundamentally generalist: Students receive broad exposure to ideas, discussion, scholarly literature, and experience, as well as a set of intellectual skills to be developed and practiced widely before being turned to special areas of interest. Visit www.wfu.edu/bioethics for more information.

The MA in Bioethics requires 30 credit hours of work: 24 hours of coursework with an average grade of B or above plus 6 hours of thesis research. At least 12 of the 24 hours of coursework must be in courses numbered 700 or above (graduate students only). The remaining 12 hours may be in either 600 or 700 level courses. All work must be completed within six years of the date of initial enrollment in the graduate program.

Students are required to follow the student handbook of the school(s) through which he/she is enrolled. To continue in a dual or joint degree program, a student must remain in good academic standing with the respective School (Wake Forest College, Divinity, Law or Medicine) and the Graduate School of Arts and Sciences.

**Degree Requirements:** please see “Requirements for Degrees” beginning on page 25.

**Courses of Instruction**

*619. Concepts of Health and Disease.* (2 or 3) Concepts of health and disease shape discussions in bioethics and health policy. This course examines and critically evaluates competing conceptions of health and disease. The implications of adopting different understandings of health and disease for bioethics and health policy will be explored. *P—POI*

*670. Communication Ethics and Bioethics: An Interface* (3) This course explores: 1) how the phenomena of the call of conscience, acknowledgment, and our metaphysical desire for perfection inform the ontological status of communication ethics; 2) how communication ethics is a necessary concern for bioethics scholars, policy makers, researchers, and others interested in assessing the ongoing debate over the benefits and burdens of biotechnology; and 3) how biotechnology affects our collective understanding of human dignity. Students will also be involved as role-players in a Wake Radio program where an actual case study in communication and bioethics is broadcast to the University community. Also listed as COM 670. *P—POI*

*701. Historical Foundation of Bioethics.* (2 or 3) Explores the origins of bioethics thought, through examination of core concepts in philosophy, moral theory, social and cultural studies, and law and policy. Topics may include: the ancient Greeks, Confucius, and key religious teaching on health; the civil rights movement; the history of scientific medicine; and the legal conceptualization of medical practice. This course expands and extends students' knowledge of the contemporary history of bioethics as incorporated in to various aspects of their required courses. *P—POI*

*702. Biomedical Research Ethics.* (3) A historical and conceptual survey of ethics and policy issues in biomedical research. Emphasis is on research involving human subjects; translational research, including oversight of novel biotechnologies; and the ethical implications of research design and funding decisions. Topics include the regulatory structure of research and proposals for reform; genomics and biopspecimen research; and the relationship between medical research and medical treatment. Students are required to successfully complete two of the following courses: BIE 702, 704, or 705. *P—POI*

*703. Bioethics Theory.* (3) An investigation of the main theoretical approaches to contemporary bioethics and their philosophical foundations. The course begins with the principles of beneficence, autonomy, and justice first propounded in the Belmont Report. Criticisms of and alternatives to what has come to be called the “principlist approach to bioethics” will be critically reviewed. *P—POI*

*704. Public Policy, Medicine, and Justice.* (3) An examination of the organization of medicine and biomedical science in the U.S. today. The relationships between scientific and medical institutions and the implementation of public policies are critically analyzed in light of the requirements of the principle of justice. Topics include conflicts of interest, broadly understood, within and between institutional and professional actors; the regulation of medical practice; access to health care; and the balance between the public good and market forces. Students are required to successfully complete two of the following courses: BIE 702, 704, or 705. *P—POI*

*705. Clinical Ethics.* (3) Focuses on “ethics at the bedside” and makes extensive use of case studies. Emphasis is on patient-provider relationships, broadly understood, and on problems of communication and the social, cultural, and institutional contexts in which they arise. Clinical decision making in a wide range of contexts is examined. Questions of organizational ethics are also considered. Students are required to successfully complete two of the following courses: BIE 702, 704, or 705. *P—POI*

*706/707. Bioethics Seminar.* (1-3) A seminar on bioethics topics of interest featuring Wake Forest University and invited external faculty, with additional student presentations. Participants engage with presenters and scholarly literature on a variety of aspects of bioethics, including, but not limited to, the scholarly and professional practice of bioethics, the role of empirical scholarship in bioethics and related disciplines, the relationship of bioethics to advocacy and policy, and bioethics communication and mediation. May be repeated for credit up to a maximum of 6 hours. *P—POI*

*708. Research Methods.* (2) An introduction to the methods, concepts, and tools used in quantitative and qualitative empirical research in bioethics. Students develop skills in design, conduct, interpretation, and evaluation of bioethics research. *P—POI*

*709. Ethics of Health Communication.* (3) Topics may include: communication with patients, including truth-telling, confidentiality, and techniques for effective communication; communication within and between institutions, including portable advance directives, access to patient records, and the prevention of medical errors; and communication with the public, including issues arising from the presentation of bioethical issues in news media, film, and television. *P—POI*

*710. Global Bioethics.* (2 or 3) A comparison of American bioethics with the views of other societies and cultures, including western and non-western perspectives. Topics may include: individualism vs. the community, reproductive freedom, organ transplantation, definitions and views of death, access to medical advances, and the use of human subjects in medical research. Other topics include health disparities, justice in research, and the role of humanitarian aid in promotion of global health. *P—POI*

*711. Current Topics in Clinical and Biomedical Research Ethics.* (2 or 3) An in-depth critical examination of selected topics of current interest in clinical and research ethics. Topics are identified by staff and students. Examples of pertinent topics include human pluripotent stem cell research; assisted-reproduction; research without consent; the sale of human organs; pandemic and biodefense preparedness; synthetic body parts and transhumanism; genetic enhancement; regenerative medicine and biogerontology. May be repeated for credit up to a maximum of 6 hours. *P—POI*

*713. Law, Medicine, and Ethics.* (2 or 3) Examination of the relationships between law and medicine, including the legal regulation of medical practice, concepts of medical malpractice, medical neglect, in-formed consent and legal competence, confidentiality and privacy, and definitions of death. The ethical implications of the intersection of law and medicine are critically analyzed. *P—POI*

*715. Bioethics and Religion.* (3) Explores fundamental themes, methods, and issues in religious bioethics. Seeks to determine the ways that religious approaches offer distinctive, complementary, or overlapping perspectives with secular approaches. Specific topics will include assisted reproductive technologies, family planning and abortion, genetic therapy and enhancement, withholding and withdrawing life-sustaining treatment, suicide and euthanasia, and justice issues in the allocation of health care resources. Combines lectures and discussions with case analysis. *P—POI*

*717. Ethics, Economics, and Health Policy.* (3) Examines ethical and justice aspects of social decision-making and market allocation mechanisms in the context of health care, health policy, and population health. *P—POI*

*721, 722. Research/Independent Study.* (1-3) Students may work with a faculty member on a project of mutual interest. May be repeated for credit up to a maximum of 6 hours. *P—POI*
723. Bioethics at the Movies. (2) A critical examination of the bioethical issues raised in selected full length feature films. The goal of this course is to increase students’ ability to think critically about complex issues, paying close attention to relevant details. P—POI

725. Health Care Law and Policy. (2 or 3) Introduces students to the structure, financing, and regulation of the health care system and proposals for its reform. Topics include Medicare, medical staff disputes, health care antitrust, HMOs and insurance regulation. Also listed as Law 525. P—POI

727. Performable Case Studies in Bioethics. (2 or 3) Students will develop a bioethics case study and present it as a dramatic reading with audience discussion at semester’s end. From an initial prompt (e.g. subject matter, situation, incident) and associated readings, the work will be implemented in three phases of approximately equal length: 1) discussion and analysis of the prompt and readings; 2) student presentations of additional research, either individually or in teams, and concomitant discussion and analysis from ethical, social, legal, and, policy perspectives; and 3) script (case) development during in-class writing sessions. The over-arching goal is to exploit the unique ability of dramatic art to engage complex, multifaceted issues in ways that are neither nebulous nor propagandistic, and to highlight the relationship between process, close analysis, art, and scholarship in bioethics. P—POI

729. Bioethics as a Profession. (2) A critical examination of the scholarly literature both in and about bioethics. Topics may include the ethics of the profession of bioethics, controversies concerning the role of bioethics professionals, and the standards and evaluation of practitioners of bioethics. P—POI

731. Bioethics at Work: The IRB. (1-3) Provides students with the opportunity to experience and understand human research oversight by attending Institutional Review Board (IRB) meetings reviewing submitted protocols, and considering the ethical issues arising therein. Students assigned to a single IRB for a single semester will receive credit. They will attend monthly meetings, meet periodically with course faculty and staff, and meet with IRB senior staff at the beginning and end of the semester. Students are also required to maintain a journal of commentary on meetings and protocols and the ethical issues arising therein and an end of semester paper. Initial enrollment must be concurrent with enrollment in BIE 702: Biomedical Research Ethics or LAW 677/BIE 777. Additional credits may be earned by students who attend the meetings of more than one IRB or who continue attendance during the summer terms and for in the fall semester. Course may be repeated up to a maximum of 3 hours. Co-Requisite BIE 702 or LAW 677/BIE 777 POI.

733. Bioethics at Work: The Clinical Context. (1-3) Provides students with the opportunity to experience and understand clinical ethics activities in the academic medical center setting, through attendance at Clinical Ethics Committee and Subcommittee meetings and other ethics-related events. Students attend meetings of the WFBMC Clinical Ethics Committee, the Consultation, Policy, and Organizational Ethics Subcommittees, and educational sessions organized by the Education Subcommittee. Monthly 2-hour meetings with faculty will explore the application of bioethics theory to cases, topics, and issues encountered in clinical settings. Students may also be able to attend ethics consultations by arrangement. Course may be repeated up to a maximum of 4 hours. P—BIE 705 and POI.

737: Bioethics & Genetics (3) An exploration of some of the ethical issues generated by the acquisition and application of knowledge about the human genome. Topics include eugenics, confidentiality, gene therapy, genetic testing of minors, genetic testing of adults, and ownership of genetic information. P—POI

739. Neuroethics. (3) This course introduces students to basic philosophical and ethical issues in neuroethics. In this course we explore two branches of neuroethics: the ethics of neuroscience and the neuroscience of ethics. The ethics of neuroscience investigates the ethical implications of the application of neurotechnology for individuals and society, and the neuroscience of ethics attempts to answer traditional ethical questions through neuroscience. In the first half of the course, we study issues related to the ethics of neuroscience such as brain privacy (mind reading), brain manipulation, and cognitive enhancement, and in the second half we review contemporary neuroscientific results bearing on ethical issues like personal identity, free will, and the nature of normative judgments.

741. Narrative and Bioethics. (3) This team-taught course provides bioethics students with an overview of the different ways in which narratives of diverse types are instrumental to bioethics thinking. Four to six faculty will teach individual course units of 2-3 sessions, addressing topics including but not limited to: illness narratives; bioethics in fiction and film; performable case studies addressing bioethics issues; the voice of the medical case presentation; narrative reading and narrative writing; bioethics in the news; and the ethics of “thick description.” Involvement of multiple faculty enables critical reflection on narrative from a variety of disciplinary perspectives common to bioethics. P—POI. Staff.

757. Biotechnology Law and Policy. (2 or 3) Surveys a range of legal and public policy topics in biotechnology, such as: FDA regulation of drugs and devices, regulation of medical research, product liability, insurance coverage of pharmaceuticals, intellectual property and genetics. This course is cross-listed as LAW 657. P—POI

777. Health Related Research: Law, Regulation and Policy. (2) The course explores the regulatory framework and the policy issues that animate health-related research. Topics include public health and quality improvement research, genetic research, health related behavioral and social science research, first-in-human trials, and international considerations. This course is cross-listed as LAW 677.

790. Biotechnology and Ethics. (3) With the convergence of medicine, nanotechnology, computer science, molecular biology, genetic engineering, and business, biotechnologies are emerging not only as an important provider of life-saving and life-enhancing treatments but also a fast-growing and very profitable industry. This course explores some of the major ethical issues related to the current and proposed uses of biotechnologies with particular attention to the reasons and arguments that are often used to support various views on the use of biotechnology. This course is cross-listed as THS 790. P—POI

791, 792. Thesis Research. (1-6) Research directed toward fulfilling the thesis requirement. May be repeated for credit up to a maximum of 6 hours. P—POI. Satisfactory/Unsatisfactory

794. Bioethics and Law. (2 or 3) Students act as a court or administrative agency and write opinions ad-dressing emerging legal and ethical issues created by society’s advancements in medicine and biotechnology, including genetic testing, biomedical experimentation, reproductive rights and end-of-life decisions. This course is cross-listed as LAW 594. P—POI

Biology (BIO)

Reynolds Campus

Program Director Miriam A. Ashley-Ross
Chair Susan E. Fahrbach
Reynolds Professor Susan E. Fahrbach
Charles M. Allen Professor of Biology Gerald W. Esch
Andrew Sabin Family Foundation Presidential Chair in Conservation Biology Miles R. Silman
William L. Poteat Professor of Biology Raymond E. Kuhn
Charles H. Babcock Chair of Botany William K. Smith
T. Michael Anderson, Erik C. Johnson, Brian W. Tague
Matthew J. Fuxjager, James B. Pease, Ke Zhang
A. Daniel Johnson, Pat C.W. Lord
Diana R. Arnett, Anna Kate Lack

Associate Professors
Assistant Professor
Teaching Professors
Assistant Teaching Professors
Overview
The Department of Biology offers programs of study leading to the MS and PhD degrees. For admission to graduate work, the department requires an undergraduate major in the biological sciences or the equivalent, plus at least four semesters of courses in the physical sciences. Any deficiencies in these areas must be removed prior to admission to candidacy for a graduate degree.

Research opportunities include behavioral ecology, biochemistry and molecular biology, biomechanics, cell biology, ecology, epigenetics, evolution, genomics, microbiology, neurobiology, physiology, population genetics, sensory biology, and systematics.

At the master’s level, the department emphasizes broad training rather than narrow specialization, and combines coursework with thesis research. At the doctoral level, few specific requirements are prescribed. Individual programs are designed for each student at both levels under the guidance of the student’s faculty adviser, advisory committee and departmental graduate committee. Enrollment in the graduate program is open only to students whose interests are reflected by the areas of expertise represented by the faculty. Prospective PhD students are encouraged to correspond with staff members whose areas of research interest are compatible with their own. Additional information is available from the Biology Program Director.

At least one year of teaching, e.g. as a teaching assistant, is required of all PhD students during their tenure.

To remain a graduate student in good standing, the student must maintain an overall B average in all courses attempted. Any time this condition is not met the student will lose all financial support and must reapply for acceptance into the program.

Study leading to the MS degree was inaugurated in 1961. The PhD degree program began in September 1970. A departmental graduate committee consisting of Biology department faculty and an appointed graduate student representative oversees all aspects of the graduate program from application review to acceptance to matriculation.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.

Courses of Instruction
601-605. Topics in Biology. (1-4) Seminar and/or lecture courses in selected topics, some involving laboratory instruction. May be repeated for credit.

607. Biophysics. (3) Introduction to the structure, dynamic behavior, and function of DNA and proteins, and a survey of membrane biophysics. The physical principles of structure determination by X-ray, NMR, and optical methods are emphasized.

611. Ecology & Conservation Biology of Coral Reefs. (3) In-depth study of the various biotic and abiotic components that come together to structure ecosystem function and biodiversity at all spatial scales in one of Earth’s most productive and diverse environments, yet one most threatened by human use and climate change.

612. Ecology & Conservation Biology of Coral Reefs. (4) In-depth study of the various biotic and abiotic components that come together to structure ecosystem function and biodiversity at all spatial scales in one of Earth’s most productive and diverse environments, yet one most threatened by human use and climate change. Lab component is a one-week field trip over spring break.

613. Herpetology. (3) Lecture course on the biology of reptiles and amphibians, emphasizing the unique morphological, physiological, and behavioral adaptations of both groups, and their evolutionary histories and relationships. Two local field trips are planned.

614. Evolution. (3) Analysis of the theories, evidences, and mechanisms of evolution.

615. Population Genetics. (4) Study of the amount and distribution of genetic variation in populations of organisms, and of how processes such as mutation, recombination, and selection affect genetic variation. Lectures present both an introduction to theoretical studies and discussion of molecular and phenotypic variation in natural populations.

617. Plant Physiology and Development. (3) Lecture course examining the growth, development, and physiological processes of plants. The control of these processes are examined on genetic, biochemical, and whole plant levels.

618. Plant Physiology and Development. (4) Lecture course examining the growth, development, and physiological processes of plants. The control of these processes are examined on genetic, biochemical, and whole plant levels. Labs consist of structured experiments and an independently designed research project.

620. Comparative Anatomy. (4) Study of the vertebrate body from an evolutionary, functional, and developmental perspective. Labs emphasize structure and function, primarily through the dissection of representative vertebrates.

621. Parasitology. (4) Survey of protozoan, helminth, and arthropod parasites from the standpoint of morphology, taxonomy, life histories, and host-parasite relationships.

622. Biomechanics. (4) Analysis of the relationship between organismal form and function using principles from physics and engineering. Solid and fluid mechanics are employed to study design in living systems, especially vertebrates.


624. Hormones and Behavior. (3) Introduction to the hormonal regulation of behavior in a broad range of animals, including humans and invertebrates. Topics include reproductive behavior, parental behavior, social behavior, sex differences, aggressive behavior, stress, mood, and the regulations of molting in insects.

625. Chronobiology. (3) Introduction to the field of biological rhythms, covering different types of rhythms, their evolution, and the mechanisms by which such rhythms are generated and regulated at the molecular, cellular, and system levels.

626. Microbiology. (4) The structure, function, and taxonomy of microorganisms with emphasis on bacteria. Topics include microbial ecology, industrial microbiology, and medical microbiology. Labs emphasize microbial diversity through characterizations of isolates from nature.

627. Epigenetics. (3) An introduction to the concepts of epigenetics. This course involves the study of molecular level of how chromatin structure affects DNA template processes including transcription, DNA replication and DNA repair. Topics will cover the mechanisms of chromatin modifications, the role of non-coding RNA in epigenetics, how epigenetic modifications affect phenotypic expression, the environmental impact on the epigenome, heritability of epigenetic modifications, and the role of epigenetics in health and diseases.


630. Land and Natural-Resource Management. (3) Provides a fundamental understanding of land and resource management. The major focus is on federal oversight and policies but state, local, non-profit, and international aspects are included.

631. Invertebrates. (4) Systematic study of invertebrates, with emphasis on functional morphology, behavior, ecology, and phylogeny.

633. Vertebrates. (4) Systematic study of vertebrates, with emphasis on evolution, physiology, behavior, and ecology. Laboratory devoted to systematic, field, and experimental studies.

635. Insect Biology. (4) Study of the diversity, structure, development, physiology, behavior, and ecology of insects.

635S. Insect Biology. (4) A five-week course taught during the summer. A study of the diversity, structure, development, physiology, behavior, and ecology of one of the most diverse taxa on earth. Course location and field trip destinations to be announced each summer. P—POI

636. Development. (3) A study of the molecular, cellular, and anatomical aspects of embryonic development or invertebrate and vertebrate organisms.

637. Development. (4) Lecture and laboratory study of the molecular, cellular, and anatomical
aspects of embryonic development of invertebrate and vertebrate organisms.

638. Plant Systematics. (4) Study of the diversity and evolution of flowering plants. Lectures emphasize the comparative study of selected plant families, their relationships, and the use of new information and techniques to enhance our understanding of plant evolution. Labs emphasize more practical aspects of plant systematics such as the use of identification keys, recognition of common local plants, molecular techniques, and basic phylogenetic analysis.

639. Principles of Biosystematics. (4) Exploration of the current theoretical and practical approaches to the study of macroevolution in plants and animals. Topics include theory and methods of constructing evolutionary trees, sources of data, and cladistic biogeography.


641. Marine Biology. (4) Introduction to the physical, chemical, and biological parameters affecting the distribution of marine organisms.

642. Aquatic Ecology. (4) Designed to cover the general principles and concepts of limnology and aquatic biology as they apply to lentic and lotic habitats. A major portion of the field studies centered at the Charles M. Allen Biological Station.


644S. Tropical Marine Ecology. (4) Intensive field-oriented course focusing on tropical marine ecosystems and their biological communities. Emphasis is on biodiversity, the ecology of dominant taxa, the interaction between physical and biological processes, and the structure and function of representative communities. Includes 2.5 weeks at the Hobart and William Smith Colleges, New Zealand. Offered during summer school only. (First term/Summer term)

646. Neurobiology. (4) Introduction to the structure and function of the nervous system with emphasis on neurophysiology. The labs emphasize traditional electrophysiological techniques with experiments from the cellular to the behavioral level.

647. Physiological Plant Ecology. (3) Designed to provide a fundamental understanding of how plants have adapted to the stresses of their habitats, particularly in harsh or extreme environments such as deserts, the alpine, the arctic tundra, and tropical rain forests.

648. Physiological Plant Ecology. (4) Designed to provide a fundamental understanding of how plants have adapted to the stresses of their habitats, particularly in harsh or extreme environments such as deserts, the alpine, the arctic tundra, and tropical rain forests. The labs introduce students to a broad array of field instrumentation.

649S. Tropical Biodiversity. (4) Intensive field course in tropical biodiversity. Students travel to major tropical biomes, including deserts, the alpine, the arctic tundra, and tropical rain forests. Labs introduce students to the diversity of tropical plants and their adaptations to their habitats, particularly in harsh or extreme environments. Special attention is given to the ecological interactions within these communities. Emphasis is on biodiversity, the ecology of dominant taxa, the interaction between physical and biological processes, and the structure and function of representative communities. Includes 2.5 weeks at the Hobart and William Smith Colleges, New Zealand. Offered during summer school only. (First term/Summer term)

650. Conservation Biology. (3) Lectures, readings, and discussions examining biological resources, their limitations and methods for sustainability. Genetic, aquatic, terrestrial, and ecosystem resources are examined.

650L. Conservation Biology Lab. (1) Taught using the case study approach with an in-depth field study of the ecology and conservation of a particular ecosystem. Includes an extended field trip.

651. Vertebrate Physiology. (4) Lecture and laboratory course that examines the functional systems that sustain life in vertebrate animals.

652. Developmental Neuroscience. (4) Focuses on the development of neural structures and the plasticity of the mature nervous system. Special attention is given to experimental model systems, particularly Drosophila melanogaster. The labs feature molecular, immunocytochemical, and cell culture techniques for the study of neurons.

653. Functional Neuroanatomy. (3) An Introduction to the gross and cellular anatomical organization of the vertebrate central nervous system. Attention is given to relating structure to function, the anatomical basis of neuropathologies, and modern approaches on neuroanatomy and imaging.

654. Endocrinology. (3) Lecture course that explores the evolution of hormones and endocrine glands, and the physiology of the main hormonal pathways of vertebrates.

655. Avian Biology. (4) A lecture and lab course emphasizing ecological and evolutionary influences on the physiology, behavior, and population biology of birds. Includes taxonomy of the world’s major bird groups.

656. Ecology and Resource Management of Southeast Australia. (4) Intensive field-oriented course focusing on ecosystems, natural resource management and environmental conservation of southeastern Australia. Students travel to major biomes including sub-tropical rainforests, coral reefs and the Australian urban environment. Labs are field-based with some consisting of study-designed field projects. Taught only in summers in Australia.

657. Bioinspiration and Biomimetics. (3) Explores the way in which biological mechanisms can inspire new technologies, products, and businesses. The course combines basic biological and entrepreneurial principles. Also listed as ESE 657.

659. Genomics. (3) Introduction to the acquisition, analysis, and utility of DNA sequence information. Topics covered include structural, comparative, and functional genomics, genetic mapping, bioinformatics, and proteomics.

660. Development. (4) A description of the major events and processes of animal development, with an analysis of the causal factors underlying them. Special attention is given to the embryonic development of vertebrates, but consideration is also given to other types of development and other organisms. Topics include fertilization, early development, growth and cell division, cell differentiation, the role of genes in development, cell interaction, morphogenesis, regeneration, birth defects, and cancer.

661. Microbial Pathogenesis. (3) Explores the molecular mechanisms by which microorganisms attack hosts, how hosts defend against pathogens, and how these interactions cause disease.

662. Immunology. (3) Study of the components and protective mechanisms of the immune system.

663. Sensory Biology. (3) Lecture course that examines a variety of sensory systems. Emphasis is on sensory physiology, although other aspects of sensory systems, e.g. molecular biology and anatomy, are also covered.

664. Sensory Biology. (4) Lecture and lab course that examines a variety of sensory systems. The emphasis is on sensory physiology, although other aspects of sensory systems, e.g. molecular biology and anatomy, are also covered. In the laboratory, students learn several different procedures which they use to conduct assigned experiments. A final project is required in which students design and carry out their own experiments.

665. Biology of the Cell. (4) Lecture and lab course on recent advances in cell biology. Lectures emphasize analysis and interpretation of experimental data in the primary literature, focusing on topics such as the large scale architecture of the cell, targeting of macromolecules, cell-cell communication, cell signaling, and the control of cell division. The labs introduce basic techniques in cell biology and lead to an independent project.

667. Virology. (3) Designed to introduce students to viruses, viral/host interactions, pathogenicity, methods of control and their use in molecular biology, including gene therapy.

668. The Cell Biological Basis of Disease. (3) Examines some of the defects in basic cellular mechanisms that are responsible for many diseases.

669. The Cell Biological Basis of Disease. (4) Examines some of the defects in basic cellular mechanisms that are responsible for many diseases. The labs use advanced microscopic and histological techniques to investigate basic properties of cells.

670. Biochemistry: Macromolecules and Metabolism. (3) Lecture course introducing the
principles of biochemistry, with an emphasis on the experimental approaches that elucidated these principles. Major topics include structure, function, and biosynthesis of biological molecules, analysis of enzyme function and activity, bioenergetics, and regulation of metabolic pathways.

671. Biochemistry Macromolecules and Metabolism. (4) Lecture and lab course introducing the principles of biochemistry, with an emphasis on the experimental approaches that elucidated these principles. Major topics include structure, function, and biosynthesis of biological molecules, analysis of enzyme function and activity, bio-energetics, and regulation of metabolic pathways. The labs emphasize approaches for isolation of proteins and enzymes.

672. Molecular Biology. (4) Analysis of the molecular mechanisms by which stored information directs cellular development. Emphasis is on storage and transmission of genetic information, regulation of gene expression, and the role of these processes in development. The labs focus on modern techniques of recombinant DNA analysis.

673. Cancer Biology. (3) Analysis of molecular and cellular mechanisms that transform normal cells, trigger abnormal proliferation, and lead to tumor formation. Emphasis is on the biological basis of cancer, with some exploration of clinical and social consequences.

674. Neuropharmacology. (3) An introduction to how pharmacological agents affect cellular and molecular functions in the nervous system of normal and disease states. Lecture and case studies will be used to examine topics including drugs targeting mood and emotion, memory and dementia, and movement disorders. Drugs of abuse and the neurological basis of addiction will also be evaluated.

675. Great Neglected Diseases of Mankind. (3) This course will examine various diseases and, particularly, those found in developing countries. Students will research these diseases, prepare a Power Point presentation on them, and write a comprehensive paper of each disease that will include clinical aspects of the diseases, treatments (if any), social and political aspects of the diseases, and evaluate why these diseases remain threats to mankind.

676. Methods in Molecular Genetics. (4) A hybrid lecture/lab course that gives students a hands-on introduction to a diverse array of techniques commonly used in molecular genetics laboratories.

OR


677. Community Ecology. (4) An advanced ecology course covering mechanisms that determine the dynamics and distribution of plant and animal assemblages: life-history, competition, predation, geology, climate, soils, and history. Lectures focus on ecological principles and theory. Labs include local field trips and discussion of primary literature. Several weekend field trips.

678. Biogeography. (3) Study of geographical, historical, and ecological influences on the distribution, movements, and diversity of organisms. The seminar relies on extensive reading, film, and map work as a basis for class discussions.

679. Introduction to Geographic Information systems (GIS). (4) Lecture and laboratory course that introduces the concepts and uses of GIS as a mapping and analytical tool. Lectures cover the history of GIS, GIS data structures and sources of data, data projections, GIS tools, applications, and resources. Exercises include examples of GIS applications in environmental modeling, sociodemographic change and site suitability analyses.

680. Biostatistics. (3) Introduction to statistical methods used by biologists, including descriptive statistics, hypothesis testing, analysis of variance, and regression and correlation.

681. Biostatistics Laboratory. (1) Application of computer-based statistical software. Optional laboratory available only to students who have taken or are currently enrolled in BIO 680.

691, 692, 693, 694. Research in Biology. (1, 1, 1, 1) Independent library and laboratory investigation carried out under the supervision of a member of the staff. May be repeated for credit. 

P—POI

701—708. Topics in Biology. (1—4) Seminar courses in selected topics, some involving laboratory instruction. At least one offered each semester. May be repeated for credit.

711, 712. Directed Study in Biology. (1, 1) Reading and/or laboratory problems carried out under and by permission of a faculty member. May be repeated for credit if topic varies.

715. Foundations of Physiology. (1—4) Covers classical and current topics and techniques in comparative physiology. Format varies from seminar to a full laboratory course.

716. Signal Transduction. (2) Focuses on the mechanisms of inter- and intracellular communication. Topics range from receptors to signaling molecules to physiological responses. Largely based on the primary literature and requires student presentation of primary research articles. C. Browne, Muday, Tague

717. Developmental Mechanisms. (2) Seminar course examining the molecular, biochemical, and cellular mechanisms of animal and/or plant development. Relevant topics selected from the current literature are discussed in lecture and presentation formats.

718. Gene Expression. (2) Seminar covers gene expression in eukaryotic and prokaryotic systems. Topics range from transcription to translation to other aspects of gene regulation. Emphasis is on the experimental basis for understanding the mechanisms of gene expression. Students present, in seminar format, appropriate papers from literature. All students participate in discussion and evaluation of presentations.

725. Plant Genetics. (1,2) Covers various aspects of plant genetics in a seminar format. Topics range from classical Mendelian genetics to genomics and bioinformatics, depending on the interests of the students. Students present the results, conclusions, and significance of appropriate papers from the literature. All students participate in discussion and evaluation of presentations.

726. Plant Physiology. (1, 2) Covers various aspects of plant physiology and hormones in a seminar format. Topics range from auxin transport to properties of light within the leaf. Students present the results, conclusions, and significance of appropriate papers from the literature. All students participate in discussion and evaluation of presentations.

727. Plant Evolution. (1,2) Covers various aspects of plant evolution in a seminar format. Topics range from problems in phylogeny reconstruction and patterns of diversity to major evolutionary innovations in various plant groups. Students present the results, conclusions, and significance of appropriate papers from the literature. All students participate in discussion and evaluation of presentations.

728. Plant Ecology. (1,2) Covers various aspects of plant ecology in a seminar format. Topics vary depending on graduate student interest. Students present the results, conclusions, and significance of appropriate papers from the literature. All students participate in discussion and evaluation of presentations.

730. Invertebrate Zoology. (4) Emphasis on the physiology and ecology of invertebrate animals.

736. Bioacoustics. (4) Analysis of the mechanisms of sound production, transmission, and reception and their relevance to animal orientation and communication.

740. Physiological Ecology. (4) Introduction to evolutionary/ecological physiology, with emphasis on the interactions between organisms and major abiotic factors of the environment including, water balance—hydration, gaseous exchange—respiration, temperature tolerance—thermal physiology.

757. Techniques in Mathematical Biology. (3) Offers students a framework for understanding the use of mathematics in both biological theory and empirical research. Emphasis is on practical applications of mathematical techniques, and learning by doing. A central goal is to give students tools to use in their own research. Topics covered include continuous and discrete population models, matrix models, stochastic models, life-history theory, and fitting models for data. Mathematical skills are taught and refreshed, but knowledge of basic calculus is required.

762. Immunology. (4) Humoral and cellular immune responses are examined to understand
the basic immunobiology of vertebrates with special emphasis on cell-cell interactions and immunoregulation. Labs introduce students to basic methods in immunological research.

763. Cellular and Molecular Interactions Between Hosts and Parasites. (3) Examines the responses of animal hosts in attempting to immunologically and non-immunologically reject/control both endo- and ecto-parasites and responses of these parasites to the host environment. Consists of lectures and student presentations and requires a comprehensive review article by students.

764. Sensory Biology. (4) Lecture and lab course involving a study of energy in the environment and how it is absorbed and transduced in sensory systems. Anatomical, physiological, biochemical, and biophysical approaches are integrated in the study of sensory mechanisms in plants and animals. A lab project implementing the scientific method and designed to produce new knowledge is required.

765. Foundations of Ecology. (3) A graduate seminar focusing on understanding the seminal developments in the field of ecology and then tracing their intellectual impacts on the modern literature.

775. Microscopy for the Biological Sciences. (4) Introduction to the various types of light, confocal, and electron microscopy. Students learn technical and theoretical aspects of microscopy, methods of sample preparation, digital image acquisition and analysis, and the preparation of publication quality images. Emphasizes practical applications of microscopy, microscopy experimental design, and hands-on use of microscopes and digital imaging systems. Students are expected to design and conduct a microscopy project and present their results to the class. Additionally, students are expected to participate in class discussions regarding newly emerging microscopy techniques in various biological disciplines.

777. Biophysical Ecology. (4) Designed to introduce students to the interactions of the organism with the physical environment. Sunlight, temperature, water availability and humidity, wind, and longwave radiation (greenhouse effect) strongly influence an organism's growth and reproductive potential. Differences in heat and mass transfer to and from the organism, plus corresponding organism responses in structure, physiology, and behavior to changes in the local environment, are addressed. These same principles are also important to the design of energy-efficient homes (passive solar), clothing design (Gortex), outdoor survival and gardening, to name only a few of humankind's everyday activities.

778. Advanced Ecology. (4) Covers current research in the field of ecology with a focus at the community level. Experimental design, data analysis, and interpretation are emphasized.

779. Molecular Techniques in Evolution and Systematics. (4) Lecture and lab course that explores molecular methods that are basic to many disciplines within biology, especially ecology, evolution, and systematics. Labs focus on the acquisition of molecular techniques, including allozyme electrophoresis, mitochondrial plastid, and nuclear DNA restriction fragment length polymorphism analyses, gene amplification, PCR (polymerase chain reaction), direct and/or cycle sequencing, and RAPD's (randomly amplified polymorphic DNAs).

780. Advanced Systematics. (3) Literature-based course that covers various subdisciplines within systematics including cladistic biogeography, history and theory of systematics, analytical techniques and database management of systematic data.

782. Behavioral Ecology. (3) Lecture course analyzing behavioral solutions to challenges faced by animals in nature, emphasizing the role of natural selection in shaping behavior. Topics include mating systems, optimal foraging, sociobiology, parental care, and evolution of sexual reproduction.

783. Teaching Skills and Instructional Development. (3) Introduction to teaching college-level science courses. Emphasis is on: defining and achieving realistic course goals; mechanics of selecting, developing and refining topics for lecture or laboratory; effective presentation strategies; and creating an active learning environment. Students develop a teaching portfolio containing course syllabi, lecture outlines, and student-ready laboratory materials. Format combines didactic lectures, individual projects, and group discussions and critiques. Course meets for two, 2-hour periods each week.

791, 792. Thesis Research. (1-9) May be repeated for credit. Satisfactory/Unsatisfactory

891, 892. Dissertation Research. (1-9) May be repeated for credit. Satisfactory/Unsatisfactory

Biomedical Engineering (BMES)
Bowman Gray Campus

Chair  Joel D. Stitzel
Professor Satoru Hayasaka, Boris Pasche, Christopher Porada, Alexander Powers, Christopher Whitlow
Assistant Professors Philip Brown, Scott Gayzik, Jillian Urban Hobson, Robert A. Kraft, Adam R. Hall, Eleahs Rahbar, Ashley Weaver, Zhongwei Zhang, Dawen Zhao
Associate Professors Anthony Atala, Graca Almeida-Portada, Kristin Beavers, Khalil Bitar, J. Daniel Bourland, David Carroll, Kerry Danelson, Dwayne Godwin, Satoru Hayasaka, Youngkoo Jung, Paul Laurienti, Nicole Levi-Polyachenko, Sang Jin Lee, King Li, Michael Morykwas, Michael Munley, Emmanuel Opara, Boris Pasche, Christopher Porada, Alexander Powers, Thomas Smith, Shy Soker, Thad Wadas, William Wagner, Christopher Whitlow, James Yoo, Wei Zhang

Overview
The Department of Biomedical Engineering offers PhD and MS degrees in biomedical engineering in conjunction with the joint degree program in the Virginia Tech–Wake Forest University School of Biomedical Engineering and Sciences (SBES). The program emphasizes medical applications, particularly in image and signal processing and analysis, regenerative medicine/tissue engineering, biomechanics, and medical physics. Qualified applicants should have undergraduate degrees in technical fields, including engineering, computer science, mathematics and physics. Additional training in life sciences is desirable but not essential.

The program consists of traditional classroom instruction, independent research with a mentoring team, and clinical experience. Courses come from engineering and life science core courses and selected electives in engineering, life sciences, and related physical sciences, offerings include courses in the physics, mathematics, and computer science departments. The program is very flexible, and selection of elective courses can be individualized to complement the student's background and interests.

A clinical rotation is offered to PhD students following their first year of study. Students are exposed to technical equipment with medical applications; and to patient care and procedures used in medical centers, thus providing relevance and context for their classroom studies and research.

Office and laboratory space are located throughout the Medical Center and include the Image Analysis Lab, the Movement Biomechanics Lab, the Tissue Mechanics Lab, the Center for Injury Biomechanics, the Wake Forest Institute for Regenerative Medicine, Radiation Oncology, Plastic and Reconstructive Surgery, and others. Facilities also include a chemistry lab and a machine shop with associated instrumentation and tools. Academic space is provided in the Magnetic Resonance Imaging Building. Computer and network facilities are state of the art, and several projects utilize the cluster computer facility, the DEAC Cluster. Associated labs in clinical and basic science departments also provide equipment for student research.

More information is available on the website, www.sbes.vt.edu. Prospective students are encouraged to contact individual faculty members or schedule a visit to the department.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

For the MS degree, students must take a minimum of 21-24 course credit hours and 6-9 hours in
Courses of Instruction

600. Mammalian Physiology. (4) Topics include cell biology, neurologically and muscle physiology, autonomic nervous system, cardiovascular system, cardiac function and hormonal regulation, pulmonary system, renal system, endocrinology, gastrointestinal system, glucose and lipid storage.

602. Biomedical Engineering and Human Disease. (3) Comprehensive overview of a variety of human diseases, including neurological disorders, cardiovascular disease, infectious disease, and cancer, designed primarily for graduate students majoring in engineering and other related areas who have a long-term academic and professional goal in the field of biomedical engineering and life sciences. Introduction to state-of-the-art biomedical engineering approaches used for the study of early detection/diagnosis, treatment, and prevention of human disease. P—BMES 600

605. Quantitative Cell Physiology. (3) This course in mathematical modeling and simulation will include the following: quantitative descriptions of cell physiology and control pathways; numerical simulations of cellular physiologic processes such as, reaction kinetics, inhibition and cooperatively, passive transport, facilitated and carrier-mediated reaction kinetics; cell membrane resting potential in nerve and muscle tissue. Additionally, the course will cover modeling of neuronal processes such as voltage-gated channels, neurotransmitter release and uptake kinetics, and postsynaptic membrane potentials.


610. Engineering Analysis of Physiologic Systems I. (3) Engineering analysis of human physiology. Physiologic systems are treated as engineering systems with emphasis on input-output considerations, system interrelationships and engineering analogs. Also studied are mass and electrolyte transfer, nerves, muscles and renal system. P—POI

611. Engineering Analysis of Physiologic Systems II. (3) Engineering analysis of human physiology. Physiologic systems are treated as engineering systems with emphasis on input-output considerations, system interrelationships and engineering analogs. Also studied are cardiovascular mechanics, respiratory system, digestive systems, and senses. P—POI


613. Biomechanics and Simulation of Movement I. (3) Key topics in movement biomechanics, including muscle physiology and mechanics, neural control, kinematic and dynamic modeling, and dynamic simulation. Discussion of real-life applications in medicine and sports, and practical experience using engineering equipment (motion capture and EMG) and software used in research and industry to analyze human movement.

614. Biomechanics and Simulation of Movement II. (3) Advanced topics in movement biomechanics and computational analyses of human movement, including advanced muscle modeling, motor control theories, dynamic simulation and optimization, and neural interfaces. Discussion of fundamental research underpinnings and clinical applications. Practical simulation labs and project-based explorations of dynamic analyses. P—Graduate Standing (3H, 3C).

616. Advanced Impact Biomechanics. (3) Review of impact biomechanics and critical investigation of the impact response of the human body. Participants study the dynamic response of the head, neck, chest, abdomen, upper and lower extremities. Real-world examples from automobile safety, military applications, and sport biomechanics. P—POI.

617. Biomechanics of Crash Injury Prevention. (3) Presents an introduction to the design and analysis of crash injury prevention methods in vehicle crashes. Encompasses three major focus areas: crash energy absorption in (1) the vehicle structure, (2) the occupant, and (3) the occupant restraints.

618. Injury Physiology. (3) Presents an introduction to the physiology of injury. Focuses on the pathophysiologic mechanisms, and outcomes of injury in mammalian tissues. Explores injury physiology at the organ, tissue, and cellular level. Topics include physiology of injury to tissues of the peripheral and central nervous systems, the musculoskeletal system, the pulmonary system, the abdomen, the pregnant female, and the eye.

620. Work Physiology. (3) Anthropometry, skeletal systems, biomechanics, sensorimotor control, muscles, respiration, circulation, metabolism, climate. Ergonomic design of task, equipment, and environment. P—POI

621. Human Physical Capabilities. (3) Examination of human physical attributes in human-technology systems, with emphasis on models of anthropometry and biomechanics, on intero- and exteroceptors, and on the work environment; force fields (transitory and sustained), sound, light, and climate. P—POI

624. Biofluids. (3) Fluid dynamics of physiological systems with focus on cardiovascular and respiratory systems. Addresses the heart, arterial blood vessels, airways; cardiac and pulmonary circulation; anatomy and function of the heart and respiratory systems; mechanics of soft tissues; basic fluid mechanics; continuum mechanics and constitutive modeling; rheology of blood, Newtonian and non-Newtonian; viscous flow in vessels, Navier-Stokes; mathematical analysis of pulsatile flow; pulse-wave propagation through vessels; particulate flows and particle transport on airways. P—POI

630. Biological Transport Phenomena. (3) The fundamental principles of mass transport phenomena are introduced and applied to the characterization of transport behavior in biological systems (e.g. cell, tissues, organs, people). Topics include active, passive, and convective molecular transport mechanism. These fundamentals will be used to develop analytical and predicitive models and describe phenomena such as oxygen transport, kidney function, systemic drug delivery, and design of extracorporeal devices. P—Undergraduate courses in fluid mechanics and transport phenomena.

631. Introduction to Regenerative Medicine I. (3) The course explores the current state of the field of regenerative medicine with specific emphasis on the technological challenges that limit the progress of clinical transition of engineered tissues and therapies. Content will be presented from both the life science (e.g., cell biology, organ physiology, biochemical methods) and engineering perspective (e.g. transport phenomena, materials engineering) to compare and evaluate alternative approaches and strategies that are being developed and tested. Emphasis is placed on the promising roles of stem cells, biologically-inspired materials, and gene therapies. P—Graduate standing or consent of instructor. Undergraduate biology and calculus are suggested.

641. Biomaterials. (3) Lectures and problems dealing with materials used to mimic/replace body functions. Topics include basic material types and possible functions, tissue response mechanisms, and considerations for long-term usage. Issues of multicomponent materials design in prosthetic devices for hard and soft tissues are discussed.

642. Fundamentals of Tissue Structure, Function, and Replacement. (2) Descriptions of the structures of tissues such as skin, bone, ligament, cartilage, and blood vessels. Relationships between the structures of these tissues and their functions. Descriptions of the components of these tissues and their mechanical properties. Introduction to tissue mechanics and mathematical modeling of tissue behavior. Introduction to mechanical testing methods of hard and soft tissues. Methods for tissue replacement.

643. Polymeric Biomaterials. (3) The major objective of this course is to introduce principles and concepts critical to the successful design of polymer-based biomaterials, drug-delivery devices, and
bio-implants. The course will be broken down into the following four areas, polymer design and processing, inflammatory responses to polymers, interaction of blood with polymeric materials, and the effect of mechanical, chemical, and surface properties of polymers on cells.

651. Digital Signal Processing. (3) The fundamentals of digital signal processing of data experimentally obtained from mechanical systems is covered. Attention is given to data acquisition, A/D conversion, aliasing, anti-aliasing filtering, sampling rates, valid frequency ranges, windowing functions, leakage, and various transform methods. Special attention is given to random, transient, and harmonic function data processing. Various methods of estimation of frequency response function (FRF) are explored. The estimation methods are assessed as to their impact on FRF estimation errors.

652. Stochastic Signals and Systems. (3) Engineering applications of probability theory, random variables and random processes. Time and frequency response of linear systems to random inputs using both classical transform and modern state space techniques.

655. Biomedical Signal and Image Processing. (3) The mathematical theory underlying the processing of one and two dimensional signals, including Fourier transforms, sampling, quantization, correlation, and filtering. For images, the topics of segmentation, restoration, enhancement, color, and registration will be explored. Matlab projects will be utilized extensively, with an emphasis on biomedical signals and images.

671. Biomedical Microdevices. (3) Builds the foundation necessary for engineering research in micro- and nano- biotechnology. Covers micro- and nano-fabrication techniques; the fundamentals of microfluidics; micro- and nano-particle manipulation; and engineering aspects of cells and their membranes. Provides students with the knowledge required to create biomedical micro- and nano-devices with a focus on the unique physics, biology and design aspects at these scales. Students are expected to know undergraduate engineering, physics, and calculus.

693. Mathematica-A Hands on Course for Science and Engineering Students. (1) Mathematica is a high-level computer language and programming environment that allows one to perform a variety of tasks essential for a successful career in science and engineering. This course will provide students with a fundamental understanding of Mathematica and how to leverage its capabilities to accomplish a variety of tasks in their courses and research. For example, students will learn how to create figures in Mathematica suitable for publication, perform data analysis with Mathematica’s built-in statistical functions, and create interactive documents and animations that can be shared with anyone. For more information on the capabilities of Mathematica students are encouraged to visit http://www.wolfram.com/mathematica/.

694. Seminar. (1) The focus of this course is on presentation of scientific work. Attendance at all SBES-sponsored, invited lectures is required. A minimum of 5 invited talks (i.e. no VT or WFU speaker affiliation) are to be attended by each student every semester, although these may not all be SBES-sponsored. Prior permission from the Course Director is required for all non-SBES talks to be applied to the 5 lecture requirement. First year graduate students are required to attend additional lectures aimed toward presentation skills, grant writing, and other special topics. Development of a grant application by all first year graduate students is also required.

697. Independent Study. (3) Opportunity to pursue a topic covered in a regular course in greater depth. Usually involves extensive reading and tutorial sessions with a faculty supervisor. Written papers may be required.

698. Special Study. (3) Designed for a group of students. It may be used to study a timely topic—one in which there is current, but not necessarily lasting interest. It also may be used to launch an experimental course before the course is incorporated into the regular curriculum.

706. Clinical Rotation. (2) Offers both a broad view of the use of engineering principles in medicine and general clinical care, together with an in-depth study of a particular aspect of medicine under the direct supervision of a physician. The student sees the operation and maintenance of various clinical modalities, systems, and devices under the guidance of a working engineer or technician. Students participate in clinical rounds and in image reading sessions to gain insight into the actual operation and needs of departments using medical imaging modalities.
Biomedical Informatics (BMI)
Bowman Gray Campus

Program Directors William Turkett and Sean Simpson

Overview
The Master of Science in Biomedical Informatics degree is a full-time, graduate degree option that is designed to train and mentor students to become well qualified scientists and researchers within the domain of informatics as applied to biomedical data. Students learn, in an interdisciplinary environment, the quantitative and analytical methods necessary for understanding, evaluating, implementing, and using biomedical data and information. These methods can be applied to a variety of biomedical fields including imaging, genomics, clinical informatics, and public health informatics. Graduates from the program will be well positioned to work in the biotechnology, device, and pharmaceutical industries, private and government research labs, and academia.

Four areas of specialization, implemented via formal concentrations, are expected:
- Bioinformatics
- Clinical informatics
- Imaging informatics
- Public health informatics

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

All students take a minimum of 34 semester hour credits in the analytical sciences. All students will be required to take 16 hours of core courses – 6 hours in biomedical informatics, 6 hours in statistics, and 4 hours of coursework in scientific professionalism and the responsible conduct of research.

- BMI 701, 702 – Biomedical Informatics I and II
- MTH 657, 658 – Probability, Mathematical Statistics

In addition to the core courses, an additional 12 hours of elective credit are required by all students. Students completing the project or thesis option will enroll in at least 6 hours of research credit, accumulating a minimum of 34 total credit hours. Students completing the coursework option will enroll in an additional 8 hours of elective coursework, accumulating a minimum of 36 total credit hours.

At least half of all coursework must be at the 700-level. Electives are offered in a variety of disciplines, including biomedical engineering, clinical and population translational science, computer science, mathematics and statistics, and molecular and cellular biosciences.

For Wake Forest undergraduate students pursuing the 4+1 variant, students begin the research or project aspects of the program during their senior undergraduate year and/or make use of excess hours beyond the 120 required for graduation with a Bachelor's degree to pursue courses applicable to the MS degree. The courses that students are suggested to take, if excess credit hours are available, are:

- Mathematics 657 or Mathematics 658: These courses fulfill the core conceptual material in the area of statistics and are taught on the Wake Forest University Reynolda campus.
- CSC 621, CSC 646, or any BMI approved Computer Science or Mathematics and Statistics courses. These courses work towards the elective and/concentration requirements for the degree and are taught on the Wake Forest University Reynolda campus.

Courses of Instruction
701. Introduction to Biomedical Informatics. (3) Provides an introduction to the broad areas of biomedical informatics, including specific coverage of topics in bioinformatics, imaging informatics, clinical informatics, and public health informatics. Students will be exposed to exemplar data-sets and contemporary research within the broad field.

702. Data Representation and Analysis. (3) Provides a conceptual introduction to and experiences with fundamental approaches for storing and manipulating data at scale, as well as fundamental algorithms for mining information and insights from forms of large datasets encountered in biomedical settings.

703. Machine Learning. (3) Provides an overview of the important concepts and methods in machine learning, including linear and logistic regression, classification, decision trees, boosting, support vector machines, hidden Markov models, and Bayesian networks. Coursework will emphasize the practical implementation of these methods.

Biomedical Science
Bowman Gray Campus

Faculty Members
The faculty of the program are graduate faculty members from the Bowman Gray Campus. Students who enter directly into the MS in Biomedical Science outside of the track structure will be managed within the Graduate School under the direction of the Dean or program director appointed by the Dean.

Overview
The graduate program in Biomedical Science offers a program of study leading to the MS degree. This program is a full-time, graduate degree option that is designed to help students with a bachelor's degree, preferably with a major in the biomedical science, improve their academic foundation in the biomedical sciences and augment their credentials for admission into health professional programs, medical school, doctoral study in the sciences or entrance to the workforce. All students take a minimum of 30-36 semester hour credits in the basic sciences. Courses are in disciplines including: biochemistry, molecular cell biology, neuroscience, biomedical engineering, genetics, human physiology, microbiology, immunology, pharmacology, scientific professionalism and the responsible conduct of research. Elective credits, offered in a variety of disciplines, include other biomedical science courses. These electives improve critical thinking skills, study skills, and enhance the student's preparation for professional school application or entrance to the workforce.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Additional requirements
- Option 1 - MS Degree with Thesis: requires 30 semester hours including 6 hours of thesis research in the student's chosen area of specialty and a successfully completed thesis.
- Option 2 - MS Degree with Research Internship: requires 30 semester hours including 4 - 6 hours of research under an advisor and a written report that summarizes the research. The report will be evaluated by the advisor, the Program Director in the student's area of specialty, and one other faculty member.
- Option 3 - MS Degree with Project: requires 30 semester hours and a written review of a topic agreed upon by the advisor and student. The review will be evaluated by the advisor, Program Director in the student's area of specialty, and one other faculty member.
- Option 4 - MS Degree without Thesis, Internship or Project: 36 course hours are required.

Students will select an area of specialization in either Track 4, 5, 6 or the pre-medical post-baccalaureate program. Students will be advised under the direction of the faculty director in their chosen area of concentration or specialization.
Areas of Concentration:
- Integrative Physiology and Pharmacology
- Neuroscience

Areas of Specialization:
- Molecular and Cellular Biosciences
- Pre-medical post-baccalaureate

Courses of Instruction

701. Medical Career Path I (1) This course is designed for individualized career exploration, serve as an adjunct to career mentoring and provide students with a reasonable path/map for career goals. They will learn about professionalism, explore real life opportunities for building their professional portfolio and pathway to medical licensure and practice of medicine. Satisfactory/Unsatisfactory

702. Medical Career Path II (1) This course is designed as a continuation of individualized career exploration, serve as an adjunct to career mentoring and provide students with a reasonable path/map for career goals. They will learn about professionalism, explore real life opportunities for building their professional portfolio and pathway to medical licensure and practice of medicine. Satisfactory/Unsatisfactory

707, 708. Topics in Biomedical Science (1-6) This course will consider current topics in Biomedical Science that are not considered in regular courses. Course requirements and grading may be based on participation written assignments or hands-on projects. Content will vary.

795. Project. (1-6) A written review of a scholarly topic or project in biomedical sciences, developed in consultation with the student's graduate advisor. Satisfactory/Unsatisfactory

Cancer Biology (CABI)

Bowman Gray Campus

Program Director
Steven Kridel

Chair
Boris Pasche

Professors
Yong Chen, William H. Gmeiner, Boris Pasche

Associate Professors
Steven Kridel, George Kulik, Hui-Wei Lo, Lance Miller, Ravi N. Singh, Thad Wadas

Assistant Professors

Overview
The cancer biology graduate program was established in 1997. The graduate training program of the Department of Cancer Biology is designed to prepare students for future research careers focused on the issues relevant to human cancer. All applicants are required to have taken the general Graduate Record Exams prior to admission to the cancer biology graduate program. Subject tests are not required. Applicants must have completed college-level fundamental courses in biology, and general and organic chemistry. Courses in physics and mathematics through calculus are encouraged, but not required.

Students enter the Cancer Biology program through the Molecular and Cellular Biosciences (MCB) track. During the first year, in addition to the MCB common curriculum, students considering the Cancer Biology training program should consider taking one or more of the following electives: MCB721 Carcinogenesis, DNA Damage and Repair, MCB722 Molecular Pathogenesis of Cancer, and MCB723 Topics in Cancer Biology. If not taken as electives in Year 1, students matriculating in the Cancer Biology training program will be required to complete these courses in subsequent years. Additional coursework in subsequent years will include Advanced Topics in Cancer Biology, Statistical Experimental Design, Cancer Cell Biology, Tutorials in Cancer Biology, and an elective course of the students’ choice. Students also participate in the Cancer Biology seminar series.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

MCB Track Electives

MCB721. Carcinogenesis, DNA Damage and Repair. (2) This course will cover the identification and reaction mechanisms of environmental carcinogens, DNA damage and mutagenesis by endogenous and exogenous agents, and the mechanisms of DNA repair. Typically offered in the fall term. Intended for all graduate students in cancer biology (CABI); open to students in other tracks or programs.

MCB722. Molecular Pathogenesis of Cancer. (2) Fundamental molecular changes in cells and tissues that contribute to the malignant phenotype are discussed. Topics include alterations in genes and chromatin, signaling pathways, tumor cell metabolism, and the tumor microenvironment. Typically offered in the fall term. Intended for all graduate students in cancer biology (CABI); open to students in other tracks or programs.

MCB725. Topis in Cancer Biology. (2) Teaches students how to evaluate and communicate scientifically in the area of cell biology and cancer. Examples are taken from all areas of cancer in this advanced course. Uses current peer-reviewed journal articles to teach fundamental concepts and act as a medium for allowing the students to communicate ideas with an emphasis on presentation skills. Typically offered in the fall term. Intended for all graduate students in cancer biology (CABI); open to students in other tracks or programs.

CABI Advanced Courses

701, 702. Cancer Biology Seminar Series (1) The course will consist of weekly student and postdoctoral presentations to the Cancer Biology faculty and their peers based on their ongoing research projects. Required of all students who matriculate in Cancer Biology starting in their second year and continuing throughout their training period. Students and postdoctoral fellows will be expected to present at least once per year. Emphasis will be based on developing presentation skills and learning to critique colleagues in a professional manner. Satisfactory/Unsatisfactory

705. Cancer Cell Biology. (3) This is an intensive treatment to learn how to critically review the literature and requires the writing of a proposal that is critically reviewed. The course covers apoptosis, cell-cycle, angiogenesis, cancer genomics, metastasis, cancer immunology, and tumor suppressor genes. The translational aspects of research are emphasized.

707, 708. Topics in Cancer Lecture Series. (1) A weekly lecture series taken during the second year. Each week throughout the fall and spring semesters, a different topic in the clinical presentation, course, and treatment of human malignancies is presented. Designed to be a comprehensive overview of clinical oncology for clinical medical and radiation oncology fellows and cancer biology graduate students. Satisfactory/Unsatisfactory

711, 712. Advanced Topics in Cancer Biology. (1) Focuses on new and important aspects of research in cancer biology with an emphasis on the current literature. Themes are chosen by the course director and the students. A topic is selected for presentation by each student; with the help of the course director, the student prepares a short lecture to introduce the topic, assigns two key papers for participants to read, and provides a supplemental reading list. The following week, the student leads a discussion of key experimental findings. Broad participation from faculty, postdoctoral fellows, and graduate students is encouraged. Satisfactory/Unsatisfactory

713, 714. Cancer Biology Tutorials. (2) Focuses on specific topics related to cancer predisposition, development, progression, and treatment. Topics include, but are not limited to, DNA damage and repair, damage signaling, cell death response, cell cycle checkpoint control, animal models and
cancer treatment. The purpose of the tutorial is to provide an opportunity to discuss one of the above-mentioned topics in more detail than is possible in an overview-based lecture. The topic for upcoming semesters will be determined by the faculty. The class is a combination of lectures providing background information and student presentations introducing specific topics and related research articles in the field, followed by group discussions. Attendance and at least one full length presentation are mandatory to obtain credit.

716. Special Topics: Teaching in the Small Group Setting. (2) Teaches students how to use a problem-based interactive approach to facilitate student self-learning. Introduces students to general methods of teaching with a focus on teaching in the small group setting of a literature-based course. Topics covered include teaching skills for reading scientific papers, oral presentation techniques, and scientific writing. Each student facilitates two weeks (4 class sessions) of the course including in-class participation as well as assisting with the written evaluation portion of the class.

718. Introduction to Radiation Biology. (3) Focuses on the biological changes which follow the interaction of ionizing and non-ionizing radiation with living matter. Emphasis is on the role of ionizing radiation in the treatment of cancer, mechanisms of radiation-induced carcinogenesis, and changes in normal and tumor cells at the molecular, cellular and tissue levels.

723, 724. Research in Cancer Biology. Opportunities for investigation in a variety of the facets of cancer biology under the guidance of staff members. Satisfactory/Unsatisfactory

Chemistry (CHM)
Reynolda Campus

Program Director
Patricia C. Dos Santos

Assistant Professors
Lindsay R. Comstock, Paul B. Jones, Patricia C. Dos Santos

Overview
The Department of Chemistry offers programs of study leading to the MS and PhD degrees. Opportunities for study in courses and through research are available in analytical, biological, inorganic, organic, and physical chemistry. Research plays a major role in the graduate program. Since the number of graduate students is limited, the research program of the individual student is enhanced by close daily contact with the faculty.

All applicants for graduate work in the department are expected to offer as preparation college-level fundamental courses in general, analytical, organic, inorganic, and physical chemistry; physics; and mathematics through one year of calculus. During registration all new graduate students take qualifier examinations covering the fields of analytical, biological, inorganic, organic, and physical chemistry. Programs of study are in part determined by the results of these examinations, and deficiencies are to be remedied during the student's first academic year.

For the MS degree, the student is expected to undertake a broad program of coursework at an advanced level and to complete successfully an original investigation. This investigation must be of the highest quality but necessarily limited in scope. Students who hold assistantships normally spend two years in residence for the completion of this degree.

For the PhD degree, individual programs are designed for each student under the guidance of the student's faculty adviser and advisory committee and with the approval of the graduate committee. The University preliminary examination requirement is satisfied by successful completion of a series of written cumulative examinations and by presentation of two research proposals, one of which is the dissertation research project. Each student is to present at least one departmental seminar on the results of his or her dissertation research. The student must present a dissertation and pass an examination on it as prescribed by the Graduate School, and other University requirements must be satisfied.

The chemistry program participates in the Interdisciplinary Graduate Track in Structural and Computational Biophysics. For more information, refer to the pages in this bulletin regarding the program.

The original graduate program, which led to the MS degree, was discontinued in 1949. The present graduate program was begun in 1961, the PhD in 1972.

Graduate courses offered by the Department of Chemistry are from the following list. Not all courses are offered every year.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Courses of Instruction


625, 626. Organic Synthesis. (4, 4) Reagents for and design of synthetic routes to organic molecules.

634. Chemical Analysis. (3 or 4) Theoretical and practical applications of modern methods of chemical analysis. C—CHM 641

641, 642, 644. Physical Chemistry. (3 or 4) Fundamentals of physical chemistry.


651. Special Topics in Biochemistry. (3) Fundamentals of biochemistry, with particular emphasis on mechanistic analysis of metabolic pathways, enzymatic activity, and drug action.

656, 657. Chemical Spectroscopy. (1.5, 1.5) Fundamental aspects of the theory and application of chemical spectroscopy, as found in the areas of analytical, inorganic, organic, and physical chemistry. Emphasis varies. Seven week courses. P—CHM 642 or 644, 661, or POI. May be repeated for a maximum of 3 hours each.

661. Inorganic Chemistry. (3 or 4) Principles and reactions of inorganic chemistry.

666. Chemistry and Physics of Solid State Materials. (3) Describes basic principles of solid state chemistry. Focuses on the design, synthesis, structure, chemical, and physical properties and the application of solid state materials. The relationships between electronic structure, chemical bonding, and crystal structure are developed. Case studies are drawn from materials for energy generation and storage, e.g. batteries and fuel cells, and from emerging technologies, e.g., nano- and biomaterials.

664, 664L. Materials Chemistry. (3, 1) A survey of inorganic-, organic-, bio-, and nano-materials, including hybrid materials and applications. P—CHM 641 or POI

670. Biochemistry: Macromolecules and Metabolism. (3) A lecture course introducing the principles of biochemistry, with emphasis on the experimental approaches that elucidated these principles. Major topics include structure, function, and biosynthesis of biological molecules, analysis of enzyme function and activity, bioenergetics, and regulation of metabolic pathways.

673. Biochemistry: Protein and Nucleic Acid Structure and Function. (3) Special topics in biochemistry, including catalytic mechanisms of enzymes and ribozymes, use of sequence and structure databases, and molecular basis of disease and drug action. P—CHM 670 or POI

681, 682. Chemistry Seminar and Literature. (.5, .5) Discussions of contemporary research and introduction to the chemical literature and acquisition of chemical information. Pass/Fail

701. Advanced Physical Chemistry. (3) An accelerated survey of classical and statistical
thermodynamics, chemical kinetics, and quantum chemistry.

711, 712. Directed Study in Chemistry. (1 or 2, 1 or 2) Reading and/or lab problems carried out under supervision of a faculty member. P—Permission of graduate committee. May be repeated for credit if topic varies.


726. Reactive Intermediates. (3) Mechanistic and preparative photochemistry. Structure and chemistry of excited states, free radicals, carbenes, and selected ions.

735. Chemical Separations. (3) Theory and practice of modern separation methods with emphasis on gas and liquid chromatographic techniques.

736. Spectrochemical Analysis. (3) Principles of atomic and molecular spectrometric methods; discussion of instrumentation, methodology, and applications.


738. Statistics for Analytical Chemistry. (3) Practical investigation of the statistical procedures employed in modern analytical chemistry.

739. Special Topics in Analytical Chemistry. (3) The study of topical fields of research in analytical chemistry, with a focus on one or more specialities, such as ICP-MS; fluorescence; LIBS; Raman spectroscopy; nanoparticles in analysis; biosensors; or others. May be repeated for credit if course content differs.

740. Drug Discovery, Design, and Development—Molecules to Medicine. (3) Conducted as a combination of lectures, reading assignments, and student-led discussions. Examines drug discovery and development pathways from target and lead compound identification through metabolic and toxicology studies, clinical trials, FDA approval, and marketing. Regulatory processes, intellectual property, and ethical issues are also considered. Taught by WFU faculty from both the Reynolda and Bowman Gray campuses and colleagues in the pharmaceutical and biotechnology industries, students work in teams to present case studies on the discovery, development, and marketing of recently approved pharmaceuticals. Also listed as BICM 740. P—Organic chemistry and biochemistry.

745. Statistical Thermodynamics. (3) The application of statistical mechanics to chemistry to understand and predict the thermodynamic properties.

746. Chemical Kinetics. (3) Kinetics and mechanisms of chemical reactions; theories of reaction rates.

747. Self-Organization in Nonequilibrium Chemistry. (3) Study of the phenomena of self-organization, such as oscillations, multistability, propagating waves, and formation of spatial patterns. Kinetic systems with autocatalysis will be studied using bifurcation theory and other methods of non-linear systems.

751. Biochemistry of Nucleic Acids. (1.5-3) Advanced survey of the structure, reactivity, and catalytic properties of RNA and DNA, including modern experimental techniques. Current literature will be presented and critically evaluated.

752. Protein Chemistry. (1.5-3) Advanced survey of protein biochemistry with an emphasis on structural families, enzyme catalytic mechanisms, expression and purification methods, and biophysical and structural experimental techniques.

753. Chemical Biology. (3) Survey of the origins and emerging frontiers of chemical biology, with a focus on the impact of chemical methods on our understanding of biology. Topics include protein design, chemical genetics, and methods in genomics and proteomics research.

755. Biomolecular Mass Spectrometry: Fundamentals and Applications. (1.5-3) Designed for graduate and advanced undergraduates focusing on the principles of mass spectrometry and use in the analysis of small molecules, peptides, proteins, and nucleic acids. Covers sample preparation, data acquisition and interpretation, database searching, and quantification of molecules using a variety of techniques. P—Biochemistry

756. Biomolecular NMR. (1.5) One-half semester course designed for graduate and advanced undergraduates focusing on NMR of small oligonucleotides and proteins. Covers sample preparation, data acquisition and processing as well as generating solution structures from NMR data. A student should have command of 1D acquisition and processing as well as experience with 2D acquisition and processing before taking this class. All computational exercises involve some familiarity with the UNIX operating system. P—POI

757. Macromolecular Crystallography. (1.5) One-half semester course designed for graduate and advanced undergraduates focusing on structural characterization of macromolecules utilizing X-ray crystallography. Covers sample preparation, diffraction theory, data acquisition and processing as well as structure solution and refinement techniques. P—CHM 656 highly recommended.

761. Chemistry of the Main Group Elements. (3) Principles of bonding, structure, spectroscopy, and reactivity of compounds of the main group elements. Synthesis and applications of organometallic compounds of the main group.

762. Coordination Chemistry. (3) Theory, structure, properties, and selected reaction mechanisms of transition metal complexes. Design and synthesis of ligands and their applications in bioinorganic chemistry.


765. Bioinorganic Chemistry. (3) The inorganic chemistry of life. a) Metals in biocatalysis: elucidation of structure and function of metalloenzymes by various spectroscopic and molecular biology methods; biomimetic ligands; synthetic models of active sites. b) Metals and toxicity. c) Inorganic compounds in therapy and diagnosis.

771. Quantum Chemistry. (3) The quantum theory and its application to the structure, properties, and interactions of atoms and molecules. Theoretical and computational approaches.


829. Tutorial in Organic Chemistry. (3)

830. Heterocyclic Chemistry. (3) Survey of the major groups of heterocyclic compounds. Modern applications of heterocycles.


832. Theoretical Organic Chemistry. (3) Molecular orbital treatment of structure and reactivity of organic molecules with emphasis on the applications of MO theory in pericyclic and photochemical reactions.

833. Advanced Reaction Mechanisms. (3) Detailed analysis of mechanisms with emphasis on characterization of transition state structure.

838. Advances in Analytical Chemistry—Luminescence Spectroscopy. (3) Instrumentation, methods, and applications of molecular luminescence spectroscopy.
Clinical and Population Translational Sciences (CPTS)

Bowman Gray Campus

Program Co-Directors Janet Toozé, Capri Foy
Division Director Gregory L. Burke


Associate Professors G. Haiying Chen, Laura H. Coker, Suzanne Danhauer, Jasmin Divers, Matthew Edwards, Gregory Evans, Emily Gower, Kathleen Hayden, Jason Hoth, Denise K. Houston, Tim Howard, Wei Lang, Iris Leng, Shannon Mihalko, David Miller, Carlos Rodriguez, Kayce Sink, Assistant Professors Joseph Skelton, Elsayed Soliman, Erin Sutfin, Janet Toozé, Kathryn Weaver

Overview

The master of science degree in Clinical and Population Translational Sciences is administered through the Division of Public Health Sciences and the Translational Science Institute. The CPTS Program is open to individuals who already hold or are pursuing advanced degrees, such as the MD, DVM, Sc.D, PhD, DDS, DSN, MMS (Physician Assistant), or MSN who are seeking training in the clinical and population aspects of translational research. The program also may be appropriate for qualified applicants with at least a BA or BS in a social science, public health, or other health-related field, although additional post-baccalaureate coursework may be required. For applicants without an advanced degree, previous experience in a health-related field is required.

The purpose of this program is to assist students in developing competencies (theoretical/conceptual, methodology, statistics) required for the conduct of clinical and population research and the translation of knowledge gained from such research into improved human health. Developing translational research skills is vital for the future success of researchers in the basic science and health professions. Translational research includes two areas of translation. One is the process of applying discoveries generated during laboratory research, and in preclinical studies, to the development of trials and studies in humans. The second area of translation concerns research aimed at enhancing the adoption of best practices in health care settings and the community. This program focuses on clinical research and the second area of translational research described above.

Clinical and Population research comprises studies and trials in human subjects including:
- Patient-oriented research. Research conducted with human subjects (or on material of human origin such as tissues, specimens and cognitive phenomena) for which an investigator (or colleague) directly interacts with human subjects;
- Epidemiologic and behavioral studies; and
- Outcomes research and health services research.

While a minimum of twelve months of full-time work or its equivalent in residence is required for the master’s degree, this program normally requires two years. In addition to coursework, all students complete a thesis project under the direction of a thesis committee. Students may initiate original data collection or analyze existing data sets. It is feasible to extend the program from two to three years. Students may matriculate only at the beginning of the fall semester each year.

The master of science degree in clinical and population translation science was initiated in the fall of 2008. It is one of a small number of similarly structured master’s degree programs in the U.S., placing it on the cutting edge of graduate education.

CPTS Certificate

In addition to the master of science degree, an abbreviated CPTS Certificate is also available for students who do not have time to complete a thesis. The purpose and entrance requirements are identical to the master’s program. Although a thesis is not required, students will need to complete at least 15 hours of CPTS coursework, complete ethics training requirements and demonstrate competency in basic biostatistics.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Courses of Instruction

703. Ethics and Responsibility in Clinical and Population Translational Science I. (1) Provides students with an overview of topics related to ethics and the responsible conduct of human subjects research. Students utilize a case-based format to address such topics as: study oversight and research design, informed consent, selection of subjects, conflicts of interest, the social effects of research, the use of embryos, fetuses and children in research, genetic research, and authorship and publication
of study findings. Students are required to complete the Collaborative Institutional Training Initiative (CITI) Human Research On-Line Curriculum as part of this course. \(P—CPTS 703\) or POI; Satisfactory/ Unsatisfactory

704. Ethics and Responsibility in Clinical and Population Translational Science. (1) Provides students with an overview of topics related to ethics and the responsible conduct of human subjects research. Students utilize a case-based format to address such topics as: study oversight and research design, informed consent, selection of subjects, conflicts of interest, the social effects of research, the use of embryos, fetuses and children in research, genetic research, and authorship and publication of study findings. Students are required to complete the Collaborative Institutional Training Initiative (CITI) Human Research On-Line Curriculum as part of this course. \(P—CPTS 703\) or POI; Satisfactory/Unsatisfactory

705. Team Science Practicum in Clinical Translational Science. (3) Provides students with practical hands-on experience working on a collaborative, multidisciplinary translational study. Students from the molecular medicine and the clinical and population translational science programs work together in teams assigned to ongoing projects in the Translational Science Institute. Students become familiar with the study protocol and procedures, including mechanisms for protection of animals or human subjects. Students participate in study conduct, review and interpretation of study data, and prepare a written report and oral presentation describing the practicum experience. \(P—POI\)

720. Epidemiology. (4) Provides students with a foundation in the history, concepts, and methods of epidemiology. Topics include measurement of exposure to disease, prevalence, incidence, association, and sensitivity/specificity analyses. Measurement error, bias, confounding, effect modification, causality, and policy implications are discussed. The following observational study designs are reviewed: cross-sectional, cohort, ecological, and meta-analysis. Includes a weekly 1h problem solving laboratory. \(P—POI\)

730. Introduction to Statistics. (4) The course is an introduction to statistical concepts and basic methodologies that are prevalent in biomedical literature. It includes discussion topics such as descriptive statistics, probability, sampling distributions, hypothesis testing, simple linear regression, correlation, one-way analysis of variance, categorical data analysis, survival analysis, sample size and power analysis, and nonparametric methods. Access to SAS Enterprise Guide required. \(P—POI\)

732. Applied Linear Models. (4) The topics of the course include statistical concepts and basic methodologies related to the general linear model and its extensions. The basic statistical procedures discussed in the course include simple and multiple linear regression, analysis of variance and covariance, logistical regression, and repeated measures analysis. Emphasis is given to proper application and interpretation of statistical methods and results. Access to SAS Enterprise Guide required. \(P—CPTS 730\) or POI

741. Research Grant Preparation. (3) Provides students with the knowledge and skills to develop grant proposals to pursue funding in their areas of interest. Topics covered include: the role of external funding in biomedical research; how to identify public and private sources of funding; required components of grant submission; and human subjects and budgeting considerations. Students develop a research proposal for peer review and critical discussion. \(P—POI\)

742. Clinical Trial Methods. (3) Provides students with knowledge of clinical trials methodology from Phase I through Phase IV and beyond. Topics include: why trials are needed; specification of the trial question(s); basic trial designs; identification of the appropriate study population, interventions, and response variables; the randomization process; masking; sample size; data analysis; recruitment/retention/adherence; trial monitoring and interim analyses; assessing/reporting adverse effects; interpreting trial results; meta-analyses; and post marketing surveillance. \(P—POI\)

747. Topics in Cancer Survivorship Research. (1) Provides students with an overview of topics related to cancer survivorship. Topics include: epidemiology of cancer survivorship, quality of life issues, cancer and the family, disparities in morbidity and mortality, late effects of cancer treatment, ethical issues, complementary and alternative medicine, symptom management, behavioral and lifestyle issues post-treatment, health services research, and special populations. Course may be repeated for credit. \(P—POI\)

748. Population Research Methods I. (2) The course will focus on the development of integrated aims, literature reviews, and conceptual frameworks that provide the necessary foundation for successful community and health delivery translational research. To provide students with the opportunity to expand their ability to develop and communicate research concepts, the course will include numerous in-class activities and several written assignments.

749. Population Research Methods II. (4) The course explores how study designs are selected and examines specific application of these designs within the community and health delivery settings. The latter part of the course focuses on measurement, with emphasis on the development of data collection forms and surveys. To provide students with the opportunity to expand their ability to develop and communicate research concepts, the course will include in-class activities plus a presentation and written assignments.

760. Topics in Clinical and Population Translational Sciences. (1-6) Seminar and/or lecture course on selected topics of current interest in clinical and population translational sciences not currently covered in the same depth in other courses.

761. Detecting and Understanding Health Disparities. (1) This course will define and measure health disparities, evaluate landmark reports, and examine the social determinants and health systems determinants of healthcare disparities. Professional skills developed in this course will include evaluation of implicit bias, critical thinking in health care ethics, adjusting to group dynamics, and practice in public speaking. The prerequisite for this course is IPP716.

762. Promoting Health Equity. (1) This course will address organizational and community points of interventions to reduce health disparities, strategies for policy intervention to address health disparities, development of platforms for community engagement, and incorporating service learning projects into the educational structure. Professional skills developed in this course will include problem-solving skills, adjusting to group dynamics, and written communications. The prerequisite for this course is CPTS 761.

766. Individual Study in Clinical and Population Translational Science. (1-4) Provides students with opportunities to pursue advanced topics in their individual areas of interest with guidance from expert faculty. May be repeated for credit. \(P—POI\)

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**Communication (COM)**

**Reynolda Campus**

Program Director: Ron Von Burg
Chair: Allan D. Louden

**Professors**
- Mary Dalton, Sandra Dickson, Michael David Hazen
- Woodrow Hood, Marina Krcmar, Allan D Louden, Ananda Mitra, Randall G. Rogan

**Associate Professors**
- Jarrod Atchison (Director of Debate), Steven Giles, John Llewellyn, Alessandra Von Burg, Margaret D. Zulic

**Assistant Professors**
- Mollie Canzona, Jennifer Priem, Ron Von Burg (Director of Graduate Studies)
- Rowie Kirby-Straker, David Stokes Pierce
- Sherri Williams
- Justin Green
- Ken Strange
- T. Nathaniel French
- Peter Gilbert, Cindy Hill, Cara Pinson
- Ernest S. Jarrett
- Richard Robeson
Overview

The Department of Communication offers graduate study leading to the MA degree. Students who enroll for the master's degree are expected to have a strong undergraduate background and rationale for graduate work in communication. The program is designed as a PhD preparation program. Most students will require two academic years to complete the program. The graduate program is associated with the Bioethics and Documentary Film graduate programs. Students have the opportunity to take classes in those areas as well. The program began in 1969.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.

Thesis Option

The minimum requirement is 33 semester hours of work, six of which are allotted for the thesis. The program requires a core of courses in research methodology and then allows students to take courses in context areas such as health communication, intercultural communication, interpersonal communication, mass communication, organizational communication, and public communication. In addition, the department provides work in communication ethics, communication technologies, and argumentation. A program of study should include 6 hours of thesis work and a minimum of 27 hours of coursework, of which 6 hours may be in electives outside the department. At least 18 of the 27 hours of coursework must be in courses numbered 700 or above. Credits for up to 6 hours of graduate work can be transferred from another institution.

All students must demonstrate competence in a research skill relevant to their thesis and/or professional goals. Most students demonstrate their competency in empirical methodology or critical methodology; however, a foreign language also may be elected.

Comprehensive Examination Option

Students are required to complete 33 semester hours of coursework. At least 24 of the 33 hours required for the degree must be in courses numbered 700 or above. The remaining 9 hours may be in either 600-level or 700-level courses. A program of study can include 6 hours of coursework in electives outside the department. This includes credit for as many as 6 hours of graduate work transferred from another institution. Students will be required to successfully complete a comprehensive examination at the end of completing the 33 hours of coursework. Students are required to indicate their desire to take a comprehensive examination by the end of the first year of graduate work.

Courses of Instruction

600. Classical Rhetoric. (3) Study of major writings in Greek and Roman rhetorical theory from the Sophists to Augustine. Offered in alternate years.

601. Semantics and Language in Communication. (3) Study of how meaning is created by sign processes. Among the topics studied are language theory, semiotics, speech act theory, and pragmatics.

602. Argumentation Theory. (3) Examination of argumentation theory and criticism; emphasis on both theoretical issues and social practices.

604. Freedom of Speech. (3) Examination of the philosophical and historical traditions, significant cases, and contemporary controversies concerning freedom of expression.

605. Communication and Ethics. (3) A study of the role of communication in ethical controversies.

606. Burke & Bakhtin Seminar. (3) Examines the language theories of Kenneth Burke and Mikhail Bakhtin in relation to contemporary rhetorical theory.

610. Advanced Media Production. (3) Special projects in audio and video production for students with previous media production experience. P—POI

612. Film History to 1945. (3) Survey of the developments of motion pictures to 1945; includes lectures, readings, reports, and screenings.

613. Film History since 1945. (3) Survey of the development of motion pictures from 1946 to present day; includes lectures, readings, reports, and screenings.

614. Media Effects. (3) Theoretical approaches to the role of communication in reaching mass audiences and its relationship to other levels of communication.

615. Communication and Technology. (3) Exploration of how communication technologies influence the social, political, and organizational practices of everyday life.

616. Screenwriting. (3) Introduction to narrative theory as well as examination of the role of the screenwriter in the motion picture industry, the influence of genre on screenwriting, and exploration of nontraditional narrative structures. Students complete and original, feature-length screenplay.

617. Communication and Popular Culture. (3) Explores the relationship between contemporary media and popular culture from a cultural studies perspective using examples from media texts.

619. Media Ethics. (3) Examines historical and contemporary ethical issues in the media professions within the context of selected major ethical theories while covering, among other areas, issues relevant to: journalism, advertising, public relations, filmmaking, and media management.

620. Media Theory and Criticism. (3) Critical study of media including a survey of major theoretical frameworks.

630. Communication and Conflict. (3) Review of the various theoretical perspectives on conflict and negotiation as well as methods for managing relational conflict.

635. Survey of Organizational Communication. (3) Overview of the role of communication in constituting and maintaining the pattern of activities that sustain the modern organization.

636. Organizational Rhetoric. (3) Explores the persuasive nature of organizational messages—those exchanged between organizational members and those presented on behalf of the organization as a whole.

637. Rhetoric of Institutions. (3) A study of the communication practices of institutions as they seek to gain and maintain social legitimacy.

638. 20th-Century African-American Rhetoric. (3) Explores how African Americans have invented a public voice in the 20th century. Focuses on how artistic cultural expression, in particular, has shaped black public speech.

639. Practices of Citizenship. (3) Explores the history and theory of citizenship as a deliberative practice linked to the rhetorical tradition of communication with an emphasis on participatory and deliberative skills as part of the process in which communities are formed and citizens emerge as members.

640. Public Discourse I. (3) Examines the interrelation of American rhetorical movements through the 19th century by reading and analyzing original speeches and documents, with emphasis on antislavery and women's rights.

641. Public Discourse II. (3) Examines the interrelation of American rhetorical movements in the 20th century by reading and analyzing original speeches and documents. Among the movements addressed are labor, civil rights, student radicals, and women's liberation.

642. Political Communication. (3) Study of electoral communication including candidate and media influences on campaign speeches, debates, and advertising. Offered in alternate years.

643. Presidential Rhetoric. (3) Examines theory and practice of speakmaking and mediated presidential communication. Offered in alternate years.

650. Intercultural Communication. (3) Introduction to the study of communication phenomena between individuals and groups with different cultural backgrounds. Offered in alternate years.

651. Comparative Communication. (1, 5, 3) Comparison of communicative and rhetorical processes in the U.S. with one or more other national cultures with an emphasis on both historical and contemporary phenomena. a) Japan; b) Russia; c) Great Britain; d) Multiple countries. Offered in alternate years.

654. International Communication. (3) In-depth look at the role of mass media in shaping
communication between and about cultures using examples from traditional and emerging media systems.

655. Health Communication. (3) Examination of theories, research, and processes of health communication in contemporary society. May be repeated for credit.

656. Health Communication: Patient-Provider. (3) Explores contemporary issues related to communication in health care contexts, notably theories and research on patient-provider communication.

657. Health Communication Campaigns. (3) Examination of the principles behind designing, implementing, and evaluating a health campaign, including message design and application of media theories for behavior change.

670. Special Topics. (1-4) Examination of topics not covered in the regular curriculum.

680. Great Teachers. (3) Intensive study of the ideas of three noted scholars and teachers in the field of communication. Students interact with visiting scholars during visits to Wake Forest.

719. Theory and Research Design in Communication Science. (3) Examination of communication science theory with a focus on critiquing and utilizing theory in research, accompanied by an overview of quantitative research design and methodology.

720. Quantitative Analysis in Communication Science. (3) Overview of statistical data analysis, interpretation, and reporting for communication research. P—COM 719

753. Seminar in Persuasion. (3) Study of contemporary social science approaches to persuasion theory and research. Influence is examined with interpersonal, social, and mass media contexts.

758. Rhetorical Theory. (3) Introduction to primary texts in the theory of rhetoric including classical theories, dramatism, semiotics, and critical/cultural studies.

759. Rhetorical Criticism. (3) The critical application of rhetorical theories aligning with the traditions covered in Communications 758. P—COM 758

763, 764. Proseminar in Communication. (1.5, 1.5) Introduction to graduate study in communication.

773. Seminar in Interpersonal Communication. (3) Study of recent research and theoretical developments in dyadic communication. Methodology examined includes conversational analysis, field, and experimental approaches.

774. Research and Theory of Organizational Communication. (3) Advanced study of theoretical approaches to the role of communication in organizations and empirical application of such theories.

780. Special Seminar. (1-3) Intensive study of selected topics in communication. Topics may be drawn from any theory or content area of communication and offer a wide variety of special topics across a two year program. May be repeated for credit for a maximum of 12 hours.

781, 782. Readings and Research in Speech Communication. (1-3, 1-3) Students may receive credit for a special reading project in an area not covered by regular courses or for a special research project not related to the master's thesis. May be repeated for credit for a maximum of 16 hours.

791, 792. Thesis Research. (1-9). May be repeated for credit. Satisfactory/Unsatisfactory

Comparative Medicine (COMD)
Bowman Gray Campus

PATHOLOGY (SECTION ON COMPARATIVE MEDICINE)

Program Director
J. Mark Cline

Section Head
J. Mark Cline

Professors
J. Mark Cline, Christopher Jerome, Jay R. Kaplan, Nancy D. Kock, Thomas C. Register, Carol A. Shively

Associate Professor
Susan Appt, Matthew J. Jorgensen, David L. Caudell, Kylie Kavanagh

Overview

The section on comparative medicine in the Department of Pathology offers a program leading to the Master of Science (MS) degree in Comparative Medicine for individuals that have previously achieved the MD or DVM degree. The MS degree has been offered since 1964.

Research is an important facet of departmental activities, and research training is emphasized in its educational programs. Investigative efforts focus on animals as models of human disease and the use of animals in biomedical research. Major interests include cardiovascular disease (especially atherosclerosis), cancer biology and risk assessment, diabetes and obesity, behavioral biology such as depression and anxiety, women's health/reproductive medicine, nutrition, comparative pathology, radiation countermeasures, and substance abuse.

There is an active interest in the biology and diseases of nonhuman primates as translational surrogates for the study of human diseases. A colony of approximately 1,000 nonhuman primates of several species is maintained to provide ample opportunity for students interested in nonhuman primate biology. In addition, specialized colonies of rodents and other species are also used in conjunction with other biomedical research programs at Wake Forest University. A full description of research interests may be found by linking to the Center for Comparative Medicine Research, which is supported by the Medical School and serves as an institution-wide research resource that develops and applies animal models – especially nonhuman primates – to diseases of human relevance.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Courses of Instruction

703. Diseases of Laboratory Animals. (3) Naturally occurring diseases of laboratory animals are considered in depth. Lectures are organized by animal species and are designed to emphasize the prevalence and physiological and pathological expression of both infectious and metabolic/degenerative diseases. Additional emphasis is on the diagnosis and management of these diseases in the laboratory animal facility. Special topics, including disease surveillance, zoonoses, and strain differences in disease susceptibility, are also presented. Offered in even-numbered years. P—DVM or MD degree or POI.

706. Animal Models in Biomedical Research. (3) Designed to provide the student with the current knowledge about animal models used in biomedical research. The major disease problems of man are discussed by organ system. For each disease problem, the advantages and disadvantages of animal models in current use are discussed. Both experimentally induced and naturally occurring diseases of animals are considered. Offered in odd-numbered years. P—POI

708. Medical Primatology. (3) acquaints the student with animal models used in biomedical research. The major disease problems of man are discussed by organ system. For each disease problem, the advantages and disadvantages of animal models in current use are discussed. Both experimentally induced and naturally occurring diseases of animals are considered. Offered in odd-numbered years. P—POI
709, 710. Advanced Topics in Comparative Medicine. (Credit to be arranged, 1-5) An advanced lecture and student participation course dealing with areas of new knowledge in comparative medicine. P—General biochemistry, general pathology, or equivalents.

711, 712. Comparative Pathology Conference. (1, 1) Necropsy cases are presented and discussed by postdoctoral fellows and staff. Management of current medical problems and the comparative aspects of the materials presented are emphasized.

713, 714. Research. Research in a variety of topics in comparative medicine, including research in preparation for the master's thesis and the doctoral dissertation. Satisfactory/Unsatisfactory

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**Computer Science (CSC)**

*Reynolda Campus*

**Program Director**

William Turkett

**Chair**

Peter Santago

**Emeritus Reynolds Professor**

Robert J. Plemmons

**Professors**


**Associate Professors**

Samuel S. Cho

**Assistant Professor**

Satisfactory/Unsatisfactory

**Overview**

The department offers a program of study leading to the Master of Science degree in computer science. The program is designed to accommodate students seeking a terminal MS degree or preparation for entering a PhD program.

In addition to the graduate school admission requirements, students entering the graduate program must have completed computer science coursework in the areas of: 1) programming in a modern high-level language, 2) basic computer organization and architecture, 3) data structures and algorithms, and 4) principles of operating systems and networks. Students should also have completed mathematics courses equivalent to: 1) differential and integral calculus including infinite series, 2) discrete mathematics, 3) linear algebra, and 4) probability and statistics.

The courses CSC 631, 641, 702, and 721 are identified as the core courses for the MS degree and are required of all students. The complete requirements for the MS degree may be fulfilled in one of three ways.

The MS degree with thesis requires thirty semester hours including six hours of thesis research (CSC 791, 792) and a successfully completed thesis. The coursework must include the twelve-hour core. The remaining twelve hours are selected from computer science courses with at least six of these hours from 700-level courses other than CSC 791, 792, and 795.

The MS degree with project requires thirty-six semester hours including three hours of project research (CSC 795) and a successfully completed project. The coursework must include the twelve-hour core. The remaining twenty-one hours are selected from computer science courses with at least six of these hours from 700-level courses other than CSC 791, 792 and 795.

For the MS degree without thesis or project, thirty-six semester hours are required. The coursework must include the twelve-hour core. The remaining hours are selected from computer science courses with at least six of these hours from 700-level courses other than CSC 791, 792 and 795.

With the approval of the graduate adviser, graduate courses may be taken outside of the department to fulfill requirements; however, no more than six such hours may count toward the degree.

Students in the program may apply to participate in the Interdisciplinary Graduate Track in Structural and Computational Biophysics. The specific requirements are found in this bulletin under the courses of instruction. On successful completion of this track, a student will earn an MS degree in computer science (thesis option) with a Certificate in Structural and Computational Biophysics.

Current information on the program and links to faculty interests can be accessed on the Web at http://college.wfu.edu/cs/.

**Degree Requirements:** please see “Requirements for Degrees” beginning on page 25.

**Courses of Instruction**

611. Computer Architecture. (3) In-depth study of computer systems and architecture design. Topics include processor design, memory hierarchy, external storage devices, interface design, and parallel architectures.

621. Database Management Systems. (3) Introduction to database management systems. Topics include data independence, database models, query languages, security, integrity, and transactions.

622. Database Management and Analytics. (3) Management, analysis, and visualization of large-scale data sets. Topics include key-value databases, distributed file systems, map-reduce techniques, similarity measures, link analysis, and clustering. P—CSC 621.

631. Software Engineering. (3) Study of fundamental topics in software engineering including software processes, agile software development and project management, requirements engineering, system modeling, design patterns and implementation, and software testing. Students practice software engineering principles through team projects.

632. Mobile and Pervasive Computing. (3) Study of the fundamental design concepts and software principles underlying mobile and pervasive computing, including mobile interface design, data management, mobile networks, location aware computing, and mobile security. Involves significant programming on modern mobile platforms.

633. Principles of Translators for Compilers and Interpreters. (3) Study of techniques for translating high-level programming languages to a target language. Typical target languages include Java bytecode and assembly language. Topics include lexical analysis, parsing, intermediate representations, language semantics, code generation, and optimization.

641. Operating Systems. (3) Study of the different modules that compose a modern operating system. In-depth study of concurrency, processor management, memory management, file management, and security.

643. Internet Protocols. (3) Study of wide area connectivity through interconnection networks. Emphasis is on Internet architecture and protocols. Topics include addressing, routing, multicasting, quality of service, and network security.

646. Parallel Computation. (3) Study of techniques for parallel and high performance computing. Topics include an overview of modern high-performance computer design, pipelining, concurrency, data dependency, shared memory, message passing, and graphics processors. Select parallel algorithms and methods for asymptotic scalability analysis are also presented. Assignments may include coding with OpenMP, MPI, and the CUDA library.

648. Computer Security. (3) Introduction to computer security concepts and associated theory. Detailed coverage of the core concepts of access control, cryptography, trusted computing bases, digital signatures, authentication, network security, and secure architectures. Legal issues, security policies, risk management, certification and accreditation are covered in their supporting roles. Students will learn to analyze, design, and build secure systems of moderate complexity.

652. Numerical Linear Algebra. (3) Numerical methods for solving matrix and related problems in science and engineering using a high-level matrix-oriented language such as MATLAB. Topics include systems of linear equations, least squares methods, and eigenvalue computations. Special emphasis given to applications. Credit not allowed for both CSC 652 and MTH 626.

655. Introduction to Numerical Methods. (3) An introduction to numerical computations on modern computer architectures; floating point arithmetic and round-off error including programming in a scientific/engineering language such as MATLAB, C or Fortran. Topics include
691. Selected Topics. (1, 2, 3) Topics in computer science that are not studied in regular courses or which further examine topics begun in regular courses. P—POI

693. Individual Study. (1 or 2) Independent study directed by a faculty adviser. By prearrangement. May be repeated for credit.

702. Theory of Computation. (3) Basic theoretical principles of computer science. Topics include the relationship between automata and grammars, Church's thesis, unsolvability, and computational complexity.

721. Theory of Algorithms. (3) Design and analysis of algorithms. Topics may include time and space complexity analysis, divide-and-conquer algorithms, the fast Fourier transform, NP-complete problems, and efficient algorithms for operations on lists, trees, graphs, and matrices.

726. Parallel Algorithms. (3) A thorough, current treatment of parallel processing and supercomputing. Modern high-performance commercial architectures, parallel programming, and various supercomputing applications are discussed. Hands-on experience is emphasized. Students are given access to a variety of machines.

731. Compiler Optimization. (3) Design and implementation of optimizing compilers. Optimization techniques, parallelizing transforms, and comparative examples from the literature. P—CSC 633

743. Topics in Operating Systems. (3) Issues in operating system development; resource management, queuing theory, concurrent processing, and languages for operating system development. P—CSC 641

753. Nonlinear Optimization. (3) The problem of finding global minimums of functions is addressed in the context of problems in which many local minima exist. Numerical techniques are emphasized, including gradient descent and quasi-Newton methods. Current literature is examined and a comparison made of various techniques for both unconstrained and constrained optimization problems. Credit not allowed for both MTH 753 and CSC 753. P—CSC or MTH 655

754. Numerical Methods for Partial Differential Equations. (3) Numerical techniques for solving partial differential equations (including elliptic, parabolic and hyperbolic) are studied along with applications to science and engineering. Theoretical foundations are described and emphasis is on algorithm design and implementation using either C, FORTRAN or MATLAB. Also listed as MTH 754. Credit not allowed for both MTH 754 and CSC 754. P—CSC 655 or MTH 655.

765. Image Processing. (3) Advanced techniques in image processing including image formation and corruption models, digitization, Fourier domain methods, enhancement, restoration, and tomographic reconstruction. P—CSC 721

766. Pattern Recognition. (3) Study of statistical pattern recognition techniques and computer-based methods for decision-making, including discriminant functions, feature extraction, and classification strategies. Emphasis is on applications to medical image analysis. P—POI

767. Computer Vision. (3) Techniques for extracting features from images: optimal thresholding, 2D and 3D feature measurement, graph isomorphism and graph matching methods. P—CSC 766


779. Topics in Artificial Intelligence. (3) Advanced topics in artificial intelligence. Individual projects are assigned. P—CSC 671.

781. Computer Science Seminar. (0) Discussions of contemporary research. No credit.

790. Advanced Topics in Computer Science. (3) Advanced topics of current interest in computer science not covered by existing courses. P—POI

791, 792. Thesis Research. (1-9). May be repeated for a maximum of 18 hours each. Satisfactory/Unsatisfactory

795. Project. (3). Satisfactory/Unsatisfactory

Counseling (CNS)

Reynolda Campus

Program Director
Donna A. Henderson

Professors
Samuel T. Gladding, Donna A. Henderson, Jose A. Villalba

Debbie W. Newsome, Mark B. Scholl

Associate Professors
Erin E. Binkley, Philip B. Clarke, Jamie Crockett, Seth C.W. Hayden, Nathaniel N. Ivers, Jennifer L. Rogers, Katherine Ziff


Assistant Teaching Professors
Carla Emerson

Clinical Program Manager

Overview

The master of arts in counseling degree is awarded to candidates who successfully complete a minimum of sixty semester hours in a planned and directed program of study. The program consists of a common core of courses to provide knowledge in eight areas: human growth and development, social and cultural foundations, helping relationships, group work, career and lifestyle development, appraisal, research and program evaluation, and professional orientation. The program also supplies clinical instruction with practicum and internship experiences. In addition, students must select a program specialty area-school counseling or clinical mental health counseling-in which they complete their internships and take courses that assure at least entry-level competence.

Admission to the Programs. Admissions decisions are based on consideration of a combination of criteria: college grade-point average, Graduate Record Examination scores, recommendations, professional commitment, work or volunteer experience in the human services field, and suitability for the profession. Applicants being considered for admission are required to have a personal
interview with program faculty. Candidates for the counseling programs are not required to have a specific undergraduate major or minor. Candidates for the MAHS program are not required to have a specific undergraduate major or minor.

Criminal Background Check. Acceptance to the program will be contingent on the successful completion of a criminal background check. The background check is standardized and mandatory for all students. Any student who has a criminal offense documented through this procedure will have to address this on a case-by-case basis with the Program Director and Department Chair. Areas of concern may include, but are not limited to, felony convictions, especially those involving harm to others, theft or fraud convictions, and patterns of misdemeanors other than moving traffic violations.

Continuance in the program and admission to candidacy are based on success in academic courses and on personal, ethical, and performance considerations.

Graduates are eligible to sit for the National Certified Counselor examination. Those who complete the school counseling program are eligible to apply for licensure with the public schools of North Carolina.

On Campus and On-line Programs

There are two counseling programs offered through the Department of Counseling: the school counseling program and the clinical mental health counseling program. Both programs are offered on campus and via online delivery systems. The Department of Counseling also offers a masters of arts in human services which is offered via the online delivery system only. The campus programs are for full-time students and take three years to complete. Applications are accepted for entry into the on campus programs for the fall semester only. The online programs are for part-time students and take three years to complete. Applications are accepted for entry in the online programs for the fall, spring and summer semesters. Course and admissions requirements for on campus and online students are the same.

Course Requirements

The master of arts degree in counseling is awarded to candidates to successfully complete a minimum of 60 hours in a planned and directed program of study. Courses required by the program cannot be taken as Pass/Fail.

Master of Arts in Counseling - School Counseling

The school counseling program provides prospective school counselors with the knowledge, skills, and competence necessary to establish and conduct effective developmental guidance and counseling programs in schools, kindergarten through the 12th grade. The course of study which leads to a license in school counseling in North Carolina is based on the requirements of the North Carolina Department of Public Instruction and is accredited by the National Council for Accreditation of Teacher Education and by the Council on Accreditation of Counseling and Related Educational Programs (CACREP). School counseling students are not required to hold a teacher's license to enter the program.

Master of Arts in Counseling - Clinical Mental Health

In the clinical mental health program, students are prepared for counseling in a wide variety of community settings and agencies. The course of study is accredited by the Council on Accreditation of Counseling and Related Educational Programs (CACREP).

Master of Arts in Human Services (Online Only)

The Masters of Arts in Human Services degree is offered by the Department of Counseling via online delivery only. The degree will be awarded to candidates who successfully complete a minimum of 39 semester hours in a planned and directed program of study. The program consists of 30 hours of courses in common with the Masters in Counseling program, an additional 6 hours of specialized study in human services administration and programming, and 3 hours of field experience. At present, the Master of Arts in Human Service degree is offered only in an online delivery system. The MAHS degree takes seven semesters to complete. Applications are accepted for entry in the online programs for the fall, spring and summer semesters.

Residency Requirements

Two Thursday night through Sunday at noon residency experiences are required for online classroom students. These face-to-face sessions will allow faculty to engage in competency and readiness evaluations as well as to plan and evaluate practicum and internship arrangements. Students will also complete the experiential group requirements at this time. Dates will be announced six months in advance.

Courses of Instruction (All courses listed are open to counseling students only unless otherwise noted.)

721. Research Analysis in Counseling. (3) Qualitative and quantitative research methods. Analysis and evidence-based evaluation of research-based literature in the counseling field. Grant writing. Program evaluation. Descriptive, inferential, parametric and non-parametric statistical procedures involved in research.


736. Appraisal Procedures for Counselors. (3) Appraisal, assessment, and diagnosis of personality, emotional, intellectual, and learning characteristics and disorders of clients in schools, colleges, and community human service agencies. Use of tests in counseling as an adjunct to clinical impressions.

737. Basic Counseling Skills and Techniques. (3) Basic communication skills, helping relationships, and strategies for personal change. Issues and ethics in counseling.

738. Counseling Practicum. (3) Supervised experience for the development of individual and group counseling skills under individual and group supervision in a school or community agency. Involvement in direct service work and activities similar to those of regularly employed professional staff. Individual and group supervision of practicum experiences. P—EDU737

a. School b. Clinical mental health

739. Advanced Counseling Skills and Crisis Management. (3) Topics covered will be advanced and specialized counseling interventions including crisis intervention, suicide prevention, and emergency management models. Students will be required to demonstrate appropriate skill level. P—CNS 737

740. Professional Orientation to Counseling. (3) Covers the history, roles, organizational structures, ethics, standards, specializations, and credentialing in the profession of counseling. Public policy processes and contemporary issues are also considered.

741. Theories and Models of Counseling. (3) Study of theories and approaches to professional counseling: psychoanalytic (Freud, Adler, Jung), person-centered ( Rogers), existential (May, Frankl), behavioral (Skinner, Glasser), cognitive/rational (Ellis), holistic/systemic, eclectic. Professional orientation, issues, ethics, cultural pluralism, and trends in counseling.

742. Group Procedures in Counseling. (3) An experiential and conceptual exploration of the psychological dynamics and interpersonal communication of small groups, including group structure, leadership models, group process and practice, stages of group development, group techniques, and ethical principles.

743. Career Development and Counseling. (3) Vocational development throughout life; psychological aspects of work; occupational structure and the classifications of occupational literature; theories of vocational choice and their implications for career counseling.

744. Counseling Internship I. (2-3) Supervised counseling experience in a school, college, or clinical mental health agency under a regularly employed staff member professionally trained in counseling and in supervision. Active participation in direct service work to clients. Monitoring of audio or videotaped interviews. Case review. P—CNS 738

a. School b. Clinical mental health
745. Counseling Internship II. (2-3) Supervised counseling experience in a school, college, or clinical mental health agency under a regularly employed staff member professionally trained in counseling and in supervision. Active participation in direct service work to clients. Monitoring of audio or videotaped interviews. Case review. P—CNS 744
   a. School b. Clinical mental health


747. Cultures and Counseling. (3) The influence of culture in human development and in counseling relationships. A study of major theories and principles of human development across the life span, including physical, psychological, intellectual, social, and moral perspectives.


750. The Vienna Theorists—Freud, Adler, Moreno and Frankl. (3) Examination of the original writings of four of the leading theorists of modern counseling, which is enhanced by a visit to the city in which they initially formulated their clinical ideas. Students read and discuss several original writings of each practitioner—Freud, Adler, Moreno, and Frankl—prior to and during a two-week stay in the Wake Forest University Flow House in Vienna during which they visit relevant historical sites and institutes.

752. Human Services Administration (3) This course will focus on the knowledge, theory, and skills used in the administrative aspects of the human services delivery systems including organizational management, supervision, strategic planning, budgeting, and legal/regulatory issues. The course also covers managing the professional development of staff, recruiting and managing volunteers, and advocacy techniques. P—CNS 737, 741, 742

753. Human Services Program Planning and Evaluation (3) This course will focus on the range and characteristics of human services delivery systems and major conceptual models used to integrate prevention, maintenance, intervention, and rehabilitation and healthy functioning. The course includes the history of human services as well as the systematic analysis of service needs. The course also covers the selection of strategies, services or interventions and the evaluation of outcomes. P—CNS 737, 741, 742.

754. Human Services Fieldwork (3) Field experience is a learning experience in a human services delivery organization in which the student will complete 350 hours of on-site volunteer work with an agency. Students, university supervisors, and on-site partners will determine the student's role, activities, outcomes, and instructional needs based on placement site possibilities. P—CNS 752, 753.

755. Counseling Internship III. (2) Supervised counseling experience in a school, college, or clinical mental health agency under a regularly employed staff member professionally trained in counseling and in supervision. Active participation in direct service work to clients. Monitoring of audio or videotaped interviews. Case review. P—CNS 745
   a. School b. Clinical mental health

758. Studies in Educational Leadership. (3) This course includes examination of contemporary leadership theory and its various applications in education. It includes field work and reflections (Service Learning). P—EDU 664L

760. Issues in School Counseling. (3) Designed to allow students to investigate current issues related to the practice of school counseling. Emphasis is on identifying appropriate prevention responses to these issues.

762. Issues in Clinical Mental Health Counseling. (3) Examines specific issues related to clinical mental health counseling including, but not limited to, reimbursement, outcome evaluation, advocacy strategies, clinical mental health counselor roles and functions.

763. Specialized Study in Counseling. (1-3) Exploration of special topics or areas of practice in the field of counseling.

764. Creative Arts in Counseling. (1-3) Examines history, theories, processes, and techniques of using the creative arts in counseling with clients throughout the life span. Particular attention is given to the visual and verbal arts, such as drawing, imagery, photography, cartooning, cinema, movement, dance, literature, drama, and music.

765. Addiction Counseling. (3) Introduces the concepts of chemical dependency, counseling procedures and techniques, and treatment considerations. The student has opportunities to apply models of chemical dependency counseling to hypothetical situations at various stages of substance use.

766. Crisis Prevention and Response. (3) This course will present counseling approaches which effectivelly address crises. The course will examine the characteristics and impact of trauma and crisis and potential neurobiological responses. Students will gain knowledge and skills useful in theory-based prevention and response models and community-based strategies for a diverse society. Students will also explore counseling and human service contexts for application of assessment and intervention approaches in addressing specific crisis situations. POI

767. Human Sexuality. (3) This course is designed for counseling students whose work will bring them into contact with clients experiencing problems and concerns with their sexuality. The course is designed to develop: a.) students’ knowledge base related to human sexuality, b.) an understanding of the varied sexuality issues which may be encountered in professional counseling practice, c.) students’ skills in assessment and intervention skills with sexuality issues and d.) increased awareness of one's personal perceptions, attitudes and affect related to sexuality issues. Course participants will become more effective in identifying, assessing and intervening with human sexuality related counseling issues.

768. PsychoPharmacology for Counselors. (3) Students will learn the basic principles of psychopharmacology, pharmacokinetics, and neurobiology as they pertain to their role as a professional counselor. They will learn how psychopharmacological drugs are classified, prescribed, and managed. The information presented in this course will prepare student to function as knowledgeable members of multi-disciplinary treatment teams serving clients seeking counseling services. Finally, students will gain knowledge about the important and complex ethical and legal issues that surround the use of psychopharmacological drugs. POI

770. Classification of Mental and Emotional Disorders. (3) Analyzes healthy and unhealthy personality, as well as developmental and situational problems in adjustment. Studies the classification of mental disorders, as defined by the American Psychiatric Association in the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders. Examines appropriate ways in which diagnosis can be utilized by counselors to explore personality and systemic interventions for career, educational, and relationship concerns.


772. Marriage and Family Systems. (3) Study of the institutions of marriage and the family from
a general systems perspective. Exploration of how changes in developmental and situational aspects of the family life cycle influence individuals within the systems of marriage and the family. Both horizontal and vertical dimensions of change are focused on through the use of genograms. Different forms of family lifestyles, such as dual career, single parent, and blended are covered.

773. Family Counseling. (3) Examination of the philosophy and goals of seven major theories of family counseling (Bowenian, Adlerian, psychodynamic, experiential/humanistic, behavioral, structural, strategic) as well as the development of the profession of family counseling from an historical and current trends perspective. Differences between family counseling and individual/group counseling are highlighted and ethical/legal considerations for working with family units are stressed. Techniques associated with theories are demonstrated through video and play simulations. Research methods for gathering data on families are highlighted.

774. Marriage Counseling. (3) Study of the philosophy and goals of six main theories of marriage counseling (psychoanalytic, social learning, Bowenian, structural-strategic, experiential/humanistic, and rational-emotive) and the techniques associated with each. Historical and current trends associated with the field of marriage counseling are explored, along with related issues such as premarital counseling, family-of-origin influences within marriage, and widowhood. Appropriate marriage assessment instruments, research methods, and ethical/legal questions involved in marriage counseling are addressed.

775. Marital and Family Health and Dysfunctionality. (3) Examines system and individual dynamics associated with marital and family health and dysfunctionality. Longitudinal research on factors connected with healthy, long-term marriages and functional family life are explored. Interactive patterns that lead to such marital and family dysfunctionality as spouse and child abuse, anorexia nervosa, addictive disorders, and dependency are examined.

780. Professional, Ethical and Legal Issues in Counseling. (2) Provides an overview of the critical professional issues in counseling with emphasis on current ethical, legal, and values-related questions and the relationship of these issues to the counselor’s role in training, supervision, consultation, appraisal, and research. P—Advanced graduate standing or POI

782. Developmental Counseling Psychology. (3) Theoretical, research, and methodological aspects of a developmental/holistic/systems framework for counseling. Integration and application of major theories and approaches to counseling.

786. Consultation and Program Development in Counseling. (2) Consultation theory and process. Consultation with families, schools, colleges, and community agencies. Models for facilitating change in human systems.

790. Professional Identity Capstone Course. (2) Review and application of counseling skills, settings, practice parameters and other current issues necessary to integrate students into the profession of counseling. P—CNS 744

Documentary Film Program (DOC)

Reynolda Campus

Program Director Cynthia Hill and Cara Pilson
Professor Sandra Dickson
Professor of Practice Peter Gilbert

Overview

The Documentary Film Program offers an MFA degree through a three-year course of study and an MA through a two year course of study. The program admits students on a full-time basis only.

The comprehensive curriculum is designed not only to equip students with the skill set needed to produce professional quality films, but also to develop a respect for the traditions of the craft, an understanding of the economic aspects of the industry, and the intellectual discipline required to translate a creative vision into film. While this is a skills intensive curriculum, it is also a plan of study that emphasizes the social awareness elements that lie at the heart of the documentary tradition. The faculty believes it is imperative to impart to students the power and responsibility documentary filmmakers have in a world increasingly dependent on the moving image as a way to educate, inform, and affect change.

Requirements

The MFA requires 57 hours: The first two years of the program are dedicated to documentary core courses such as research, theory, writing, direction, and production and the development of the thesis film. The third year builds on the foundation of the first two years of study with courses in entrepreneurship and pedagogy, an option to take a teaching practicum, and the opportunity to produce an individual creative project. Students may also take elective courses in an area of special interest.

The MA requires 36 hours. Students take required documentary courses in research, theory, writing, direction, and production and develop and produce a short thesis film. Students will also have the opportunity to take additional coursework in sports storytelling

Courses of Instruction

701. Internship I. (1.5) Internships may be taken for 1.5 credits on a pass/fail basis when approved by faculty members. These internships provide students the opportunity for experiential learning at production houses, television networks, public television stations, and at other facilities deemed useful as well as with independent producers. Pass/Fall

702. Internship II. (1.5) Internships may be taken for 1.5 credits on a pass/fail basis when approved by faculty members. These internships provide students the opportunity for experiential learning at production houses, television networks, public television stations, and at other facilities deemed useful as well as with independent producers. Pass/Fall

713. Documentary Storytelling I. (3) The course provides an introduction to the fundamental theory and craft of non-fiction visual storytelling and familiarizes students with concepts such as drama structure, story development and visual style.

715. Cinematography and Sound. (3) Through a combination of lectures, film screenings, hands-on demonstrations, and field exercises, this course familiarizes students with the basics of documentary shooting, lighting, and sound gathering.

717. Fundamentals of Documentary Editing. (3) Through a combination of lectures, film screenings, hands-on demonstrations, and assignments, this course familiarizes students with the basics of documentary editing.

722. Documentary Storytelling II. (3) This course teaches students how to research, conceptualize and develop a non-fiction story idea. Students receive instruction on effective research strategies, idea development, production planning, and proposal writing and pitching. P—DOC713, DOC715, DOC 717,

724. Advanced Documentary Production. (3) Designed to teach theoretical, aesthetic, and technical principles of non-linear editing for documentary. Principally, students are taught how to: digitize and organize source material, create basic effects and titles, develop sequences, and organize and edit raw materials into a polished final product. P—DOC717

728. Documentary History. (3) Acquaints students with the historical development of documentary film from its roots in 19th-century art forms to the present. Examines various styles and techniques of documentary and analyzes the contribution of the documentary as a persuasive means of communication to achieve social and political goals. Open to all Wake Forest University graduate students with POI.

735. Documentary Law and Ethics. (3) Provides students with the opportunity to explore the ethical issues that can arise in documentary filmmaking. The discussion points will evolve from the in-depth examination of a select group of films and directors.

737. Documentary Storytelling III. (3) The class focuses on advanced principles of writing,
producing, directing and editing documentary. Theoretical, aesthetic, technical and ethical aspects of the creative non-fiction storytelling process will be the focus. The class format will be a combination of theory and practice as it relates to the dramaturgical process of filmmaking. P—DOC 713, DOC 715, DOC 717, DOC 728, DOC 722, DOC 724, DOC 750

746. Documentary Storytelling IV. (3) The course combines lectures, screenings, and exercises to build a technical and aesthetic foundation in digital post-production. Special emphasis will be placed on advanced visual storytelling techniques—including continuity, pacing, character development and dramatic structure. Students will also explore various distribution strategies and transmedia applications P—DOC 713, DOC 715, DOC 717, DOC 728, DOC 722, DOC 724, DOC 750, DOC 735, DOC 737, DOC 748.

748. Creative Thesis Project. (9) Students work under faculty supervision on a creative thesis project.

750. The Imagination Project (6) Students will produce short films, digital study guides or E-books and/or other types of multimedia materials on important social, political, cultural and economic issues. The course, structured around digital media projects, provides opportunities for students to immerse themselves in a single topic and interact with scholars from various disciplines. The topics will vary each year. Students take this course in their first year and in their third year for a total of 6 credits. P—1st year students: DOC 713, DOC 715, DOC 717, DOC 728; 3rd year students: DOC 713, DOC 715, DOC 717, DOC 728, DOC 722, DOC 724, DOC 750 (first year course), DOC 735, DOC 737, DOC 748, DOC 746, DOC 751, DOC 755.

751. Pedagogy and Curriculum. (3) Provides an understanding of pedagogical practices and major theories of curriculum and provide a foundation for students interested in pursuing careers in academe.

753. Individual Study. (1-3) For students who wish to perform independent study in a cognate area with a professor from the Documentary Film Program or another program. May be repeated for credit for a maximum of 9 hours.

755. Entrepreneurship Education in Non-fiction Filmmaking. (3) This course will provide students with the knowledge and skills to help them create their own creative arts venture and help them design and teach a course in entrepreneurship in the creative arts, particularly digital media and non-fiction filmmaking.

764. Individual Study. (1-3) For students who wish to perform independent study in a cognate area with a professor from the Documentary Film Program or another program. May be repeated for credit for a maximum of 9 hours.

766. Teaching Practicum. (3) Students work closely with Documentary Film Program faculty during the teaching of an undergraduate course. Students participate in the design and development of course material and observe classroom and organizational aspects of teaching in an apprenticeship role. Satisfactory/Unsatisfactory

780. Special Topics. (3) Intensive study of selected topics in documentary film. Topics may be drawn from any content area of documentary studies and production. May be repeated for credit for a maximum of 6 hours.

Education (EDU)

Reynolda Campus

Program Director
Leah McCoy

Chair
Adam Friedman

Professors
Leah P. McCoy, Linda N. Nielsen, Mary Lynn Redmond

Associate Professors
Ann Cunningham, Adam Friedman

Assistant Professors
M. Alan Brown, Sarah Fick, Donal Mulcahy, Geoff Price

Overview
The Department of Education offers professional graduate programs in teacher education. The goals and requirements for these programs are available in the Licensure Office of the department.

Initial Licensure Program – Master Teacher Fellows (MTF). This thirteen-month program involves coursework and fieldwork, including one semester of full-time student teaching. It is offered for either Secondary (grades 9-12) or for Elementary (grades K-6). For secondary, students must have a Bachelor's degree (or equivalent coursework) in one of our content areas: English, Foreign Languages (French or Spanish, K-12), Mathematics, Science (Biology, Chemistry, or Physics), or Social Studies.

Advanced Licensure Program – Master Teacher Associates (MTA). This program provides an extension of the candidate's current teaching license. It is also thirteen months and it includes coursework and other requirements to foster the candidate's further development in content, pedagogy, and leadership. It is offered for either Elementary or Secondary levels.

Non-Licensure Program – Master of Educational Studies (MES). This program is for students who are interested in education, but choose not to seek a teaching license.

Certificate Program – The Curriculum, Instruction, and Assessment Certificate is appropriate for those with elementary, secondary, or higher education interest.

Requirements
Graduate work in the Department of Education is offered leading to the master of arts in education degree. In addition to qualifying for admission to the Graduate School, candidates for the master of arts in education degree seeking a North Carolina Class M Teacher's License must possess a North Carolina Class A Teacher's License or its equivalent. Master Teacher Fellows are not expected to hold a teacher's license when they enter the program.

Residence Requirement. Full-time teacher education students complete the program in one academic year. Students enrolled on a part-time basis may require three years or longer to complete the degree. The master of arts in education degree is awarded to candidates who successfully complete the following requirements within six calendar years of the date of initial enrollment in the Graduate School. Credit may be awarded for as many as six hours of graduate work transferred from another institution at the discretion of the program director and dean of the Graduate School.

Course Requirements. The Master Teacher Fellows program requires 44-47 semester hours. The Master Teacher Associates and Master of Educational Studies programs each require 39 semester hours. The Curriculum, Instruction, and Assessment Certificate requires 15 credit hours. Field-based courses, including 614L, 650L, 664L, and 665, are offered only as pass/fail. All remaining coursework must be taken for a grade. All courses must be approved, and an overall grade-point average of B must be maintained. The course requirements must be completed in courses numbered 600 or above, with at least half of the total number of required hours in courses numbered 700 or above.

Research Competence in Teacher Education. Research competence in Teacher Education includes a set of three courses that include both research studies and personal reflection.

Admission to Degree Candidacy. A student is admitted to degree candidacy by the dean of the Graduate School after recommendation by the education department. The student must expect to complete the master's degree requirements with one additional semester's work.

Licensure Only Coursework. Students who wish to enroll in graduate courses to obtain or renew a license may seek admission through the Licensure Officer of the Department of Education. The GRE is not required. A copy of the Title II Federal Report Card may be obtained in the Licensure Office of the department.

Courses of Instruction
601. Microcomputer and Audiovisual Literacy. (3) Introduction to microcomputers for educators and other users, emphasizing familiarity with computers, use and evaluation of software, and elementary programming skills. Experience with audiovisual materials and techniques is included.

602. Production of Instructional Materials. (3) Methods of producing instructional materials and other technological techniques. P—EDU 601 and senior or graduate standing.
603. History of Western Education. (3) Educational theory and practice from ancient times through the modern period, including American education.

604. Social Justice Issues in Education. (3) This course facilitates exploration of issues of social justice and schooling from both theoretical and practical perspectives. It includes a focus on multicultural education, global awareness, issues of equity in school funding, urban and rural education, poverty, and marginalized populations.

605. The Sociology of Education. (3) Study of contemporary educational institutions. Examines such issues as school desegregation, schooling and social mobility, gender equity, and multiculturality.

606. Studies in the History and Philosophy of Education. (3) Study of selected historical eras, influential thinkers, or crucial problems in education. Topics announced annually.

612. Teaching Children with Special Needs. (3) Survey of the various types of learning problems commonly found in elementary children. Students observe exemplary programs, tutor children with special needs, and attend seminars on effective instructional techniques.

613. Human Growth and Development. (3) Theories of childhood and adolescent development, their relation to empirical research, and their educational implications. Consideration of the relation to learning of physical, intellectual, emotional, social, and moral development in childhood and adolescence.

614. Elementary Teaching Rounds. (2) Includes practical experiences in elementary classrooms with focus on pedagogy and content. Weekly public school experience and seminar. Pass/Fail

637. TESOL Linguistics. (3) Introduction to the theoretical and practical linguistics resources and skills for teaching English to speakers of other languages (TESOL) within the U.S. or abroad. P--LIN/ANT 150, or ENG 304

641. Teaching Elementary Literacy. (3) Methods and materials for implementing research-based strategies for teaching and assessing reading, writing, listening and speaking in grades K-6.

642. Teaching Elementary Social Studies. (3) Methods and materials for teaching K-6 social studies, including adaptations for diverse and exceptional learners. Also includes experience in diverse elementary classrooms

643. Teaching Elementary STEM (Science, Technology, Engineering, Mathematics). (3) Methods and materials for teaching STEM subjects in elementary schools, emphasizing inquiry teaching and learning, and including adaptations for diverse and exceptional learners.


651. Adolescent Psychology. (4) Introduction to theories of adolescent psychology as related to teaching and counseling in various settings. Readings emphasize researchers' suggestions for parenting, teaching, and counseling adolescents between the ages of 13 and 19.

654. Content Pedagogy. (3) Methods, materials, and techniques used in teaching particular secondary subjects (English, mathematics, science, second languages, social studies).

654L. Content Pedagogy Rounds. (2) Practical experiences in classrooms with focus on pedagogy and content. Weekly public school experience and seminar. Pass/Fail


661. Foundations of Education. (3) Philosophical, historical, and sociological foundations of education, including analysis of contemporary issues and problems.

664L. Student Teaching Internship. (9) Supervised teaching experience in grades 9-12 (K-12 for foreign language). Full-time, 15-week field experience. Includes a weekly on-campus seminar. Pass/Fail


668. Professional Experience in Education. (3) This course offers students a placement in an educational setting under the supervision of a professional mentor. During this internship, students examine a critical topic in a local school, a community agency, a nonprofit organization, or other educational setting.

673. Student Teaching Seminar. (1.5) Analysis and discussion of practical problems and issues in the teaching of particular secondary subjects (English, mathematics, science, second languages, social studies). Emphasis is on the application of contemporary instructional methods and materials. Includes prior (intercession) 20 hours field experience requirement.

677. Literacy in the 21st Century. (3) This course examines the impact of emerging literacy trends on 21st century students in a digital, global world. There is specific focus on engaging reluctant and struggling readers.

681. Special Needs Seminar. (1) Analysis and discussion of practical problems and issues in the teaching of special needs students in the secondary classroom. Topics include classroom management, reading and writing in the content area, inclusion, and evaluation. Pass/Fail

682. Reading and Writing in the Content Areas. (2) Survey of methods for teaching reading and writing to help students learn in the various content areas, and of techniques for adapting instruction to the literacy levels of students.

683. Classroom Management Seminar. (1) Examination of research and practice-based strategies for secondary school classroom management and discipline Pass/Fail

684. Creative Research Methodologies. (2) Investigation of source materials, printed and manuscript, and research methods which are applied to creative classroom experiences and the preparation of research papers in literature and social studies.

685. Diversity Seminar. (1) Exploration of multi-cultural issues and relevant Spanish language and cultural teaching practices essential for classroom communication. Pass/Fail

687. Tutoring Basic Writing. (2) Review of recent writing theory applicable to teaching basic writers (including the learning disabled and non-native speakers). Special attention to invention strategies and heuristic techniques. Includes experience with tutoring in the Writing Center. (Credit not allowed for both EDU 387 and ENG 387.)

688. Writing Pedagogy. (3) This course blends theory and practice, providing students from all content areas with a foundational understanding of writing pedagogy methods and approaches. Topics of study will include writing across the curriculum, writing research and writing assessment.

690. Methods and Materials for Teaching Foreign Language (K-6). (3) Survey of the basic materials, methods, and techniques of teaching foreign languages in the elementary and middle grades. Emphasis is on issues and problems involved in planning and implementing effective second language programs in grades K-6. Spring only.

693. Individual Study. (3) A project in an area of study not otherwise available in the department; permitted upon departmental approval of petition presented by a qualified student. May be repeated for credit.

695. Teaching Diverse Learners. (3) This course addresses diversity in the classroom, particularly the needs of English Language Learners (ELL) and Exceptional Children (EC). It examines differentiated instruction with appropriate instructional and behavioral strategies to meet the needs of all students.

698. Seminar in Secondary Education. (1) Investigation of the issues that form the context for teaching in secondary schools.

705. Sociology of Education. (3) Study of contemporary society and education, including goals and values, institutional culture, and the teaching/learning process.
707. Educational Policy and Practice. (3) Examination of the impact of race, ethnicity, and social class on educational achievement and attainment, including consideration of philosophical, historical, and sociological issues.

708. School and Society. (3) Study of continuity and change in educational institutions, including analysis of teachers, students, curriculum, assessment and evaluation, and contemporary problems and reform movements.

711. Reading Theory and Practice. (3) Study of current reading theory and consideration of its application in the teaching of reading, grades K-12.

712. Learning and Cognitive Science. (3) Examination of patterns of human development, and theories and principles of cognition applied to teaching and learning.

713. Classroom Climate: Classroom Management and Conflict Resolution. (3) This course focuses on the development and maintenance of a safe, orderly, and respectful classroom environment in conjunction with advanced pedagogical strategies. Students learn classroom management and conflict resolution techniques while considering their own teaching practices.

714. Advanced Content Pedagogy. (3) This course assists students in developing skills for content-specific teaching of critical thinking and problem solving while building upon existing pedagogical content knowledge through collaboration that is rooted in current practice, and addressing state and national standards.

715. Action Research I. (3) Individual planning for action research study on a specific pedagogical topic in a school setting. Includes definition of research problem, literature review, and proposal for collection of field data and reporting of results.

716. Professional Growth Seminar. (3) Students will provide reflections on their teaching experiences, report the results of their action research, and define their professional goals.

717. Instructional Design, Assessment and Technology. (3) Introduction to contemporary technologies and their applications for supporting instruction, assessment, professional practice, and school leadership.

718. Advanced Multimedia Technology in Education. (3) This course develops advanced technology skills and knowledge of how to incorporate technology tools into pedagogical practice through a variety of assignments including an implementation project.


725. Action Research II. (1) Reporting of results of action research study on pedagogical topic. Includes oral and written presentations.

730L. Service Learning: Tutoring. (1) Practical experiences in classrooms with focus on tutoring and assisting with preparation for standardized testing. Includes field work and reflection. Pass/Fail

731. Foundations of Curriculum Development. (3) Philosophical, psychological, and social influences on the school curriculum. Examination of both theoretical and practical curriculum patterns for the modern school. Processes of curriculum development, including the leadership function of administration and research.

733. Supervision of Instruction. (3) Analysis of various techniques of supervision: orientation of teachers, in-service education, classroom observation, individual follow-up conferences, ways to evaluate instruction, and methods for initiating changes.

735. Assessment of Teaching and Learning. (3) This course focuses on the assessment of learning from a theoretical and practical perspective. It includes an understanding of formative and summative assessments, traditional and non-traditional assessments, standardized testing, and the interpretation and application of test data.


751. Adolescent Psychology. (3) Introduction to theories of adolescent psychology as related to teaching and counseling in various settings. Readings emphasize researchers' suggestions for parenting, teaching, and counseling adolescents between the ages of 13 and 19.

758. Studies in Educational Leadership. (3) Examination of contemporary leadership theory and its various applications in education.

764. Seminar in Curriculum and Instruction. (3) Exploration of special topics in the field of curriculum and instruction.

781. Methodology and Research. (3) Advanced study of the methods and materials of a specific discipline (English, French, Spanish, social studies, mathematics, science) in the curriculum with special attention directed to the basic research in the discipline. Includes 20 hours field experience/project.

783. Readings and Research in Education. (1-3) Independent study and research on topics relevant to the student's field of concentration which may include a special reading program in an area not covered by other courses or a special research project. Supervision by faculty members. Hours of credit to be determined prior to registration. May be repeated for credit.

784. Research in Writing. (3) Investigation of selected topics related to the writing process.

785. Teaching Writing. (3) Examination of the theories and methods of instruction of writing.

787. Teaching Advanced Placement. (2 or 3) Investigation of the content of and the pedagogy appropriate to advanced placement courses in the various disciplines. A. English Literature and Composition; B. Calculus; C. English Language and Composition; J. Chemistry; L. U.S. Government and Politics; M. Psychology; L. U.S. History. Offered in summer only.

788. Teaching Foreign Languages in the Elementary Grades. (2) Intensive period of observation and instruction in an elementary school setting with a foreign language specialist. Methods for development of listening, speaking, reading, writing, and cultural awareness using content-based instruction and thematic units.

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English (ENG)  
Reynolda Campus

Program Director: Omaar Hena  
Chair: Scott W. Klein  
Associate Chair: Dean J. Franco

Reynolds Professor of English: Herman Rapaport  
Charles E. Taylor Professor of English: James S. Hans

Thomas H. Pritchard Professor of English: Eric G. Wilson

Professors: Anne Boyle, Dean Franco, Jefferson M. Holdridge, Claudia Thomas Kairoff, Scott W. Klein, Philip F. Kuberski, Barry G. Maine, William M. Moss, Gillian R. Overing, Gale Sigal

Associate Professors: Omaar Hena, Melissa S. Jenkins, Judith Madera, Jessica A. Richard, Erica Still, Olga Valbuena-Hanson

Assistant Professors: Laura Aull, Amy Catanzano, Susan Harlan, Sarah Hogan, Zak Lancaster, Joanne Ruocco

Overview: The courses for which credit may be earned toward the fulfillment of requirements for the MA degree offer opportunities for study and research in most of the major areas of both British and American literature and in the English language. The courses for graduates only (numbered
above 700) stress independent study and research out of which theses may develop. With approval by the departmental graduate committee, students may take one or two related courses in other departments.

Applicants for graduate work in the department are expected to hold an undergraduate degree in English from an accredited institution. This major should consist of a well-rounded selection of courses demonstrating significant exposure to the range of literatures written in English and to ideas of literary history and interpretation. Candidates for degrees are required to have a reading knowledge of a modern foreign or classical language. While no individual language course taken as an undergraduate may be used to fulfill the language requirement, evidence of 18 hours (six semesters) of undergraduate work in a single language will be accepted as fulfilling the requirement. The student can also meet this requirement by making a satisfactory grade in an advanced reading course in a foreign language taken in residence at the University or by satisfactorily passing a translation examination administered by the English department.

**Degree and Grade Requirements:**

8 Courses (24 credit hours) with an average grade of B or above: at least 5 courses at the 700-level, with three additional courses at the 600-level, or 6 courses at the 700-level and 2 courses at 600-level. A number of credit hours are allotted for doing thesis research; these courses receive a grade of satisfactory or unsatisfactory only.

**Courses of Instruction**

601. Individual Authors. (3) Study of selected works from an important American or British author.

602. Ideas in Literature. (3) Study of a significant literary theme in selected works.

603. History of the English Language. (3) Survey of the development of English syntax, morphology, and phonology from Old English to the present, with attention to vocabulary growth.

604. Old English Language and Literature. (3) Introduction to the Old English language and a study of the historical and cultural background of Old English literature, including Anglo-Saxon and Viking art, runes, and Scandinavian mythology. Readings from *Beowulf* and selected poems and prose.

605. Special Topics in Rhetoric and Writing. (1.5, 3) Study of significant rhetorical or writing theories and practices focused on one area of study.

606. Beowulf. (3) This course offers an intensive study of the poem, with emphasis on language, translation skills and critical contexts.

607. Modern English Grammar. (3) A linguistics approach to grammar study. Includes a critical exploration of issues such as grammatical change and variation, the origins and effects of grammar prescriptions/proscriptions, the place of grammar instruction in education, and the politics of language authority.

610. The Medieval World. (3) Examines theological, philosophical and cultural assumptions of the Middle Ages through the reading of primary texts. Topics include Christian providential history, drama, devotional literature, the Franciscan controversy, domestic life and Arthurian romance.

611. The Legend of Arthur. (3) The origin and development of the Arthurian legend in France and England with emphasis on the works of Chrétien de Troyes and Sir Thomas Malory.

612. Medieval Poetry. (3) The origin and development of poetic genres and lyric forms of medieval vernacular poetry.

613. The Roots of Song. (3) Interdisciplinary investigation of poetry and song in the Middle Ages and early Renaissance. Study of the evolution of poetic and musical genres and styles, both sacred and secular. Students must complete a project or projects on the technical or theoretical aspects of early song.

615. Chaucer. (3) Emphasis on *The Canterbury Tales* and *Troilus and Criseyde*, with some attention to minor poems. Consideration of literary, social, religious, and philosophical background.

619. Virgil and His English Legacy. Study of Virgil's *Eclogues*, *Georgics*, and selected passages of the *Aeneid*, and their influence on English literature, using translations and original works by writers of the 16th through the 18th centuries, including Spenser, Marlowe, Milton, Dryden, and Pope. Knowledge of Latin not required.

620. British Drama to 1642. (3) British drama from its beginnings to 1642, exclusive of Shakespeare. Representative cycle plays, moralities, Elizabethan and Jacobean tragedies, comedies, and tragicomedies.

623. Shakespeare. (3) Thirteen representative plays illustrating Shakespeare's development as a poet and dramatist.

625. 16th-Century British Literature. (3) Concentration on the poetry of Spenser, Sidney, Shakespeare, Wyatt, and Drayton, with particular attention to sonnets and *The Faerie Queene*.

626. Studies in English Renaissance Literature. (3) Selected topics in Renaissance literature. Consideration of texts and their cultural background.

627. Milton. (3) The poetry and selected prose of John Milton with emphasis on *Paradise Lost*.


630. Restoration and 18th Century British Literature. (3) Representative poetry and prose, exclusive of the novel, drawn from Addison, Steele, Defoe, Swift, Pope, Johnson, and Boswell. Consideration of cultural backgrounds and significant literary trends.

631. 18th-Century British Fiction. (3) Primarily the fiction of Defoe, Richardson, Fielding, Smollett, Sterne, and Austen.

636. Restoration and 18th-Century British Drama. (3) British drama from 1660 to 1780, including representative plays by Dryden, Etherege, Wycherley, Congreve, Goldsmith, and Sheridan.


641. Literature and the Environment. (3) This course studies the relationship between environmental experience and literary representation.

644. Studies in Poetry. (3) Selected topics in poetry.

645. Studies in Fiction. (3) Selected topics in fiction.

646. Studies in Theatre. (3) Selected topics in theatre.


651. Studies in Romanticism. (3) Selected topics in European and/or American Romanticism with a focus on comparative, interdisciplinary, and theoretical approaches to literature.

653. 19th-Century British Fiction. (3) Representative major works by Dickens, Eliot, Thackeray, Hardy, the Brontës, and others.


656. Literature of the Caribbean. (3) Readings include significant works by authors from the Caribbean and authors writing about the Caribbean. Critical, historical, and cultural approaches are emphasized. All texts are in English.

658. Postcolonial Literature. (3) Survey of representative examples of postcolonial literature from geographically diverse writers, emphasizing issues of politics, nationalism, gender, and class.

659. Studies in Postcolonial Literature. (3) Examination of themes and issues in postcolonial literature, such as: globalization, postcolonialism and hybridity, feminism, nationalism, ethnic and religious conflict, the impact of the Cold War, and race and class.

660. Studies in Victorian Literature. (3) Selected topics such as development of genres, major authors and texts, cultural influences. Reading in poetry, fiction, autobiography, and other prose.

661. Literature and Science. (3) Literature of and about science. Topics vary and may include literature and medicine, the two-culture debate, poetry and science, nature in literature, the body in literature.

662. Irish Literature in the 20th Century. (3) Study of modern Irish literature from the writers of the Irish Literary Renaissance to contemporary writers. Course consists of overviews of the period as well as specific considerations of genre and of individual writers.

663. Studies in Modernism. Selected issues in Modernism. Interdisciplinary, comparative, and theoretical approaches to works and authors.

664. Studies in Literary Criticism. (3) Consideration of certain figures and schools of thought significant in the history of literary criticism.

665. 20th-Century British Fiction. (3) A study of Conrad, Ford, Forster, Joyce, Lawrence, Woolf and later British writers, with attention to their social and intellectual backgrounds.

666. James Joyce. (3) The major works by Joyce, with an emphasis on Ulysses.

667. 20th-Century English Poetry. (3) A study of 20th-century poets of the English language, exclusive of the U.S. Poets will be read in relation to the literary and social history of the period.

668. Studies in Irish Literature. (3) The development of Irish literature from the 18th century through the early 20th century in historical perspective, with attention to issues of linguistic and national identity.

669. Modern Drama. (3) Main currents in modern drama from 19th-century realism and naturalism through symbolism and expressionism. After an introduction to European precursors, the course focuses on representative plays by Wilde, Shaw, Synge, Yeats, O'Neill, Eliot, Hellman, Wilder, Williams, Hansberry, and Miller.


671. American Ethnic Literature. (3) Introduction to the field of American Ethnic literature, with special emphasis on post World War II formations of ethnic culture: Asian American, Native American, African American, Latino, and Jewish American. The course highlights issues, themes, and stylistic innovations particular to each ethnic group and examines currents in the still developing American culture.

672. American Romanticism. (3) Studies of Romanticism in American literature. Focus varies by topic and genre, to include such writers as Emerson, Thoreau, Hawthorne, Melville, Whitman, and Dickinson.

673. Literature and Film. (3) Selected topics in the relationship between literature and film, such as adaptations of literary works, the study of narrative, and the development of literary and cinematic genres.

674. American Fiction before 1865. (3) Novels and short fiction by such writers as Brocken, Cooper, Irving, Poe, Hawthorne, Melville, Stowe, and Davis.


676. American Poetry before 1900. (3) Readings and critical analysis of American poetry from its beginnings, including Bradstreet, Emerson, Longfellow, Melville, and Poe, with particular emphasis on Whitman and Dickinson.

677. American Jewish Literature. (3) Survey of writings on Jewish topics or experiences by American Jewish writers. Explores cultural and generational conflicts, responses to social change, the impact of the Shoah (Holocaust) on American Jews, and the challenges of language and form posed by Jewish and non-Jewish artistic traditions.

678. Literature of the American South. (3) Study of Southern literature from its beginnings to the present, with emphasis upon such major writers as Tate, Warren, Faulkner, O'Connor, Welty, and Styron.

679. Literary Forms of the American Personal Narrative. (3) Reading and critical analysis of autobiographical texts in which the ideas, style, and point of view of the writer are examined to demonstrate how these works contribute to an understanding of pluralism in American culture. Representative authors include Douglass, Brent, Hurston, Wright, Kingdom, Angelou, Wideman, Sarton, Hellman, and Dillard.

680. American Fiction from 1865 to 1915. (3) Study of such writers as Twain, James, Howells, Crane, Dreiser, Wharton and Cather.

681. Studies in African-American Literature. (3) Reading and critical analysis of selected fiction, poetry, drama, and other writings by American authors of African descent.


683. Theory and Practice of Poetry Writing. (3) Emphasis on reading and discussing student poems in terms of craftsmanship and general principles.

684. Playwriting. (3) Examines the elements of dramatic structure and their representations in a variety of dramatic writings. Explores the fundamentals of play writing through a series of writing exercises.

685. 20th-Century American Poetry. (3) Readings of modern American poetry in relation to the literary and social history of the period.

686. Directed Reading. (1-3) A tutorial in an area of study not otherwise provided by the department; granted upon departmental approval of petition presented by a qualified student. May be repeated for credit if topic varies.


690. The Structure of English. (3) Introduction to the principles and techniques of modern linguistics applied to contemporary American English.

691. Studies in Postmodernism. (3) Interdisciplinary, comparative, and theoretical approaches to works and authors.

692. Magazine Writing. (3) Analysis of magazines and their audiences through tone, design, and content. Practice story pitches and writing articles of various lengths aimed at a stated magazine which studies research and select. Digital skills practiced; class magazine produced.

693. Multicultural American Drama. (3) Examine the dramatic works of playwrights from various racial and ethnic communities such as Asian American, Native American, and Latino. Includes consideration of issues, themes, style, and form.

694. Contemporary Drama. (3) Considers experiments in form and substance in plays from Godot to the present. Readings cover such playwrights as Beckett, Osborne, Pinter, Stoppard, Churchill, Wertenbaker, Albee, Shepard, Mamet, Wilson, Soyinka, and Fugard.
695. Contemporary American Literature. (3) Study of post-World War II American poetry and fiction by such writers as Bellow, Gass, Barth, Pynchon, Morrison, Ashbery, Ammons, Bishop, and Rich.

696. Contemporary British Fiction. (3) Study of the British novel and short story, with particular focus on the multicultural aspects of British life, including work by Rushdie, Amis, Winterson, and Ishiguro.

697. Creative Nonfiction. (3) A writing-intensive course exploring the practice and theory of nonfiction, a genre that encompasses memoir, the personal essay, travel writing, and science writing.

698. Advanced Fiction Writing. (3) Primarily a short story workshop with class discussion on issues of craft, revision, and selected published stories.

699. Practice in Rhetoric and Writing. (3) Training and practice in the reading and writing of expository prose. Students study the uses of rhetoric to frame arguments and marshal evidence, then learn to practice these skills in their own writing of expository prose.

700. Teaching Internship. (1.5) An internship for the observation and practice of undergraduate pedagogy, placing an MA student into a core literature course taught by a tenured or tenure-track professor, typically in the first semester of the student's second year. Arranged by permission or invitation of the supervising faculty member. Must be taken as an overload in addition to the coursework for the degree. May be repeated for credit for a maximum of 3 hours.

701. Individual Authors. (3) Study of selected works from an important American, English, or Global Anglophone author.

702. Ideas in Literature. (3) Study of a significant literary theme in selected works.

710. Early Medieval Narrative. (3) A variety of forms of early medieval narrative (history, saga, chronicle, poetry, hagiography), with a focus on issues of genre and narrative form, connections between story and history, and the text's relation to the culture that produced it. Emphasis is on interdisciplinary viewpoints (artistic, archaeological, geographic), and on contemporary narrative theory.

711. Studies in the Arthurian Legend. (3) Emphasis is on the origin and developments of the Arthurian legend in England and France, with primary focus on Malory's Le Morte d'Arthur. Attention to social and intellectual backgrounds.

712. Studies in Medieval Literature: Romance and Identity. (3) A diverse corpus of medieval poetry, both lyric and narrative, is explored in an effort to trace the origin and evolution of the idea and meaning of "romance," a term signifying, for the medieval audience, narrative poetry in the vernacular, and, for our purposes, that uniquely new concept of ennobling love that emerged in the 12th century.

715. Studies in Chaucer. (3) Emphasis on selected Canterbury Tales, Troilus and Criseyde, and the longer minor works, with attention to social, critical, and intellectual background. Lectures, reports, discussions, and a critical paper.

720. Renaissance Drama. (3) Using an historical approach, this seminar examines the relationship between the theater as an institution and centers of authority during the Tudor and Stuart periods. The plays—tragedies, comedies, tragicomedies—are approached as the products of a dynamic exchange between individual authors and the larger political and social concerns of the period.

721. Studies in Spenser. (3) Emphasis on The Faerie Queene; attention to the minor works; intellectual and critical background. Lectures, discussions, and class papers.

722. Studies in 16th-Century British Literature. (3) Introduction to critical and scholarly methodology for the study of the literature; particular emphasis on Spenser's Faerie Queene and Sidney's Arcadia.

723. Studies in Shakespeare. (3) Representative text from all genres, examined in light of critical methodologies in the field of Shakespeare studies. Emphasis is on reading primary sources as well as on discussion of the impact that historical, cultural, and religious developments had on Shakespeare, the theater, and the thematics of his plays.

725. Studies in 17th-Century British Literature. (3) Non-dramatic literature of the 17th century, exclusive of Milton. Emphasis on selected major writers. Lectures, discussions, and presentation of studies by members of the class.


733. 18th-Century British Fiction. (3) A study of two major British novelists of the 18th century. Lectures, reports, critical papers. Authors for study chosen from the following: Defoe, Richardson, Fielding, Smollet, and Austen.

737. Studies in Restoration and 18th-Century British Literature. (3) Selected topics in Restoration and 18th-century literature. Consideration of texts and their cultural background.

740. Studies in Gender and Literature. (3) An examination of selected writers and/or theoretical questions focusing on issues of gender.

743. 19th-Century British Fiction. (3) Study of one or more major British novelists of the 19th century. Lectures, reports, discussions, and a critical paper. Authors for study chosen from the following: Austen, Dickens, Thackeray, Eliot, and Hardy.

745. British Poetry of the 19th and 20th Centuries. (3) Study of several British poets chosen from the major Romantics, Tennyson, Browning, Hardy, and Yeats.

746. Studies in British Romanticism. (3) Examination of major writers, topics, and/or theoretical issues from the late 18th and early 19th centuries.

757. American Poetry. (3) Studies of the poetry and poetic theory of three major American writers in the 19th and 20th centuries. Writers chosen from the following: Whitman, Dickinson, Frost, Eliot, Stevens, or Williams. Discussions, reports, and a critical paper.


759. Studies in Postcolonial Literature. (3) Examination of themes and issues in postcolonial literature and/or theory such as globalization, identity and hybridity, feminism, nationalism, ethnic and religious conflict, the impact of neo-imperialism and economic policy, and race and class.

760. Studies in Victorian Literature. (3) Selected topics such as development of genres, major authors and texts and cultural influences of Victorian Literature. Readings in poetry, fiction and autobiography, and other prose.

763. Studies in Modernism. (3) This course will examine elected issues in Modernism, from interdisciplinary, comparative, and theoretical approaches.

765. Literary Criticism. (3) Review of historically significant problems in literary criticism, followed by study of the principal schools of 20th-century critical thought. Lectures, reports, discussions, and a paper of criticism.

766. Studies in 20th-Century British Literature. (3) Examination of major writers, topics and/ or theoretical issues in 20th-century British literature. In addition to fiction, the course focuses on drama, theory, prose readings, and poetry.

767. 20th-Century British Fiction. (3) Study of one or more of the major British novelists of the 20th century. Authors chosen from among the following: Conrad, Ford, Forster, Joyce, Lawrence, or Woolf.

768. Irish Literature. (3) Study of major themes, theories, individual authors, or periods, which might include discussions of mythology, folklore, landscape, poetic, narrative strategies, gender, and politics.

771. American Ethnic Literature. (3) Examination of how ethnic writers narrate cultural histories and respond to and represent the ambiguity of cultural location. Literary topics include slavery, exile, the Holocaust, immigration, assimilation, and versions of the American Dream.

774. American Fiction Before 1865. (3) Study of novels and short fiction by such writers as Brown, Cooper, Irving, Poe, Hawthorne, Melville, Stowe, and Davis.

776. American Poetry Before 1900. (3) Close reading and critical analysis of selected American poets, such as Bryant, Longfellow, Poe, Emerson, Whitman, and Dickinson.

779. Autobiographical Voices: Race, Gender, Self-Portraiture. (3) Using an historical and critical approach, this seminar examines autobiography as an activity which combines history, literary art, and self-revelation. Lectures, reports, discussions, a critical journal, a personal narrative, and a critical paper. Authors for study chosen from the following: Douglass, Brent, Hurston, Wright, Angelou, Crews, Dillard, Moody, Malcolm X, Kingston, Wideman, or Sarton.

780. Studies in American Fiction from 1865 to 1915. (3) Study of the principal fiction of one or more major American writers of the late 19th and early 20th centuries. Lectures, seminar reports, and a research paper. Authors for study chosen from the following: Twain, James, Howells, Adams, Crane, Dreiser, Wharton, or Cather.


782. Studies in American Fiction from 1915 to 1965. (3) Study of the principal fiction of one or more major American writers of the 20th century. Writers are chosen from the following: Cather, Lewis, Hemingway, Fitzgerald, Faulkner, Dos Passos, Wolfe, Baldwin, Ellison, Agee, O’Connor, Percy, or Pynchon.

783. Contemporary American Fiction. (3) Seminar devoted to the close study of some of the most important novels produced in the United States since World II.

784. Contemporary American Poetry. (3) Seminar devoted to the close study of some of the most important poems written in America since World War II.

786. Directed Reading. (1-3) A tutorial in an area of study not otherwise provided by the department; granted upon departmental approval of petition presented by a qualified student. May be repeated for credit if topic varies.

789. Linguistics in Literature. (3) Examination of theories of grammar and attitudes toward the English language reflected in the literature of selected periods.

791, 792. Thesis Research. (1-9). May be repeated for credit. Satisfactory/Unsatisfactory

Health and Exercise Science (HES)
Reynolda Campus

Program Director Peter H. Brubaker
Chair Michael J. Berry
Thurman D. Kitchin Professor of Health and Exercise Science W. Jack Rejeski
Professors Michael J. Berry, Peter H. Brubaker, Anthony P. Marsh, Stephen P. Messier, Patricia A. Nixon
Associate Professors Jeffrey A. Katula, Shannon L. Mihalko, Gary D. Miller
Assistant Professor Kristen M. Beavers

Overview
The Department of Health and Exercise Science offers a graduate program leading to the master of science degree. This program offers specialization in the area of health and exercise science and is designed for those who are interested in careers in research, preventive, and rehabilitative programs, and/or further graduate study.

Candidates for the health and exercise science program are not required to have a specific undergraduate major or minor. However, an undergraduate concentration in the sciences is preferred. Candidates for the program generally pursue research careers in exercise science (exercise physiology, biomechanics, or rehabilitation), and/or direct programs of exercise training or rehabilitation (YMCA, corporate fitness programs, and cardiac rehabilitation). The prerequisites for this program include course work in human anatomy, human physiology, physiology of exercise, and biomechanics. These courses should be completed before admission to the program. None of the prerequisites may apply toward the graduate degree. All students in the program are required to take the following courses: 660, 675, 715, 721, 733, 761, 763, 765, 783-784 and 791-792. Students can normally expect to spend two years in this program. The first year is devoted to required coursework and the identification of a thesis topic. The research and data collection for the thesis are usually completed in the second year. The second year also allows an opportunity for elective coursework outside the department.

The Department of Health and Exercise Science supports the Healthy Exercise and Lifestyle Programs (HELPs), a chronic disease prevention program for the local community. As part of the coursework in HES 761 and 765, graduate students serve an internship in HELP to gain practical experience as clinical exercise specialists. After serving an internship with HELP during the first academic year, each student will have the opportunity to be certified as an American College of Sports Medicine (ACSM) exercise specialist.

The Department of Health and Exercise Science began offering graduate study in 1967. Departmental graduate committee: Brubaker (chair), Beavers, Berry, Katula, Marsh, Messier, Mihalko, Miller, Nixon, Rejeski.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.

Courses of Instruction

650. Human Physiology. (3) A lecture course that presents the basic principles and concepts of the function of selected systems of the human body, with emphasis on the muscular, cardiovascular, pulmonary, and nervous systems.

651. Nutrition in Health and Disease. (3) A lecture/lab course that presents the principles of proper nutrition including an understanding of the basic foodstuffs and nutrients as well as the influence of genetics, eating behavior, and activity patterns on performance, energy balance, and weight control. Labs focus on intervention in obesity and coronary heart disease through diet analysis, methods of diet prescription, and behavior modification.

652. Human Gross Anatomy. (4) A lecture/lab course on the structure and function of the human body. Labs are devoted to the dissection and study of the human musculoskeletal, neuromuscular, and vascular systems.

653. Physiology of Exercise. (3) Lecture course that presents the concepts and applications of the physiological response of the human body to physical activity. The acute and chronic responses of the muscular and cardiorespiratory systems to exercise are examined. Other topics include exercise and coronary disease, strength and endurance training, somatotype and body composition, gender-related differences, and environmental influences. P—HES 650 or POI

660. Epidemiology. (3) Introduction to basic determinants of the incidence of chronic disease in the population, and development of an understanding of individual, community, and environmental approaches to promoting healthful lifestyles in youth, adults, and elderly populations. Issues are analyzed by formal statistical modeling.

670. Biomechanics of Human Movement. (3) Study of the mechanical principles which influence human movement, sport technique, and equipment design.

675. Advanced Exercise Physiology. (3) Lecture course which provides an in-depth examination of the physiological mechanisms responsible for both the acute and chronic changes which occur with exercise. Included are cellular changes in response to exercise, the ventilatory response to exercise and metabolic consequences of exercise.
682. Independent Study. (1-3) Literature reviews and/or laboratory research performed on an individual basis under the supervision of a faculty member.

715. Experimental Design. (3) Study of the various types of research relevant to health and exercise science. While attention is given to topics such as statistical treatment of data, the primary emphasis involves discussion concerning threats to internal and external validity for experimental and quasi-experimental designs. In conjunction with a sound methodological approach, practical experiences are provided in the preparation and presentation of thesis proposals.

721. Data Analysis and Interpretation. (3) The application of basic statistical techniques in the analysis and interpretation of data in scientific research. Topics include descriptive statistics, simple linear and multiple correlation/regression analysis, t-tests, analysis of variance and covariance, and non-parametric statistics.

733. Health Psychology. (3) Seminar on current topics in health psychology with a focus on wellness programs and rehabilitative medicine.

761. Cardiopulmonary Disease Management. (3) A lecture/lab class that examines the physiologic, pathologic, and pharmacologic considerations of managing patients with cardiovascular and pulmonary disease. Special emphasis on learning diagnostic procedures, interventions, and therapies, particularly models for cardiac and pulmonary rehabilitation.

763. Advanced Biomechanics. (3) An in-depth study of the mechanical principles that influence human movement. Topics include the study of kinetics, kinematics, cinematography, sport shoe design, and skeletal biomechanics. P—Anatomy, kinesiology, physics, or POI

765. Graded Exercise Testing and Exercise Prescription. (3) The study of the rationale for the use of graded exercise testing in the evaluation of functional work capacity and prescription of exercise. Lectures include the analysis of different modes of evaluation: treadmill, bicycle ergometer, arm ergometer, and field testing, with the application of the results in the evaluation of normal and cardiac patients and prescription of exercise for special populations. Lab experiences include the use of electrocardiographs, ergometers, and metabolic analyzers in the assessment of functional capacity.

780. Advanced Topics in Exercise and Sport Science. (3) This course is divided into two or more content areas to allow an in-depth treatment of selected topics that are not a regular part of required coursework. Topics are chosen from the following areas: anatomy, biomechanics, computer analysis, multivariate statistics, and physiology of exercise. Seminar and/or lab approach.

782. Independent Study in Health and Exercise Science. (1-3) Literature and/or laboratory research per-formed on an individual basis under the supervision of a faculty member. May be repeated for credit.

783, 784. Seminar in Health and Exercise Science. (1, 1) Seminar class designed to bring graduate students and faculty together on a regular basis to discuss research proposals, research design and studies, results of research, and current topics in health and exercise science. Talks by invited or visiting speakers are included as seminar sessions. Graduate students receive reading and work assignments related to the material presented in the seminar. May be repeated for credit.

791, 792. Thesis Research. (1-9). May be repeated for credit. Satisfactory/Unsatisfactory

Health Disparities in Neuroscience Related Disorders (HDND)  
Bowman Gray Campus

Program Directors  Carol Milligan and Alain Bertoni

Overview  Disparities in presentation, care, severity, and disability for neurological disorders such as stroke, Alzheimer's disease, epilepsy and Parkinson's have been identified in U.S. minority populations. Addressing health disparities becomes critical when considering the cost and burden on society of unequal care and treatment of what will be more than 50% of our society by 2060. The goal of the Health Disparities in Neuroscience-related Disorders master's program is to recruit students from diverse backgrounds into Health Disparities research program. The program builds on unique resources at Wake Forest University that make it an ideal institution for students to succeed.

The program will include coursework, a thesis research project, mentoring, and career development. The product of this program will be a solid foundation in Neuroscience, Epidemiology and Biostatistics training and hands-on, practical research projects. Another goal is to interest students in a career choice in health disparity and to develop a love of neuroscience and understanding neurological disorders to motivate students to consider moving onto PhD and MD programs and careers addressing these important issues.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Integrative Physiology and Pharmacology (IPP)  
Bowman Gray Campus

Track Director  Paul Czoty

Professors  Graca Almeida-Porada, Karl-Erik Andersson, Anthony Atala, Sarah Berga, Michael Berry, Colin Bishop, Khalil Bitar, Donald Bowden, Bridget Bronshnan, Pete Brubaker, David Carroll, Mark Chappell, Martin Childers (Adjunct), Steven Childers, Floyd Chilton, George Christ (Adjunct), J. Mark Cline, Suzanne Craft, Samuel A. Deadwyler, Osvaldo Delbono, Debra Diz, James Eisenach, J. Charles Eldridge, Carlos Ferrario, Jorge Figueroa, David Friedman, Patricia Gallagher, Randolph Geary, William Gmeiner, Dwayne Godwin, Leanne Groban, Robert Hampson, David Herrington, Allyn Howlett, Sara Jones, Jay Kaplan, Mei-Chuan (Holden) Ko, Nancy Kock, Greg Kucera, Frank Martini, Brian McCool, Stephen Messier, Michael Nader, Barbara Nicklas, John Parks, Linda Porrino, Paul Ribisi, Jim Rose, Jack Rejeski, Carol Shively, Thomas Smith, Shay Soker, Ann Tallant, Robert Taylor, Richard Weinberg, Jeffrey Weiner, Koudy Williams, James Yoo, Xiaobo Zhou

Associate Professors  Paul Czoty, Matthew Edwards, Gary M. Hellmann (Adjunct), Timothy Howard, Anthony Marsh, Thomas Martin, Shannon Mihalko, Gary Miller, Nilamadhab Mishra, Christopher Porada, Wayne Pratt, Pat Nixon, Kimberly Raab Graham, Tom Register, David Stroupe, Jasmina Varagic, Lisa Washburn, Sharon Woodard, Raghunathan Yammani


Overview  The Integrative Physiology and Pharmacology graduate program at Wake Forest University designed to train students for a research career in the physiological and pharmacological sciences. The IPP program has excelled in obtaining federal and foundational funding for many years, with dozens of highly-funded investigators working in a highly collaborative research environment. Research interests of the IPP program include a strong emphasis on substance abuse, life-span physiology, cardiovascular disease, cancer, central pain modulation, neuropsychiatric disorders, and regenerative medicine. There are currently 22 PhD students and 7 MS students in various stages of training, and there are 75 full-time primary and adjunct faculty members.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.
Courses of Instruction

701. Principles of Pharmacology. (1-3) The first required course for physiology and pharmacology students introduces students to basic principles of physiology and pharmacology and the cellular, ADME principles (administration, distribution, metabolism, elimination), pharmacokinetics, and pharmacody-namics (receptors and signal transduction).

702. Systems Physiology and Pharmacology. (1, 4, 6) The second required course for physiology and pharmacology students is composed of five blocks, with sections focusing on neurosciences, endocrine, renal/gastrontestinal, cardiovascular/pulmonary, and regenerative physiology. The course may be taken by blocks.

703, 704. Student Seminar. (1) Students present seminars as well as attend seminars by other IPP students and post-doctoral researchers. Students alternatively present a seminar or provide a written critique of a journal article. Course may be repeated.

705, 706. Student Journal Club. (1) Students participate in a journal club as well as attend a required number of seminars by faculty/outside speakers. Course may be repeated.

711, 712. Advanced Topics. (1-6) An advanced lecture and conference course that considers various topics of current research interest and concepts under rapid development. Areas of interest within the department are covered on a rotating basis. Additional topics can be offered by announcement.

713, 714. Advanced Readings. (1-4). Individualized instruction involving detailed review of literature pertaining to a specific area of interest in physiology or pharmacology.

715. Physiological Techniques. (1-2) Provides students with an introduction to the techniques used to assess physiological parameters by a combination of lectures and demonstrations.

716. Translational and Educational Research Topics. (1) Topics covered in this course include translational research, conducting clinical trials, inter-professional research, qualitative research, educational research, and an overview of statistical procedures. Professional skills developed during this course focus on team-effort, written and oral communications, and maximizing the mentor-mentee relationship. This course is available for both MS and PhD students, and is a pre-requisite for CPTS 761 and CPTS 762.

717. Current Topics in Drug Abuse. (2-3) Provides students with perspective in the problem of drug abuse. Defines the basic issues central to the field of drug abuse, including concepts of tolerance, physical dependence and reinforcement mechanisms, and relate these issues to the current problems of drug abuse in society. Describes how current research in drug abuse contributes to the design of rational treatment and prevention programs. Also listed as NEUR 717.

722. Behavioral Pharmacology. (3) Focuses on behavioral factors that influence the effects of drugs. Material presented provides a detailed review of the rate-dependent, reinforcing, and stimulus effects of drugs. Additional topics include behavioral factors related to tolerance and sensitization and a review of animal models of drug action. This course is cross-listed as NEUR 722.

724. Biology of Alcohol Abuse—Alcoholism. (3) Designed to instruct graduate and postdoctoral students on the pharmacological, physiological, and behavioral effects of alcohol. Lectures cover topics ranging from the epidemiology and etiology of alcohol abuse and alcoholism to the basic biochemistry, metabolism, and pharmacokinetics of alcohol in the mammalian system. Lectures focusing on the effects of alcohol on the nervous system include neuroreceptor interactions, ethanol's effects on intracellular signaling processes, neuroanatomical substrates for the actions of alcohol, systems electrophysiology, and mechanism of the behavioral effects of alcohol such as the reinforcing effects, anxiolytic effects, amnestic effects, and motor impairing effects. These lectures provide the basis for an exploration of the conditions leading to tolerance and dependence, and how the brain adapts to prolonged exposure to alcohol. This course is cross-listed as NEUR 724.

726. Toxicology. (2) Lecture course designed to provide the student with the basic concepts and mechanisms underlying toxic responses to xenobiotics. Emphasis is on the toxicology relevant to the diagnosis and prevention of poisoning in humans from occupational, environmental, or iatrogenic origin. Broad area studies are general principles of toxicology, common toxic agents, and target organs. Experimental models and methodologies of risk assessment are explored.

730. Lifespan Physiology and Pharmacology. (1-2) Lectures on the physiology of development and aging and the study of drugs during development and aging. Presentations address current topics relevant to age-dependent changes in various organ systems and theories of aging. The topics of age-related alterations in drug absorption, kinetics, and metabolism are also examined.

731. Perinatal Physiology I. (2) Discussion of literature in physiology and pharmacology concerning developmental aspects of mammalian organ systems. Emphasis is on the cardiovascular, endocrine and renal systems with considerations of the consequences of fetal programming of these systems.

732. Perinatal Physiology II. (2). Discussion of literature in physiology and pharmacology concerning developmental aspects of mammalian organ systems. Emphasis is on developmental pharmacology and the ability of drugs to program development.

736. Endocrinology. (2) Recent advances in endocrinology, with emphasis on receptor-linked functions, hormonally-active drugs, and influences of pharmacologic agents on endocrine function. In a tutorial setting, students study principles of structure and function, examine current technology and published literature, and design and critique experimental approaches.

738. Cardiovascular Physiology and Pharmacology. (2) Lectures, readings and discussions center on normal and abnormal cardiovascular physiology and recent developments in drugs affecting the heart and circulation.

740. Neuropharmacology. (2-3) General survey of neuropharmacology, emphasizing neurotransmitters, receptors and their interactions. Discussion of published literature with some lectures. Discusses general principles of drug action, including receptor binding, second messengers, and neurotransmitter metabolism. Surveys neurotransmitter function, including acetylcholine, biogenic amines, excitatory and other amino acids, and neuropeptides. Also covers techniques used to measure receptor function. This course is cross-listed as NEUR 740.

741. Quantitative Methods in Bioscience. (3). An introduction to essential concepts and methods for the quantitative analysis of biological data, with a focus on descriptive and inferential statistics. General topics include basic concepts in statistics such as probability theory and chance models, samples and populations, analyses of the relationships between variables, analysis of normal data, analysis of non-normal data and non-parametric analyses, an introduction to Bayesian frameworks, clustering analysis, and multivariate analyses. Didactic lectures cover core frameworks, analytic approach, and the mechanics and intuitive logic behind the methods. Laboratory sessions provide experience using a software platform (R) for data analysis and visualization using practical problems. This course is cross-listed as NEUR 741.

797, 798. Research. Mentored research on physiological or pharmacological problems in preparation for the thesis. Course may be repeated. Satisfactory/Unsatisfactory

Interpreting and Translation Studies (ITS)

Reynolda Campus

Program Directors  Sarah Barbour and Olgierda Furmanek
Charles E. Taylor Professor of Romance Languages  Candelas Gala
Associate Professors  Jerid Francom, Olgierda Furmanek, Luis González, Stephanie Pellet
Assistant Professors  Tiffany Judy, Diego Burgos
Teaching Assistant Professor  Ziyun Xu
Lecturers  Brett Rosenberg, Chaowei Zhu

Overview

This program prepares professionals for working in the growing language industry as it relates to a variety of fields—foreign affairs, media, business, law, and especially healthcare delivery. The current lack of interpreters and translators has led the U.S. Department of Labor to project a 29
percent increase in employment over the next decade. The program in interpreting and translation studies will not only help meet this demand, but also respond to Wake Forest’s “Pro Humanitate” motto, as its graduates will serve underprivileged communities while at the same time contributing to the quality of mainstream healthcare delivery and demonstrating the strong connections between liberal arts education and public service. The program offers four MA tracks: Intercultural Services in Healthcare; Teaching of Interpreting; Interpreting and Translation Studies, Spanish-English and Chinese-English. For students who are not able or ready to commit to earning an MA degree, but who would like to focus on an area of interest, the program also offers four Graduate Certificates and one postgraduate Certificate in specialized areas.

Requirements
The ITS program offers graduate study leading to a professional MA degree in Interpreting and Translation Studies through an intense two-semester course of study or an extended two year program for the Chinese-English Track. The program admits students on a full-time basis only.

Interpreting and Translation Studies: Spanish-English, Intercultural Services in Healthcare and Teaching of Interpreting are intensive two-semester programs, where students in each track are required to complete 27 credit hours of course instruction, 2 credit hours of internship, and a 5 credit hour applied research project. None of the 27 credit hours of course instruction may be taken Pass/Fail.

The Interpreting and Translation Studies: Chines-English track is a two year program of study where students are required to complete a minimum of 30 credit hours of course instruction, 2 credit hours of internship and a 5 credit hour applied research project during the last 2 semesters of the program.

At the end of each student’s program of study, the applied research project will be presented to the ITS graduate committee. The primary members of the applied research project committee are the ITS program faculty, but a student may include an approved committee member from outside of the program.

MASTER OF ARTS TRACKS.

The Interpreting and Translation Track is a language-specific, professionally oriented and research-based program that prepares interpreters and language specialists for working in the language. Graduates of this program will have a solid foundation in applied interpreting and translation studies, analysis of contextual meaning and extra-linguistic aspects of communication, cross-cultural awareness, sociolinguistics and dialectology, localization and terminology management, and advanced technologies for linguistic services. This program is especially appropriate for those who intend to pursue a doctorate in this field.

The Teaching of Interpreting Studies Track is a non-language-specific program that prepares graduates to be instructors in community or college-level interpreter training programs. It is the only program in the Northern hemisphere to focus on methods of teaching interpreting in the medical context. Graduates of the program will not only provide their students with a set of techniques on how to interpret, but they will also teach, mentor, and raise awareness about the interpreting practice. The curriculum lays the foundation for understanding the interpreting encounter, the co-conversational process and sociocultural determinations. It also includes a broad interdisciplinary research component, which is absent from the training seminars/workshops of other, non-academic programs.

The Intercultural Services in Healthcare Track is a non-language-specific program and is the first such specialization in the U.S. It prepares graduates to enter managerial positions in culture-sensitive healthcare delivery areas such as bilingual employment, patient relations, translation and interpreting services, health discourse and health messages. The curriculum provides a solid foundation in cross-cultural health communication, sociolinguistics, applied interpreting and translation studies, written and oral discourse analysis, medical translation, advanced technologies for linguistic services, localization and terminology management, organizational behavior, and health promotion as related to ethnicity.

Foreign Language or Special Skills Requirements
The Interpreting and Translation Track: Spanish-English. Applicants who do not have a college or high school degree from a Spanish speaking country are required to take an online Spanish proficiency exam.

The Interpreting and Translation Track: Chinese-English. Applicants who do not have a college or high school degree in Chinese (Mandarin) may be subject to a written exam and/or oral interview.

The Teaching of Interpreting Studies Track. Proven interpreting experience is required for this program.

The Intercultural Services in Healthcare Track. Foreign language competency is desirable, but not required for this program.

Courses of Instruction

SPA 671. Contrastive Spanish/English Grammar and Stylistics. (3) Advanced study of structures and vocabulary, with an emphasis on common transfer mismatches in healthcare settings. Exploration of general principles behind ‘atom-like’ rules and the main lexical dichotomies, and how implications for meaning help in choosing the best option. Discussion of structures that are usually taught as idiomatic but are more compositional than previously thought: satellite-frame vs. verb frame constructions, datives, verb+particle, reflexive constructions, etc.

SPA 681. Spanish Translation. (3) Spanish 681 develops advanced translating skills through practice with a strong emphasis in Spanish into English translating, primarily having in mind English speakers as a target public. Some back translation exercises will be offered.

SPA 682. Spanish English Interpreting. (3) Spanish/English Interpreting an introductory course to the art of oral translation. It develops basic strategies useful in community, conference, court, escort and other types of interpreting. Current employment opportunities in the field of interpreting will be also briefly presented. In class work will focus on learning and practicing interpreting techniques. Individual, at home, preparation besides the assigned readings and interpreting exercises- will also include a strong terminology enhancement.

SPA 683. Medical-Scientific Translation. (3) In this elective course, students will develop and refine a practical translation skill set within the scientific and medical domains. In addition, students will gain familiarity with textual conventions that govern source and target texts within these domains and deepen their understanding of both Spanish and English as language for special purposes. Apart from translation proper, students will also be able to analyze texts for register, style, tone and content to determine the most appropriate process to achieve the highest quality translation. Finally, students’ research skills will improve through the examination of available resources and the creation of domain-specific resources.

SPA 685. Spanish for Medical Professionals. (3) Study of terminology and sociocultural issues relevant to interlinguistic medical communication. Oral and written practice in the medical context.

TIS 684. Internship. (1) The internship requires 60 hours of interpreting, translation or observation work in a professional interpreting, translation, educational or healthcare setting, depending on the student’s chosen track. May be repeated for credit for a maximum of 3 hours.

TIS 731. Applied Interpreting Studies. (3) Explores connections between research and practical issues in studies of interpreting (simultaneous, consecutive, bilateral and other modalities). Focuses on the interdisciplinary nature of the interpreting field and, based on case studies, examines the interface between interpreting as a profession, research in interpreting studies, and the teaching of interpreting. Students are required to complete a research project.

TIS 732. Methodology of Teaching Interpreting. (3) Addresses syllabus design and lesson planning for teachers of interpreting in a field-specific context. It focuses on the development of interpreting skills, including recent technological developments. It explores classroom management options and strategies for providing feedback to students and covers internship design methods, including an on-site observation of various interpreting settings. Overall program design and
TIS 733. Applied Translation Studies. (3) Examines the theory and practice of translation from a variety of linguistic and cultural angles. Introduces key concepts such as relevance, equivalence, skopos, back-translation, and explores critical approaches depending on the translated text types.

TIS 734. U.S. Heritage Speakers and Bilingualism. (3) Provides a comprehensive introduction to the fields of heritage languages, bilingualism, and bilingual education from a cross-disciplinary perspective. Covers a wide variety of topics, including, among others, individual and societal conceptions of heritage and dominant languages, general bilingual educational issues, bilingualism and multilingualism as they relate to identity, political and ideological issues, Spanish in the U.S.

TIS 735. Discourse Organization and Interpreting. (3) Explores the links between social situations, interlocutors, and the functional aspects of communicative events. Focuses on several important methodological approaches that have been developed to do discourse analysis in as much as they highlight important features of translation and interpreting. Students will review the varied traditions around meaning-making, including sociolinguistics, conversation analysis, critical discourse analysis, and discursive psychology. Readings will tie in traditional topics in discourse analysis with specific issues in translation and interpreting. This course will link theory to practice. One session per week will be devoted to practical, hands-on activities using real world data in various formats: written transcripts, aural speeches, or videos.

TIS 736. Organizational Behavior and Interpreting. (3) This course is designed to apply organizational behavior theories into the interpreting field in order to bring about a better understanding of how individual interpreters or interpreter teams actually behave in the large-scale project/organizational settings. Particular emphases are placed on interpreter roles and on how to evaluate interpreter performance, motivate interpreters, and maintain a high level of interpreting services. This course prepares students to enter managerial positions in translation/interpreting companies or organizations.

TIS 742. Spanish Specialized Translation. (3) Develops and refines a practical translation skill set within specialized domains, for example, technology, law, international relations, media. Students gain familiarity with textual conventions that govern source and target texts in specialized contexts and deepen their understanding of both Spanish and English as language for specific purposes.

TIS 750. Contrastive Chinese-English Grammar and Stylistics. (3) Advanced study of structures and vocabulary. Exploration of general principles behind ‘atom-like’ rules and the main lexical dichotomies, and how implications for meaning help in choosing the best option. Discussion of structures that are usually taught as idiomatic but are more compositional than previously thought: subject-predicate vs. topic-comment, verb-particle, verb-complement, serial verb construction, relative clause construction, reduplication, imperative, negation, adposition, etc.

TIS 751. Chinese-English Translation. (3) Development of advanced translational skills through the practice or bidirectional translation with a strong emphasis on Chinese into English translating. Some back translation exercises will be offered as part of this course.

TIS 752. Chinese-English Specialized Translation. (3) Develops and refines a practical translation skill set within the specialized domains such as medicine, science, business, etc. In addition, students will gain familiarity with textual conventions that govern source and target texts within these domains and deepen their understanding of both Chinese and English as language for special purposes. Apart from translation proper, students will also be able to analyze texts for register, style, tone and content to determine the most appropriate process to achieve the highest quality translation. Students’ research skills will improve through the examination of available resources and the creation of domain-specific resources.

TIS 755. Chinese-English Interpreting. (3) Chinese-English Interpreting develops strategies for community, conference, escort and other types of interpreting. Current employment opportunities in the field of interpreting will be also briefly presented. In class work will focus on learning and interpreting techniques. Individual, at home, preparation – besides the assigned readings and interpreting exercises – will also include a strong terminology enhancement.

TIS 760. U.S. Landscape: Systems, Culture and Norms. (3) This course is designed for international students to increase their knowledge of U.S. socio-political structures and Anglo-American cultural identity through the study of U.S. history, politics and popular traditions.

TIS 785. Applied Research Project. (2) The applied research project will establish a rigorous connection between the practical experience in the workplace and the more theoretical experience in research and in the classroom. The applied research project will be divided in two components: during the fall semester (2 credit hours) students will learn about general research methodology and receive individual guidance to choose between the research project options. During the spring semester (2 credit hours) students will complete the research project under supervision of a project director.

TIS 786. Specific Topics. (1-3) Examination of topics not covered in the regular curriculum. May be repeated for credit

TIS 789. Independent Study. (1-3) Independent research project to meet the needs and interests of selected students to be carried out under the direction of a faculty member. Must be approved by program director. May be repeated for credit.

LIN 610. Sociolinguistics & Dialectology. (3) This course explores how and why language varies, with emphasis on the social context of speech. Students will learn survey methods for describing language variation, from traditional dialectology to modern discourse analysis. This course will evaluate the social, educational, and political implications of dialect variation, gender and ethnic differences, and other social variables in language differences. Suggested prerequisite: Lin/Ant 150

LIN 680. Language Use and Technology. (3) The main objective of this course is to provide students with the opportunity to become familiar with the practical and theoretical issues concerned with creating and accessing large linguistic corpora (electronic collections of “real world” text) with computers for a host of applications; both academic and professional. We will discuss the advantages of approaching language through empirical data collected from real-world sources; in addition, we will highlight conceptual and practical aspects that pose challenges to creating robust, representative language samples. This course is designed to provide the student opportunities to discover new angles to their current academic or professional interests through the use of large-scale data sources and the power of computers.

LIN 683. Language Engineering Localization and Terminology. (3) In this course students will gain a familiarity with the language industry and understand the factors involved in the localization process. In addition, students will be able to appreciate the advantages of using computer assisted tools during this process, but also recognize the limitations and disadvantages of this approach. Apart from tool usage, students will also be able to analyze the various steps in the localization of a product to determine the most appropriate process to achieve the highest quality possible. Finally, students’ translation and research skills will improve through the examination of available resources and the creation of translation resources.

Liberal Studies (LBS)
Graduate School @ Brookstown

Program Director  Anthony Parent
Assistant Director  Wanda S. Duncan
Program Assistant  Mimi Komos

Overview
The liberal studies program is devoted to the interdisciplinary examination of human ideas and values, challenging students to engage in nuanced contemplation of life's most complex problems, through the perspectives of diverse academic disciplines. Two degrees are offered: the MA in Liberal Studies and the MALS degree. In the MA degree, students choose either American Cultural Studies or Global Studies as the integrated theme. Students who choose the MA program are likely to be enrolled full-time, with aspirations for further study in an interdisciplinary doctoral program. The
MALs degree is designed for the individual who is compelled by intellectual curiosity to pursue a broad, interdisciplinary course of studies on a part-time basis. Students in either program choose from courses designed specifically for the liberal studies program and courses available in the University curriculum. Students are encouraged to use this flexibility to tailor interdisciplinary programs to suit their particular needs and interests.

Applicants for the liberal studies program should have demonstrated an ability to succeed in a graduate-level humanities program. Ability to succeed is determined by either having obtained a B average in undergraduate work or at least two Bs in graduate level courses. Because of the nature of the program, no specific undergraduate major is required. However, the applicant should have taken courses in the humanities area as an undergraduate or graduate and should express appropriate interest in an interdisciplinary humanities degree program.

Requirements

Residence Requirement. There is no minimum residence requirement. Degree requirements must be met within six years.

Course Requirements

MA in Liberal Studies: The degree is awarded to candidates who complete 24 hours of faculty-approved coursework with an average grade of B or above on all courses attempted and an acceptable thesis/project for which six hours of credit toward the 30 required for graduation are awarded.

A minimum of 12 of the 24 hours of coursework must be chosen from the interdisciplinary courses particularly designed for the liberal studies program. A student may take all required courses from these specially designed offerings. The Directed Study Course (786) does not count toward the requirement of four liberal studies courses. A maximum of five courses may be chosen from 600- and 700-level departmental courses that carry three hours of graduate credit. No more than four 600-level courses may count toward the MA degree. A student may transfer a maximum of six semester-hours from another liberal studies program or from an appropriate graduate program at the discretion of the director and the dean of the Graduate School.

MALs: The degree is awarded to candidates who complete 33 hours of faculty-approved coursework with an average grade of B or above in all courses attempted and an acceptable final paper which synthesizes their experience in the program.

A minimum of 21 of the 33 hours of coursework must be chosen from the interdisciplinary courses particularly designed for the liberal studies program. A student may take all required courses from these specially designed offerings. The Directed Study Course (786) does not count toward the requirement of seven liberal studies courses. A maximum of four courses may be chosen from 600- and 700-level departmental courses that carry three hours of graduate credit. No more than five 600-level courses may count toward the MALs degree. A student may transfer a maximum of six semester-hours from another liberal studies program or from an appropriate graduate program at the discretion of the director and the dean of the Graduate School.

Admission to Degree Candidacy. A student is admitted to degree candidacy by the dean of the Graduate School after recommendation by the liberal studies program. The student must expect to complete the master's degree requirements with one additional semester's work.

Thesis Requirement (MA degree only). Six of the 30 hours required for the MALs degree are allotted for the thesis. Thesis courses are graded S (Satisfactory) or U (Unsatisfactory). If a U is assigned, the course must be repeated and an S earned before the degree can be awarded.

Theses are written under the supervision of the student's advisory committee (an advisor, and two other readers). All members of the advisory committee should be members of the graduate faculty. The committee will be approved by the dean of the Graduate School. With the approval of his or her advisor, a student may recommend a person who is not on the graduate faculty to serve on the examining committee as a voting member; however, the committee must have a minimum of two members from the graduate faculty. The thesis advisor must justify the participation of this person on the basis of research, publications, and/or professional activities in a letter to the dean. The defense must take place by the deadline date listed on the academic calendar. The liberal studies thesis project may be a traditional research paper, a field research project, or a creative work.

Final Examination. Requirements for thesis submission and format are posted on the WFU Graduate School website. The examination covers the thesis and knowledge in related areas. The possible committee decisions are unconditional pass, pass upon rectifying deficiencies, and fail. If a student fails, he/she may be reexamined only once.

Pass. If all committee members agree that the student has passed unconditionally, there is consensus to pass the examination. The committee chair will sign the ballot, submit the ballot to the Graduate School, and the student shall be recommended for award of the degree.

Pass Upon Rectifying Minor Deficiencies. If reservations are expressed by committee members, the chair of the committee will ensure that the reservations are communicated to the student and the dean of the Graduate School by signing and submitting the ballot to the Graduate School. The student and the advisor are jointly responsible for ensuring that the thesis is modified to meet the committee's reservations. When the thesis has been modified, the student passes the examination and the student will be recommended for award of the degree.

Fail. If, in the opinion of more than one member of the thesis committee, the student has failed the examination, there is no consensus to pass. The chair of the committee will advise the student that the thesis fails to meet the requirements of the Graduate School. The chair will ensure that the student knows the reason(s) for failure and will submit the ballot to the Graduate School. If the modified or new thesis fails to meet the requirements of the Graduate School, the student shall be dismissed.

Courses of Instruction

720-729. Special Topics. (3) Topics vary by semester. Topic categories are listed below. Please see website for specific course descriptions mals.wfu.edu

LBS 720 - Special Topics – Language and Literature
LBS 721 - Special Topics – Media, Arts, and Rhetoric
LBS 722 - Special Topics – Politics and International Relations
LBS 723 - Special Topics – History, Societies, and Culture
LBS 724 - Special Topics – Philosophy and Religion
LBS 725 - Special Topics – Popular Culture
LBS 726 - Special Topics – Urban Arts and Architectural Design
LBS 727 - Special Topics – Sciences, Health, and Culture
LBS 728 - Special Topics – Fine arts, Aesthetics, and Creativity
LBS 729 - Special Topics – Psychology, Humanism and Business

786. Directed Study. (1-3) Working with a faculty advisor, the student completes a special reading project in an area not covered in regular courses or a special research project not related to the master's thesis. A student who wishes to enroll must submit the Directed Study Form, signed by the advisor, to the program director. May be repeated for credit for a maximum of 6 hours if topic varies.


792. Thesis Research II. (3) Research directed toward fulfilling the thesis requirement. Satisfactory/ Unsatisfactory
Program Director
Ellen Kirkman

Chair
Edward E. Allen

Associate Chair
Sarah Raynor

Taylor Professor
Stephen B. Robinson

Professors
Edward E. Allen, Kenneth S. Berenhaut, Richard D. Carmichael, Hugh Howards, Miao Jiang, Ellen Kirkman, James L. Norris III

Associate Professors
Jennifer Erway, Sarah Mason, Jason Parsley, Sarah Raynor

Sterge Faculty Fellows and Assistant Professor
Robert Erhardt, W. Frank Moore

Assistant Professors
John Geisser, Staci Hepler

Teacher-Scholar Postdoctoral Fellows
Jason Gaddis, Joshua Hallam, Mauricio Rivas, Robert Won

Research Professors
John Baxley, Fredric T. Howard, James Kuzmanovich, Robert J. Plemmons

Overview
The department offers a program of study leading to the master of arts degree in mathematics. The program is designed to accommodate students seeking either a terminal master’s degree or preparation for PhD work.

To obtain the MA in one year, a graduate student must present evidence of having completed the work required of an undergraduate who majors in mathematics in a fully accredited college or university. Such a major is understood to include at least 33 semester hours of mathematics, of which at least 18 require as prerequisite one year of calculus. Students who are admitted with less than the level of preparation specified should expect to take additional courses at the 600-level and remain in residence for more than one year.

The requirements for the MA degree are met by selecting either the thesis option or the non-thesis option, and by selecting one of two possible tracks for coursework. If a thesis is written, 30 semester hours of coursework, including MTH 791, 792, and at least four additional courses numbered above 700, are required for the MA degree. If a thesis is not written, 36 semester hours of coursework, including at least five courses numbered above 700, are required for the MA degree. MTH 791 and 792 cannot be counted as part of this coursework. An advanced course in analysis is required for all students; normally this requirement is met with MTH 711. For the pure mathematics track, an advanced course is required in each of algebra, and topology; normally this requirement is met with the courses MTH 721 and MTH 731. For the mathematical statistics track, both MTH 658 and MTH 667 are required, along with an advanced course in each of probability and linear models; normally this requirement is met with the courses MTH 757 and MTH 767. With the approval of the Graduate Committee, graduate courses may be taken in related areas to fulfill requirements; however, no more than 6 such hours may count toward the requirements for either the thesis or non-thesis option.

Students desiring to use work taken in the department for graduate teacher certification should consult the Department of Education before applying for candidacy.

Computers are used in mathematics in conjunction with coursework and research. The department utilizes UNIX-based workstations and fileserver along with microcomputers connected to local and wide-area networks. Access is available to the University’s computing facilities, supercomputers at the North Carolina Supercomputing Center and other specialized computing equipment.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Courses of Instruction

605. Applied Multivariable Mathematics. (3) Introduction to several topics in applied mathematics including complex numbers, probability, matrix algebra, multivariable calculus, and ordinary differential equations. May not be used toward any graduate degree offered by the department.

606. Advanced Mathematics for the Physical Sciences. (3) Advanced topics in linear algebra, special functions, integral transforms, and partial differential equations. May not be used toward any graduate degree offered by the department. P—MTH 605

611, 612. Introductory Real Analysis I, II. (3, 3) Limits and continuity in metric spaces, sequences and series, differentiation and Riemann-Stieltjes integration, uniform convergence, power series and Fourier series, differentiation of vector functions, implicit and inverse function theorems.


622. Modern Algebra II. (3) A continuation of modern abstract algebra through the study of additional properties of groups, rings, and ideals.

624. Linear Algebra II. (3) A thorough treatment of vector spaces and linear transformations over an arbitrary field, canonical forms, inner product spaces, and linear groups.

626. Numerical Linear Algebra. (3) An introduction to numerical methods for solving matrix and related problems in science and engineering using a high-level matrix-oriented language such as MATLAB. Topics include systems of linear equations, least squares methods, and eigenvalue computations. Special emphasis is given to applications.

631. Geometry. (3) An introduction to axiomatic geometry including a comparison of Euclidean and non-Euclidean geometries.

634. Differential Geometry. (3) Introduction to the theory of curves and surfaces in two and three dimensional space including such topics as curvature, geodesics, and minimal surfaces.

645. Elementary Number Theory. (3) Course topics include properties of integers, congruences, and prime numbers, with additional topics chosen from arithmetic functions, primitive roots, quadratic residues, Pythagorean triples, and sums of squares.

646. Modern Number Theory (3) Course topics include a selection of number-theory topics of recent interest. Some examples include elliptic curves, partitions, modular forms, the Riemann zeta function, and algebraic number theory.

647. Graph Theory. (3) Paths, circuits, trees, planar graphs, spanning trees, graph coloring, perfect graphs, Ramsey theory, directed graphs, enumeration of graphs and graph theoretic algorithms.

648, 649. Combinatorial Analysis I, II. (3, 3) Enumeration techniques, generating functions, recurrence formulas, the principle of inclusion and exclusion, Polya theory, graph theory, combinatorial algorithms, partially ordered sets, designs, Ramsey theory, symmetric functions, and Schur functions.

652. Partial Differential Equations. (3) Detailed study of partial differential equations, including the heat, wave, and Laplace equations, using methods such as separation of variables, characteristics, Greens functions, and the maximum principle.

653. Probability Models. (3) Course topics include an introduction to probability models, Markov chains, Poisson process and Markov decision processes. Applications will emphasize problems in business and management science.

654. Discrete Dynamical Systems. (3) Introduction to the theory of discrete dynamical systems as applied to disciplines such as biology and economics. Includes methods for finding explicit solutions, equilibrium and stability analysis, phase plane analysis, analysis of Markov chains and bifurcation theory.

655. Introduction to Numerical Methods. (3) An introduction to numerical computations on modern computer architectures; floating point arithmetic and round-off error including programming in a scientific/engineering language such as MATLAB, C, Fortran. Topics include algorithms and computer techniques for the solution of problems such as roots of functions, approximations, integration, systems of linear equations and least squares methods. Also listed as CSC 655.
656. Statistical Methods. (3) A project-orientated course emphasizing data analysis, with introductions to nonparametric methods, multiple and logistic regression, model selection, design, categorical data or Bayesian methods. May not be used toward any graduate degree offered by the department.

657. Probability. (3) Course topics include probability distributions, mathematical expectation, and sampling distributions. MTH 657 covers much of the material on the syllabus for the first actuarial exam.

658. Mathematical Statistics. (3) This course will cover derivation of point estimators, hypothesis testing, and confidence intervals using both maximum likelihood and Bayesian approaches. P—MTH 657 or POI

662. Multivariate Statistics. (3) This course will concentrate on multivariate and generalized linear methods for classification, modeling, discrimination and analysis.

664. Computational and Nonparametric Statistics. (3) This course focuses on computationally intensive methods to fit statistical models to data. Topics include simulation, Monte Carlo integration and Markov Chain Monte Carlo, sub-sampling, and nonparametric estimation and regression. P—657 or POI

667. Linear Models. (3) This course focuses on theory of estimation and testing in linear models. Topics include least squares and the normal equations, the Gauss-Markov Theorem, testing general linear hypotheses, and generalized linear models. P—657 or POI

669. Advanced Topics in Statistics. (1, 2, or 3) Topics in statistics not considered in regular courses or which continue study begun in regular courses. Content varies.

681. Individual Study. (1 or 2) A course of independent study directed by a faculty adviser. By prearrangement. May be repeated for credit.

682. Reading in Mathematics. (1, 2, or 3) Reading in mathematical topics to provide a foundational basis for more advanced study in a particular mathematical area. Topics vary and may include material from algebra, analysis, combinatorics, computational or applied mathematics, number theory, topology, or statistics. May not be used to satisfy any requirement in the mathematics MA degree with thesis. No more than three hours may be applied to the requirements for the foundation for more advanced study in a particular mathematical area. Topics may include Farey fractions, the theory of partitions, Waring's problem, prime number theorem, and Dirichlet's problem.

745, 746. Seminar on Number Theory. (1, 1)

747. Topics in Discrete Mathematics. (3) Topics vary and may include enumerative combinatorics, graph theory, algebraic combinatorics, combinatorial optimization, coding theory, experimental designs, Ramsey theory, Polya theory, representation theory, set theory and mathematical logic.

750. Dynamical Systems. (3) Introduction to modern theory of dynamical systems. Linear and nonlinear autonomous differential equations, invariant sets, closed orbits, Poincare maps, structural stability, center manifolds, normal forms, bifurcations of equilibria, linear and non-linear maps, hyperbolic sets, attractors, symbolic representation, fractal dimensions. P—MTH 611

752. Topics in Applied Mathematics. (3) Topics vary and may include computational methods in differential equations, optimization methods, approximation techniques, eigenvalue problems. May be repeated for credit.

753. Nonlinear Optimization. (3) The problem of finding global minimums of functions is addressed in the context of problems in which many local minima exist. Numerical techniques are emphasized, including gradient descent and quasi-Newton methods. Current literature is examined and a comparison made of various techniques for both unconstrained and constrained optimization problems. Credit not allowed for both MTH 753 and CSC 753. P—MTH 655 or CSC 655

754. Numerical Methods for Partial Differential Equations. (3) Numerical techniques for solving partial differential equations (including elliptic, parabolic and hyperbolic) are studied along with applications to science and engineering. Theoretical foundations are described and emphasis is placed on algorithm design and implementation using either C, FORTRAN or MATLAB. Credit not allowed for both MTH 754 and CSC 754. P—MTH 655 or CSC 655

757. Stochastic Processes and Applications. (3) This course includes the axiomatic foundations of probability theory and an introduction to stochastic processes. Applications may include Markov chains, Markov Chain Monte Carlo with Metropolis-Hastings, Gibbs sampling, Brownian motion, and related topics, with an emphasis on modern developments. P—MTH 605 and MTH 611 or POI

758. Topics in Statistics. (3) Topics vary and may include linear models, nonparametric statistics, stochastic processes. May be repeated for credit.

767. Generalized Linear Models. (3) This course includes extensions of the classical linear model to cover binary and count data, log-linear models, autoregressed time series data, and associated model selection techniques. Additional topics may include longitudinal data, the Expectation-Maximization algorithm, non-linear models, or related topics. P—MTH 605 or POI

791, 792. Thesis Research. (1-9). May be repeated for credit. Satisfactory/Unsatisfactory
Microbiology and Immunology (MICR)
Bowman Gray Campus

Program Director  Jason Grayson
Chair  Martha A. Alexander-Miller
Professors  Martha A. Alexander-Miller, Charles E. McCall, Steven B. Mize
Associate Professors  Rajendar Deora, Jason M. Grayson, David Ornellles
Assistant Professors  Erik Barton, Karen M. Haas

Overview
The Department of Microbiology and Immunology offers a graduate program leading to the
PhD degree. The program prepares students for careers in research and teaching in the fields of
bacteriology, immunology, molecular biology, and virology.

In addition to completion of the core curriculum, program specific course requirements include
Fundamentals of Bacteriology, Fundamentals of Immunology, and Fundamentals of Virology. In
addition, in the second and third years, all students participate in the interdisciplinary, literature-
based course Advanced Topics.

Students enter the program through the Molecular and Cellular Biosciences Track and
participate in the MCB common curriculum in the first year. At the end of the first year, students
select their research area and dissertation advisor. Students entering the program may choose to
do their thesis work among the areas of bacterial and viral pathogenesis, cellular and molecular
immunology, and the cell and molecular biology of the microbe-host interaction.

See the Department of Microbiology and Immunology homepage (www.wakehealth/microbio)
for further information on the department and detailed descriptions of faculty research interests.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

MCB Track Electives

MCB 731. Fundamentals of Virology. (2) Basic aspects of the structure, replication, and
pathogenesis of animal viruses are taught through a mixture of lectures and discussions based
on current literature. Typically offered in the spring term. Intended for all graduate students in
microbiology and immunology (MICR); open to students in other tracks or programs.

MCB 732. Fundamentals of Bacteriology. (2) Basic aspects of bacterial structure, physiology,
genetics, and pathogenesis are taught through a mixture of lectures and discussions based on
the current literature. Typically offered in the spring term. Intended for all graduate students in
microbiology and immunology (MICR); open to students in other tracks or programs.

MCB 734. Fundamentals of Immunology. (2) This course focuses on the cellular, biochemical, and
molecular aspects of innate, cellular and humoral immunity. Typically offered in the spring term.
Intended for all graduate students in microbiology and immunology (MICR); open to students in
other tracks or programs.

MICR Advanced Courses

704. Microbiology of Infectious Diseases. (3) An in-depth study of the role of microbial agents in
host-parasite interactions. The course includes a survey of the basic properties of bacteria, viruses,
fungi, and parasites. The pathways leading from exposure to successful infection to disease are
examined. Specific examples of major pathogens and the diseases they cause are discussed in detail
in the context of clinical situations employing the problem-based learning format. P—POI

707. Scientific Methodology. (1) Instruction in the scientific method as applied to basic research in
bacteriology, virology, and immunology and microbial pathogenesis. Examples from the scientific
literature are used to provide practical training in effective oral communication and expository
scientific writing. P—POI

711. Tutorial in Medical Microbiology. (1-3) Guided reading and discussion of the pathogenesis of
infectious diseases.

716. Practical Statistics in Microbiology and Immunology. (1) Provides a practical introduction to
the application of statistical methods commonly required for studies in bacteriology, virology,
and immunology. Consists of a mixture of lectures and in-class exercises based on problems
drawn from current research in the department. Topics include sampling principles, descriptive
statistics, parametric and non-parametric tests, one-way analysis of variance, contingency tables,
linear regression, and power calculations. Emphasis is on recognizing and applying the appropriate
methods. P—POI

719, 720. Research in Microbiology. (1-9). Satisfactory/Unsatisfactory

721, 722. Teacher Training. (0) Advanced graduate students give a lecture in their areas of
specialization in one of the graduate courses offered by the department. P—Advanced standing.

749, 750. Advanced Topics in Microbiology and Immunology. (2) Seminar course dedicated to
the analysis of current research literature on the fundamental biochemical and molecular processes
involved in the growth, differentiation, and function of bacteria, viruses, and eukaryotic cells. The
course not only provides the student with experience in literature analysis, but also offers a broad
exposure to timely and important themes and principles that link the disciplines of microbiology,
virology, and immunology. P—bacteriology, immunology, and virology.

Molecular and Cellular Biosciences (MCB)
Bowman Gray Campus

Track Director  Fred Perrino

Overview
Molecular and Cellular Biosciences (MCB) is an interdisciplinary graduate track that provides
students with opportunities to choose from among mentors whose research spans basic and
translational fields of cutting-edge molecular and cellular biology. Graduate programs within
the MCB track enable students to earn a Ph.D. in Biochemistry and Molecular Biology (BAMB),
Cancer Biology (CABI), Microbiology and Immunology (MICR), Molecular Genetics and
Genomics (MOGN), or Molecular Medicine and Translational Science (MMTS), as well as a
Certificate in Structural and Computational Biophysics (SCB). In their first year, MCB students will
complete a short course in analytical skills followed by a year-long core course that first examines
macromolecular structure, synthesis and function, as well as gene expression and genetics; the
second semester focuses on cell structure, cell communication, organ systems integration and
physiology and pathology. MCB students will also select three program-specific electives. They
will explore a range of research opportunities by participating in three research rotations, each in
a different MCB laboratory. These rotations introduce them to new techniques and guide their
selection of a graduate program and dissertation research advisor; as 2nd year students they will
complete program-specific requirements along their path toward a doctoral degree.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Courses of Instruction

700. Analytical Skills. (1) Molecular and Cellular Biosciences students will begin their graduate
education with this 1-credit course focused on data acquisition and analysis methods. Balancing
time and practice, it will refresh their mathematical skills; describe techniques for isolating and
characterizing cells and their macromolecular components; explore methods for manipulating genes
and performing high-throughput assays; and introduce bioinformatics approaches. A series of take-
home exercises reinforce problem-based learning. MCB 700 will be offered as 10 x 1.5 h. sessions in
the two weeks preceding the fall term. Intended for all graduate students enrolled in MCB, or BMSC
students with an MCB specialization. Open to students in all tracks.

701. Molecular and Cellular Biosciences. (1-6) Molecular and Cellular Biosciences students will
take a two-semester core course that will cover fundamental principles of the discipline. The overall goal of the course is to develop the student's understanding of molecular and cellular biosciences in the context of biomedical research as it relates to human disease. In the first semester students will focus on the basic building blocks of the cell, their synthesis, cellular metabolism and intracellular transport. The semester is broken into five blocks or themes that in order roughly cover; 1) proteins and enzymes; 2) carbohydrates and lipids; 3) DNA and microbial genetics; 4), mammalian genetics and genomics; and 5) intracellular sorting, cytoskeleton, extracellular matrix. The course is in the format of didactic lectures and meets for 6 hrs per week (four 90 minute lectures/week). Students are evaluated on the performance of 5 written exams given at the end of each block. Intended for all graduate students enrolled in MCB, or BMSC students with an MCB specialization. Intended for all graduate students enrolled in MCB, or BMSC students with an MCB specialization. Open to students in all tracks. Other tracks or programs may elect to have students take one or more blocks as 1 credit hour courses.

702. Molecular and Cellular Biosciences. (1-6) In the second semester students will focus on additional cell biological topics followed by several units devoted to integrative physiology. The semester is broken into five blocks or themes that cover 1) cell signaling, and cell-cell communication; 2) cell cycle, cell death, oncogenesis, developmental and stem cell biology; 3) endocrinology and metabolic control and integration; 4) renal, gastrointestinal, cardiovascular, and respiratory physiology; and 5) microbiology and innate and acquired immunity. The course is in the format of didactic lectures and meets for 6 hours per week (four 90 minute lectures/week). Students are evaluated on the performance of 5 written exams given at the end of each block. Intended for all graduate students enrolled in MCB, or BMSC students with an MCB specialization. Intended for all graduate students enrolled in MCB, or BMSC students with an MCB specialization. Open to students in all tracks. Other tracks or programs may elect to have students take one or more blocks as 1 credit hour courses. Although not required, it is expected that students are familiar with material covered in MCB 701.

703, 704, 705. Introduction to Molecular and Cellular Biosciences Research. (1-6) Molecular and Cellular Biosciences students will gain experience with the planning and execution of research, and the interpretation and presentation of experimental results. To put these principles into practice, they will carry out mentored research projects in the laboratories of three different Molecular and Cellular Biosciences faculty members with an optional fourth rotation during the summer term. Intended for all graduate students enrolled in MCB. Satisfactory/Unsatisfactory

MCB Electives: Biochemistry and Molecular Biology (BICM) Focus

711. Biological Systems and Structures. (2) In depth study of macromolecular assembly and interactions, as well as the application of structural biology and proteomics technology. Contemporary concepts of the principles of protein and nucleic acid structure will be presented. Other topics include methods for structure determination such as X-ray diffraction, NMR spectroscopy, and molecular modeling. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

712. Biological Spectroscopy. (2) Principles and practicalities of the study of biomolecules using spectroscopic techniques such as absorbance, fluorescence and circular dichroism analyses will be covered. Other biophysical approaches such as mass spectrometry and sedimentation analysis will be included. Topics in the study of enzymes utilizing these techniques will be discussed. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

713. Large Experimental Datasets and Analysis. (2) Conducted as a combination of lectures, reading assignments, and student-led discussions. Lectures detail experimental methods that generate large-scale datasets. Topics will include genotyping, expression profiling, metabolomics, high-content cellular imaging techniques and practical examples of bioinformatic software and statistical analyses. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

714. Experimental Approaches to Cell Biology and Disease. (2) Conducted as a combination of lectures, reading assignments, and student-led discussions. With an emphasis on cellular functions involved in disease, lectures detail common techniques used in cell biology experimentation. Practical examples and issues of functional genomic approaches are discussed, including design of appropriate cell biology models. Typically offered in the fall term. Intended for all graduate students in biochemistry and molecular biology (BICM); open to students in other tracks or programs.

MCB Electives: Cancer Biology (CABI) Focus

721. Carcinogenesis, DNA Damage and Repair. (2) This course will cover the identification and reaction mechanisms of environmental carcinogens, DNA damage and mutagenesis by endogenous and exogenous agents, and the mechanisms of DNA repair. Typically offered in the fall term. Intended for all graduate students in cancer biology (CABI); open to students in other tracks or programs.

722. Molecular Pathogenesis of Cancer. (2) Fundamental molecular changes in cells and tissues that contribute to the malignant phenotype are discussed. Topics include alterations in genes and chromatin, signaling pathways, tumor cell metabolism, and the tumor microenvironment. Typically offered in the fall term. Intended for all graduate students in cancer biology (CABI); open to students in other tracks or programs.

723. Topics in Cancer Biology. (2) Teaches students how to evaluate and communicate scientifically in the area of cell biology and cancer. Examples are taken from all areas of cancer in this advanced course. Uses current peer-reviewed journal articles to teach fundamental concepts and act as a medium for allowing the students to communicate ideas with an emphasis on presentation skills. Typically offered in the fall term. Intended for all graduate students in cancer biology (CABI); open to students in other tracks or programs.

MCB Electives: Microbiology and Immunology (MICR) Focus

731. Fundamentals of Virology. (2) Basic aspects of the structure, replication, and pathogenesis of animal viruses are taught through a mixture of lectures and discussions based on current literature. Typically offered in the spring term. Intended for all graduate students in microbiology and immunology (MICR); open to students in other tracks or programs.

732. Fundamentals of Bacteriology. (2) Basic aspects of bacterial structure, physiology, genetics, and pathogenesis are taught through a mixture of lectures and discussions based on the current literature. Typically offered in the spring term. Intended for all graduate students in microbiology and immunology (MICR); open to students in other tracks or programs.

734. Fundamentals of Immunology. (2) This course focuses on the cellular, biochemical, and molecular aspects of innate, cellular and humoral immunity. Typically offered in the fall term. Intended for all graduate students in microbiology and immunology (MICR); open to students in other tracks or programs.

MCB Electives: Molecular Genetics and Genomics (MOGN) Focus

741. Computational Biology. (2) An introduction to the use of software and resources available for analysis of genes and proteins. Students will learn how to use practical tools to analyze protein and gene sequences through a combination of lectures and completion of hands-on problem sets. Typically offered in the fall term. Intended for all graduate students in molecular genetics and genomics (MOGN); open to students in other tracks or programs.

742. Molecular Genetics and Genomics of Human Disease. (2) This course will introduce students to applications of molecular genetic and genomic methods for the identification and functional characterization of genes contributing to human disease. In addition, complementary lectures will address the application of cell and animal model systems and methods which provide functional insights into the mechanism of action of genes that contribute to disease. Typically offered in the fall term. Intended for all graduate students in molecular genetics and genomics (MOGN); open to students in other tracks or programs.

MCB Electives: Molecular Medicine and Translational Science (MMTS) Focus

752. Foundations of Translational Science. (2) Builds on the student's basic biochemistry and
cell biology knowledge with an intensive examination of the molecular basis of human disease and its’ treatment. The course mixes lectures with a case-based approach to take students through the diagnosis, physiology, pathophysiology, and the molecular mechanisms of several diseases. Learning issues are developed by the group, centered upon treatment options, their mechanisms of action, the appropriate design of clinical trials to test new therapies, and the research base for further advances in prevention and treatment. MD and PhD facilitators assist with student-led discussions. Relevant, current literature is examined. Typically offered in the spring term. Intended for all graduate students in molecular medicine and translational science (MMTS); open to students in other tracks or programs.

753. Advanced Topics in Regenerative Medicine. (3) The remarkable advances in biomaterials, stem cell biology, and genetic manipulation over the last several years have now made it possible to begin devising means of treating diseases that were previously incurable, and developing corrective therapies for crippling injuries. These advances have led to the emergence of the field of research/clinical investigation that is known as Regenerative Medicine, and this field promises to revolutionize the way we treat/manage both disease and injury. In this course, students will learn about the major organ/tissue systems of the body, the key enabling technologies that make regenerative medicine possible, and how these technologies can be applied to each organ/tissue to mediate regeneration/repair to treat disease/repair injury. Students will then embark on projects that will require them to apply the knowledge gained from the lectures to develop realistic and clinically translational solutions to generate specific organs for transplantation. Students will present their projects to the class at the end of the semester. Typically offered in the spring term. Intended for all graduate students in molecular medicine and translational science (MMTS); open to students in other tracks or programs.

Molecular Genetics and Genomics (MOGN)
Bowman Gray Campus

Program Director
Timothy Howard

Professors

Associate Professors
Zheng Cui, Rajendar Deora, Gregory A. Hawkins, Thomas Hollis, Timothy D. Howard, Fang-Chi Hsu, Steven J. Kridel, Youngmei Liu, W. Todd Lowther, Lance D. Miller, Akiva Mintz, Nilamadhab Mishra, Chor Yin Ng, David A. Ornelles

Assistant Professors
Peter A. Antinozzi, Timothy S. Pardee, Derek Parsonage, Stephen J. Walker

Overview

The graduate training program in Molecular Genetics and Genomics is an interdisciplinary curriculum that leads to the Ph.D. degree in Molecular Genetics and Genomics. The major goal of the program is to train students for independent research and teaching in the fields of laboratory-based molecular and cellular biology or computational analysis in genetics and genomics. The program faculty has departmental affiliations in both basic science and clinical departments of the Medical School, and departments on the Reynolda Campus.

The Graduate Program in Molecular Genetics and Genomics provides specialized training in the field of Molecular Genetics and Genomics while integrating student training as much as possible with traditional departmental disciplines. Students may elect to pursue this program of study after successful completion of the first year common curriculum of the Molecular and Cellular Biosciences (MCB) Track.

The program accepts students with a variety of undergraduate degrees including majors in the biological sciences, chemistry, mathematics, computer science and statistics. Students with a laboratory focus have typically completed courses in general biology, general chemistry, organic chemistry, physics, statistics, and mathematics through calculus. Students with analytical interests have typically completed advanced courses in mathematics, statistics, and/or computer science.

During the second year, students begin research in their dissertation laboratory and take specialty courses relevant to the area of research conducted in that laboratory. Second-year courses include the advanced seminar-style courses, 741 and 742. Dissertation research is performed under the supervision of a program faculty member and is tailored to meet the interests and training objectives of the individual student.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

MCB Track Electives

MCB 741. Computational Biology. (2) An introduction to the use of software and resources available for analysis of genes and proteins. Students will learn how to use practical tools to analyze protein and gene sequences through a combination of lectures and completion of hands-on problem sets. Typically offered in the fall term. Intended for all graduate students in molecular genetics and genomics (MOGN); open to students in other tracks or programs.

MCB 742. Molecular Genetics and Genomics of Human Disease. (2) Introduces students to applications of molecular genetic and genomic methods for the identification and functional characterization of genes contributing to human disease. In addition, complementary lectures address the application of cell and animal model systems and methods which provide functional insights into the mechanism of action of genes that contribute to disease. Typically offered in the fall term. Intended for all graduate students in molecular genetics and genomics (MOGN); open to students in other tracks or programs.

MOGN Advanced Courses

701, 702. Research in Molecular Genetics. (1-9) Research investigations in molecular genetics are conducted in the laboratories of program members studying a wide range of disciplines. Satisfactory/Unsatisfactory

710. Scientific Writing. (1) Designed to provide training in the preparation of scientific papers for publication, preparation of research proposals, and discussions of ethical conduct of scientific research. P—POI

719, 720. Special Topics in Stem Cell Biology. (2) Utilizes directed readings and student presentations of primary literature to introduce students to the field of stem cell biology. Content focuses primarily on human stem cell cell biology, including pluripotency and its maintenance, the role of chromatin remodeling in fate determination and lineage restriction, self-renewal and differentiation, and the genetic conversion of somatic cells into pluripotent stem cells. The field is expanding rapidly and course content will be modified as needed to incorporate new findings and applications in stem cell biology and translational medicine. A background in the form of undergraduate or graduate courses in and/or developmental biology is strongly recommended. The course is cross-listed as MMTS 719, 720. P—POI

726. Genetic Epidemiology. (2) Presents fundamental concepts and methods in genetic epidemiology. Introduces various genetic epidemiology study designs in related and unrelated individuals and covers basic analysis, inferences, plus their strengths and limitations. Lecture and lab. P—MCB 701, CPTS 720; CPTS 730, or POI

734. Human Molecular Genetics. (2) A combined lecture/seminar course providing an overview of current theoretical and technical approaches for locating, identifying, and cloning human genes using molecular genetic methods. Emphasis is on the search for genes that contribute to simple single-gene disorders and common complex diseases. Topics include genetic mapping and association studies, chromosome structure at the molecular level, identification of coding sequences
and disease susceptibility genes, and functional analysis of gene products. P—MCB 701 or POI
741, 742. Tutorials in Molecular Biology. (2, 2) Seminar course that focuses on new and important aspects of research in molecular and cellular biology with an emphasis on the current literature. Each semester the course explores specific themes chosen by a committee of faculty and students. Students select topics for presentation and lead discussions with faculty and graduate students.


Molecular Medicine and Translational Science (MMTS)
Bowman Gray Campus

Director
John S. Parks

Co-Director
Robert N. Taylor

Professors

Associate Professors
Susan Appt, Werner Bischoff, David Cauley, Zheng Cui, Rajendar Deora, Purnima Dubey, Cristin Ferguson, Cristina Furdui, Jason Grayson, Kristen Hairston, George Kulik, Sang Jin Lee, Jed Macosko, Akiva Mintz, Christopher Porada, Mercedes Porosnicu, Vidula Vachharajani, Raghunatha Yammami

Assistant Professors
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Overview
The graduate program in Molecular Medicine and Translational Science (MMTS), an interdisciplinary program offering the Doctor of Philosophy (PhD) and Master of Science (MS) degrees, is specifically designed to meet the challenge of training basic scientists to function successfully in clinical environments. The last decade has brought about fundamental and radical advances in a number of disciplines including biochemistry, cellular and molecular biology, and immunology. These changes have led to unparalleled opportunities to advance medical research and patient care. Both basic and clinical scientists can now test novel and provocative hypotheses using tools such as recombinant DNA technologies, functional imaging techniques, mass spectrometry, and new therapies and quickly acquire results that would have seemed fanciful science fiction only a few years ago. These new approaches have not only made it possible to understand cellular and molecular mechanisms of human disease, but they also offer the promise of new and revolutionary therapeutic options for clinicians.

Translating new advances in science to improved bedside care for patients requires erasing many of the historical divisions between basic and clinical scientists. For modern-day clinicians to understand and take advantage of new developments, a great deal of time must be spent at both the bedside and the bench. Conversely, the potential to understand mechanisms of illness and its treatment brings relevance and urgency to the work of basic scientists, moving them closer to their clinical colleagues. This movement into the clinical arena facilitates the challenge of viewing a complex clinical disorder through the eyes of the basic scientist. For these reasons, there has been a major emphasis by national, private, and industrial granting organizations to fund basic research that has the potential to immediately impact human disease. This creates a unique niche for basic (PhD) scientists who are trained on the cutting edge of molecular advances to perform "translational" research in human biology and disease.

The MMTS program provides training in the use of cellular, molecular, and integrative approaches to investigate biologic events with an emphasis on human disease. The multidisciplinary faculty consists of scientists who have major ongoing human research programs. The program offers PhD students a comprehensive knowledge of human biology and disease that allows them to develop basic research programs with fundamental clinical implications. It is also designed to train biomedical researchers to fill an important niche in academia or industry.

For MD, DVM or DO-trained physician-scientists on faculty or in training at Wake Forest University Baptist Medical Center, a master's or PhD degree in MMTS is also available for qualified candidates. The overall objective of the MS/PhD program is to train individuals who already hold an MD degree in the cellular and molecular techniques needed to integrate basic science with clinical applications involving human disease. An additional benefit of the program is that it enhances interaction between MDs in clinical departments and PhDs who are engaged in fundamental bench research focused on human disease.

The MMTS program participates in the Molecular and Cellular Biosciences (MCB) PhD track. Prospective students interested in MMTS apply to the MCB track and can indicate their interest in the MMTS program on the application. Applicants to the MCB Program should have a solid background in biological and/or physical sciences, prior research experience and a passion for scientific inquiry. Students enter the program through the MCB Track and participate in the MCB common curriculum in the first year. Curriculum in subsequent years includes participation in Translational Science Seminar Series, Clinical Experience, Foundations of Translational Science, Scientific Development and Business of Science course, and electives of the student's choice.

Prospective students are encouraged to contact individual faculty members whose research is of particular interest. For more information regarding the PhD or MS degree programs in MMTS visit http://www.wakehealth.edu/School/Molecular-Medicine-Graduate-Program/Molecular-Medicine-Graduate-Programs.htm.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

In addition, students who enter the MMTS program are required to take the following set of courses: MCB 752, MMTS 711, 712, 715, 716, 724, 791, 792, as a first-year course. Students who have an MD or are in the combined MD/PhD program are exempt from MCB 752 and MMTS 715/716. Possible statistics courses include one of the following: HES 721. Data Analysis and Interpretation. (3); CPTS 730. Introduction to Statistics. (4); IPP/NEUR 741. Quantitative Methods in Bioscience. (3). See statistics course descriptions within the appropriate program sections.

MCB Track Electives:

MCB 752. Foundations of Translational Science. (2) Builds on the student's basic biochemistry and cell biology knowledge with an intensive examination of the molecular basis of human disease and treatment. The course mixes lectures with a case-based approach to take students through the diagnosis, physiology, pathophysiology, and the molecular mechanisms of several diseases. Learning issues are developed by the group, centered upon treatment options, their mechanisms of action, the appropriate design of clinical trials to test new therapies, and the research base for further advances in prevention and treatment. MD and PhD facilitators assist with student-led discussions. Relevant, current literature is examined. Typically offered in the spring term. Intended for all graduate students in molecular medicine and translational science (MMTS); open to students in other tracks or programs.
MCB 753. Advanced Topics in Regenerative Medicine. (2) The remarkable advances in biomaterials, stem cell biology, and genetic manipulation over the last several years have now made it possible to begin devising means of treating diseases that were previously incurable, and developing therapies for crippling injuries. These advancements have led to the emergence of the field of research/clincial investigation that is known as Regenerative Medicine, and this field promises to revolutionize the way we treat/manage both disease and injury. In this course, students will learn about the major the major organ/tissue systems of the body, the key enabling technologies that make regenerative medicine possible, and how these technologies can be applied to each organ/tissue to mediate regeneration/repair to treat disease/repair injury. Students will then embark on projects that will require them to apply the knowledge gained from the lectures to develop realistic and clinically translational solutions to generate specific organs for transplantation. Students will present their projects to the class at the end of the semester. Typically offered in the spring term. Intended for all graduate students in molecular medicine and translational science (MMTS); open to students in other tracks or programs.

MMTS Advanced Courses:

711, 712. Translational Science Seminar Series. (1, 1) Faculty and students jointly describe their research in a human disease, first in clinical terms and then to follow the development of the understanding of that disease to the molecular level with an emphasis on translational applications. Presentations introduce students to potential preceptors and experimental strategies used to study human disease. Students present their own research to gain experience and professional skills for seminars and national meeting presentations.

713. Advanced Readings in MMTS. (1-2) This course allows individualized advisor-student discussion of literature pertaining to a specific area of interest in Molecular Medicine. Satisfactory/ Unsatisfactory

715/716. Clinical Experience. (1) Students who choose to enter the MMTS program must take this course in the fall (MMTS 715) and spring (MMTS 716) term. This course serves as an introduction to clinical medicine for the PhD students. Each student observes and participates in clinical activities with his/her clinical mentor. Experiences are custom-designed by the clinical mentor for each student. At the end of the semester, students enrolled in the course meet and each student presents a case study, based on his/her personal clinical experience.

719, 720. Special Topics in Stem Cell Biology. (2) This course utilizes directed readings and student presentations of primary literature to introduce students to the field of stem cell biology. Content focuses primarily on human stem cell properties, including pluripotency and its maintenance, the role of chromatin remodeling in fate determination and lineage restriction, self-renewal and differentiation, and the genetic conversion of somatic cells into pluripotent stem cells. The field is expanding rapidly and course content will be modified as needed to incorporate new findings and applications in stem cell biology and translational medicine. A background in the form of undergraduate or graduate courses in developmental biology is strongly recommended. This course is cross-listed. Also listed as MOGN 719, 720. P—POI

721. Regenerative Medicine Immersion - Fundamentals, Principles and Clinical Applications. (1-2) This course will provide a state-of-the-art review of various aspects of RM addressing the fundamental principles and progress in tissue engineering and regenerative medicine in recent years, including background material, key scientific components of RM, ethical, economic and other issues important to the field. RM has the potential to deliver cures to many diseases while also improving quality of life. RM integrates the principles of cell and molecular biology, materials science, biomedical engineering, and clinical science with the goal to develop materials and therapies to repair or replace cells, tissue, and organs damaged by disease, trauma, or congenital conditions. In recent years, approaches are being used routinely in daily clinical practice, with others in clinical studies, and multitudes in preclinical testing phase. The course addresses the interdisciplinary nature of RM, major components necessary to produce engineered tissues and organs, opportunities and today’s most critical challenges. A series of eight topic areas features prominent faculty members of the Wake Forest Institute for Regenerative Medicine (WFIRM) along with distinguished invited experts in the field. The eight content areas are grouped thematically and address a breadth of topics spanning: stem cells, cell sources, biomaterials, cellular therapies, enabling technologies and animal models, as well as legal, commercial, regulatory and ethical issues. In addition to the formal presentations, students also have the opportunity to interact with speakers in smaller groups during lunch and other informal, social networking events and settings. This course does have enrollment limits, and registrations are accommodated on a first-come, first-served basis. Satisfactory/Unsatisfactory

724. Scientific Development and the Business of Science. (1-3) This course reviews techniques for effective communication of scientific proposals and presentations, both oral and written. For oral presentations, emphasis is on content organization and connecting with the audience. Assignments include the presentation and critical discussion of student research. For written presentations, the emphasis is on grant proposal development, as well as familiarization with the peer-review process. The course consists of lectures on all aspects of grant development (including budgets and protocols and compliance regulations for human and animal research), and student preparation of a grant proposal. An oral exercise includes the discussion of an NIH ROI proposal in a mock study section format. Also listed as P—POI.

791, 792. Research. (1-9) This course involves closely supervised research in various topics in molecular medicine, with a special emphasis on models of human disease, including research in preparation for the doctoral dissertation. Satisfactory/Unsatisfactory

Other Electives:

In addition to the required courses, students in the PhD program may select, in consultation with their advisor, or one more graduate-level science courses from a range of other programs, including but not limited to: biochemistry and molecular biology (BANB), biology (BIO), biomedical engineering (BMAB), cancer biology (CABI), cell biology (CBL), chemical and population translational science (CPTS), comparative medicine (COMD), health and exercise science (HES), mathematics (MTH), microbiology and immunology (MICR), molecular genetics and genomics (MOGN), neuroscience (NEUR), physics (PHY), or integrative physiology and pharmacology (IPP). Students should complete these additional courses prior to the end of their third year.

Neuroscience (NEUR)

Bowman Gray and Reynolda Campuses

Track Director Carol Milligan

Overview

The program is composed of over 60 research faculty and 30 clinical faculty representing fourteen basic science and clinical departments. The program offers a PhD degree in neuroscience to students interested in a research and teaching career in all areas of neuroscience. All students are required to take a core curriculum of neuroscience courses over the first three semesters as well as coursework in statistics and experimental design. During the first year of graduate study, students obtain hands-on research experience by participating in laboratory rotations. Additional graduate coursework is tailored to meet the individual needs of each student. A major goal of the program is the development of neuroscientists with a broad background in cellular, molecular and systems neuroscience with specialized skills in a specific sub-area of neurobiology.

Areas of faculty research expertise include: cellular and molecular neurobiology; developmental neurobiology; epilepsy; learning and plasticity; nerve growth and regeneration; neural basis of memory; neurobiology of aging; neurobiology of drug abuse; and neurodegenerative diseases. As a major center of neuroscience research, Wake Forest has modern research facilities that cover all areas of contemporary neurobiological investigation, from gene cloning, genomics, and molecular genetics to electrophysiology, cell biology, and behavioral analysis. The PhD program began in 1989 and has graduated 60 students. There are currently 35 students in the program. For more information, visit our homepage at http://www1.wfuherc.edu/neuroscience. Prospective
students are encouraged to contact individual neuroscience faculty members to assess a potential advisor's ability to accept a student.

Applicants to the neuroscience graduate program should have demonstrated proficiency in biology, chemistry, physics, and mathematics with emphasis on coursework in cell and molecular biology, organic and inorganic chemistry, biochemistry, and statistics. Research experience although not required, is highly desirable.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.

NEUR First-year Courses

701. Introduction to Neuroscience I. (2-5) Neuroscience I is the first in a required two-course series for first-year neuroscience graduate students covering basic topics in the neurosciences. Neuroscience I is offered only in the fall semester and deals with neuroanatomy (6 weeks), cellular and molecular neuroscience (6 weeks), and developmental neuroscience (3 weeks). Approximately one third of the course includes laboratory work in neuroanatomy. For non-Neuroscience students, the neuroanatomy block may be taken separately as a two-credit course, and the cellular and molecular neuroscience block may be taken separately as a two-credit course.

702. Introduction to Neuroscience II. (2-5) Neuroscience II is the second in the series of required courses for first-year neuroscience graduate students covering basic topics in the neurosciences. Topics covered include: developmental neurosciences (3 weeks), sensory (6 weeks) and motor systems (6 weeks). Cognitive and computational neuroscience are also covered. For non-Neuroscience students, the sensory block may be taken separately as a two-credit course, and the motor systems block may be taken separately as a two-credit course. P—NEUR 701

703, 704. Seminars in Neuroscience. (1) This is a weekly seminar given by students, postdocs, faculty and external speakers. It runs throughout the year and is structured so that each student presents one research seminar in a given year. First year students give a 30-minute seminar and senior students give an hour seminar. First year students are assigned seminar slots during the summer between first and second year. The remaining slots are used by postdocs, faculty, and visiting speakers. Departments and the WNCNSIN Chapter take turns sponsoring the seminars by external speakers.

705, 706. Tutorial in Neuroscience. (1) The Tutorial in Neuroscience runs during the fall, spring and summer semesters. The format is one in which a faculty member or postdoc presents his/her research and a student presents a paper on a topic related to that research topic. Additionally, students must submit a manuscript or review paper related to his/her own research at the end of each semester.

707, 708. Research. (1-9) Lab research in all areas of modern neuroscience, including studies done as part of the first-year research rotations and the requirements for the doctoral dissertation. Satisfactory/Unsatisfactory

741. Quantitative Methods in Bioscience. (3) An introduction to essential concepts and methods for the quantitative analysis of biological data, with a focus on descriptive and inferential statistics. General topics include basic concepts in statistics such as probability theory and chance models, samples and populations, analyses of the relationships between variables, analysis of normal data, analysis of non-normal data and non-parametric analyses, an introduction to Bayesian frameworks, clustering analysis, and multivariate analyses. Didactic lectures cover core frameworks, analytic approach, and the mechanics and intuitive logic behind the methods. Laboratory sessions provide experience using a software platform (R) for data analysis and visualization using practical problems. This course is cross-listed as IPP 741.

NEUR Advanced Courses (by topics)

Behavioral Neuroscience

714. Behavioral Neuroscience. (3). Behavioral neuroscience is a relatively new and rapidly expanding discipline utilizing techniques of molecular biology, neurochemistry, neurophysiology, and psychology to investigate the neurobiological basis of behavior. A broad overview of the field and its relationship to these individual disciplines is presented. The course provides a survey of the field from the cellular level to the complexity of molar aspects of behavior including learning and memory. An introduction to lab models of human neurological disorders is included. P—NEUR 701; NEUR 702

722. Behavioral Pharmacology. (3) Focuses on behavioral factors that influence the effects of drugs. Material presented provides a detailed review of the rate-dependent, reinforcing, and stimulating effects of drugs. Additional topics include behavioral factors related to tolerance and sensitization and a review of animal models of drug action. This course is cross-listed as IPP 722.

Cell and Molecular Neuroscience

721. Molecular Neuroscience. (3) Introduces graduate and advanced undergraduate students to the basic principles of neurobiology as studied by cell and molecular biologists. Lectures introduce invertebrate and vertebrate model neuronal systems and the cellular and molecular methods to study them. P—NEUR 701; NEUR 702

Development and Aging of the Nervous System

742. Developmental Neurobiology I: Molecular Control of Neural Lineages and Differentiation. (3) Designed as an introduction to principles of early neural development. Topics include both the genetic and epigenetic control of early developmental events, including the determination of neuronal and glial cell lineages, expression of homeotic genes and neural pattern formation, inductive signal events required for neuronal differentiation and migration in both the central and peripheral nervous system, and the role of the extracellular environment in axonal growth. Students examine both historical and current models of molecular mechanisms regulating neural development through prescribed readings, tutorials and interactive discussions sessions. A weekly hands-on tutorial introduces students to a variety of cellular and molecular methods including mRNA analysis (mRNA purification, electrophoresis and Northern blot analysis, Rnase protection assays, RT-PCR analysis, cryostat sectioning, in situ hybridization) and protein analysis (protein polyacrylamide gel electrophoresis—PAGE, Western blot analysis, Immunooassays and Immunocytochemistry). P—NEUR 701; NEUR 702

743. Developmental Neurobiology II: Progressive and Regressive Events in Neural Development. (3) Emphasizes regressive and progressive events required for the maturation of neuronal systems. Topics include molecular mechanisms of regulating both normal and pathological cell death in neurons and glia, including extracellular signals, receptors and intracellular pathways promoting or preventing cell death. Also included are topics concerning the development, specificity and pruning of synaptic connections in neural networks, as well as the role of cell adhesion and extracellular matrix in the formation of neural networks. Students examine both historical and current molecular models of cell death, neurotrophism, neurotrophic factors and their receptors. A weekly hands-on tutorial introduces students to a variety of cellular and molecular methods including in vitro methods of analysis (explant and dissociated neuronal cell culture assays for studies of cell death and axonal growth) and in vitro methods (quantitative analysis of cell death including fluorescent, histological and TUNEL labeling of cell death, methods of axonal and dendritic labeling and EM ultrastructural analysis of synaptic changes). P—NEUR 701; NEUR 702; NEUR 742

744. Developmental Neurobiology III: Neural Plasticity and Regeneration. (3) Focuses on the capacity of neural networks to be modified by experience or to be reconstructed after injury. Examines molecular mechanisms proposed for activity-dependent competition in the initial construction of the nervous system, the plasticity of connections in models of activity-mediated sprouting, mechanisms proposed for neural plasticity in learning and memory, and a comparison of events required for neuronal repair and regeneration in the PNS and CNS. Current attempts to utilize neural transplantation to enhance the recovery of function in models of neurological diseases and trauma are also reviewed. Students examine both historical and current models of neural plasticity and regeneration through prescribed readings, tutorials and interactive discussion sessions. P—NEUR 701; NEUR 702; NEUR 742; NEUR 743
Sensory Neuroscience

753. Sensory Neuroscience I: Visual and Auditory Systems. (3) This course is designed to introduce students to sensory neurobiology of visual, auditory, olfactory and gustatory systems from the cellular to systems level. Under each sensory system, the topics cover the receptors in the sensory organs, signal transduction, subcortical and cortical areas and higher order processing. The course also includes topics relevant to sensory perception such as attention, working memory, decision making and plasticity. The course is structured to enable the students to learn how individual sensory systems function and to recognize the parallels between sensory systems. P—NEUR 701; NEUR 702

754. Sensory Neuroscience II: Somatosensation and Multi-sensory Integration. (3) This course is the second in a series that focuses on mammalian sensory systems. The course is designed to introduce students to somatosensory, pain and multisensory processing from the molecular to the systems level. The aim is to introduce key concepts of global organization that transcend individual modalities. Cellular, molecular, behavioral and pharmacological approaches will be covered against the backdrop of relevant model sensory systems. P—NEUR 701; NEUR 702; NEUR 753

755. Research Design in Sensory and Systems Neurobiology (3). This course combines didactic material with hands-on approaches so that students learn to properly design experiments in neurobiology and are able to analyze quantitatively the resulting experimental data. The didactic component provides a brief survey of fundamental mathematical and statistical concepts (e.g., probability, Bayesian inference, curve fitting, hypothesis testing, nonparametric statistics), which serves as a foundation for more advanced techniques used to analyze neuronal data (e.g., signal detection theory, cross-correlograms, information theory). Through computer-lab sessions and homework assignments tailored to each topic, students translate the theoretical knowledge to practical application as they learn to use the Matlab programming environment. The specific quantitative methods covered, as well as the sample data used for the hands-on analysis assignments, are tailored according to the students' backgrounds, programming experience, and research interests.

Substance Abuse and Addiction

717. Current Topics in Drug Abuse. (2-3) Provides students with perspective on the problem of drug abuse. Defines the basic issues central to the field of drug abuse, including concepts of tolerance, physical dependence and reinforcement mechanisms, and relates these issues to the current problems of drug abuse in society. Describes how current research in drug abuse contributes to the design of rational treatment and prevention programs. This course is cross-listed as IPP 717.

724. Biology of Alcohol Abuse—Alcoholism. (3) Designed to instruct graduate and postdoctoral students on the pharmacological, physiological, and behavioral effects of alcohol. Lectures cover topics with an emphasis on alcohol epidemiology and etiology of alcoholism, alcohol metabolism and pharmacokinetics of alcohol in the mammalian system. Lectures concerning effects of alcohol on specific organ systems include the hepatic system, the endocrine system, reproductive systems, the cardiovascular system, the gastrointestinal system, and the renal and pancreatic systems. Lectures focusing on the effects of alcohol on the nervous system include neuroreceptor interactions, ethanol's effects on intracellular signaling processes, neuroanatomical substrates for the actions of alcohol, systems electrophysiology, and mechanism of the behavioral effects of alcohol such as the reinforcing effects, anxiolytic effects, amnestic effects, and motor impairing effects. The neuroscience lectures provide the basis for an exploration of the conditions leading to tolerance and dependence, and how the brain adapts to prolonged exposure to alcohol. This course is cross-listed as IPP 724

740. Neuropharmacology. (3) General survey of neuropharmacology, emphasizing neurotransmitters, receptors and their interactions. Discusses general principles of drug action, including receptor binding, second messengers, and neurotransmitter metabolism. Surveys neurotransmitter function, including acetylcholine, biogenic amines, excitatory and other amino acids, and neuropeptides. This course is cross-listed as IPP 740. P—NEUR 701; NEUR 702

Translational Neuroscience

771. Clinical Neuroscience (3). Lectures and class discussions dealing with topics in neurobiology, pathophysiology, and treatment of patients with neurological and behavioral/psychiatric problems. Includes a brief introduction to major concepts of patient treatment and care with utilization of up-to-date methodology in clinical neuroscience. Students have the opportunity to observe and participate in patient evaluation and diagnostic testing in the clinical setting and to visit many of the neuroscience-related clinical research and treatment centers. Taught by both clinicians and basic science researchers. P—NEUR 701; NEUR 702

Neurosciences Journal Clubs

777, 778. Directed Journal Club in Pain and Anesthesiology. (1) This journal club covers articles related to mechanisms of pain and somatosensory processing including cellular/molecular, pharmacological, behavioral, and anatomical studies of acute and chronic pain disorders. Students are encouraged to review current research findings from all aspects of pain research including basic science, translational and clinical studies. Each week a student presents an article providing a thorough review of relevant background information drawing upon seminal and related papers.

780, 781. Directed Journal Club in Sensory Neurosciences. (1) Correlates with the formal lecture courses in Sensory Neurosciences I-II. Students are required to read and critique papers chosen to complement the classroom lectures. Both seminal papers and current research are reviewed. The directed nature of the readings enhances the student's appreciation and understanding of the formal lectures. Students lead the presentation of the journal articles, thus providing opportunities for teaching in the area of sensory systems.

783, 784. Directed Journal Club in Developmental and Molecular Neurobiology. (1) Students are required to read and critique papers related to developmental, cell and molecular, or disease/pathological issues in the nervous system. Both seminal papers and current research are reviewed. The directed nature of the readings enhances the student's appreciation and understanding of the formal lectures. Students lead the presentation of the journal articles, thus providing opportunities for teaching in these areas.

785, 786. Directed Journal Club in Network Science in Neuroimaging. (1) This journal club covers articles related to network science and its application in biological systems with a particular emphasis on the brain. Assigned reading will cover methodological foundation of network science, as well as the current literature on applications of network science in neuroimaging studies. Although the brain network will be of the main focus, readings may also include other types of networks such as biological, social and technological networks.

787, 788. Memory, Cognition and Aging Journal Club. (1) The topics in this journal club will cover all aspects of memory, cognition and cognitive aging from molecular and cellular/synaptic mechanisms to behavioral and imaging studies. Papers on basic research and translational science in any model system ranging from rodent, non-human primates to humans will be discussed. In the Journal Club course, each week a student will present a paper using a format indicated by the course director.

789, 790. Behavioral Pharmacology Journal Club. (1) In this course, students read and present journal articles of current or historical importance that involve drugs and have behavior as the primary dependent variable.

NEUR Electives

690. Contemplative Science. (2) Contemplative Science integrates experiential learning and reflection about traditional contemplative practices from a variety of secular and spiritual traditions with emerging neuroscience. It offers participants an opportunity to develop skills that will deepen and expand their future professional activities.

710. Human Gross Anatomy. (4) A regional and systematic approach to the study of human gross anatomy, incorporating cross-sections, x-ray films, CT and MRI scans with clinical implications. Course fees may apply.
The Department of Physics offers programs of study leading to the MS and PhD degrees. Opportunities for study are those usually associated with large research universities, while the atmosphere of a small liberal arts university with an ideal faculty/student ratio is maintained.

For admission to graduate work, the entering student should have knowledge of senior level undergraduate mechanics, electricity and magnetism, thermodynamics, and quantum physics. The course of study for each student is planned in conference with the graduate adviser after an evaluation of academic background and experience. Deficiencies may be removed during the first year of study by taking remedial courses.

For the MS degree, the student's course of study must include PHY 711, 712, and 741, as well as participation in the departmental seminar series (PHY601) each semester. These weekly seminars, in fields of special interest, and usually feature outside speakers. A MS degree candidate must have at least 30 credit hours of graduate credit. This must include at least six credit hours in thesis research and at least 24 credit hours in coursework. At least 12 of these 24 credit hours must be in courses numbered 700 or above. Credit may be allowed for as many as six hours of graduate work transferred from another institution at the discretion of the program director and the dean of the Graduate School. Thesis research courses are graded S (Satisfactory) or U (Unsatisfactory). If a U is assigned the course must be repeated and an S earned before the degree can be awarded. In addition to satisfying the residency and course requirements, the student must be admitted to candidacy, complete an acceptable thesis under faculty supervision, and pass an oral examination in its defense. The minimum grade point average (GPA) required for graduation is 3.0.

For the PhD degree, the student's course of study must include PHY 711, 712, 741, 742, 770, unless satisfactorily completed elsewhere, as well as participation in the weekly departmental seminar series (PHY601) each semester. Students must also take three elective courses at the graduate level (600 or 700 level), at least one of which must be in physics. To graduate, students must achieve an overall GPA of 3.0 and a 3.0 GPA in graduate courses within the physics department. The University's preliminary examination requirement is satisfied by passing a written and oral exam. The written preliminary examination is usually taken at the end of the first year of graduate study. The written examination may be retaken once, and must be passed before the third year of graduate study; extensions, for example for part-time students may be approved by the department. Students must have at least a 3.0 GPA to take the preliminary examination. A research advisory committee, appointed after completion of the written preliminary examination, determines the additional courses needed for the PhD, such as Advanced Quantum Mechanics, Biophysics, Solid State Physics, General Relativity, Nonlinear Optics, Math or Computer Science, Medical Physics, Biomedical Engineering, et. Within eighteen months of completing the preliminary written examination, the student submits to his or her individual advisory committee, and defends orally a dissertation research plan. This constitutes the oral part of the preliminary exam and upon passing it, the student can be advanced to candidacy. The research advisory committee meets annually with the student to ensure timely progress toward the degree. Upon completion of the research in the approved plan, the student writes his or her dissertation, presents it to the department, and defends it orally as prescribed by the Graduate School.

The successful completion of a program in scientific ethics is required prior to admission to degree candidacy. This requirement is fulfilled either by participating in the courses designated by the Graduate School or by satisfactory completion of approved departmental electives that incorporate extensive discussion of scientific ethics.

The research interests of the graduate faculty are in experimental and computational biophysics, nanotechnology, optics, experimental and theoretical solid state physics, particle physics, and
relativity. All research laboratories are well-equipped with state-of-the-art instrumentation, such as subpicosecond pulsed lasers; EPR; time-resolved, UV-vis spectrophotometers; optical tweezers; atomic force microscopes; single molecule manipulators; high-sensitivity optical and confocal microscopes; numerous, standard biochemical research apparatuses; and others. The Center of Nanotechnology and Molecular Materials (www.wfu.edu/nanotech), which houses state-of-the-art electronmicroscopies, and sample analysis and preparation instruments and a clean room, is part of the physics department. Theoretical research is supported by the DEAC Linux Cluster with over 2,300 computational processing cores.

For more details on the PhD program, visit www.wfu.edu/physics or write to the chair of the graduate committee. Departmental graduate committee: Guthold (chair), Carroll, Cook, Holzwarth, Jurchescu, Salsbury.

Degree Requirements: please see “Requirements for Degrees” beginning on page 25.

Courses of Instruction

601, 602. Physics Seminar. (0.5, 0.5) Discussion of contemporary research, usually with visiting scientists. May be repeated for credit. Satisfactory/Unsatisfactory

607. Biophysics. (3) Introduction to the structure, dynamic behavior, and function of DNA and proteins, and a survey of membrane biophysics. The physical principles of several biophysical methods, such as X-ray diffraction, sedimentation, light scattering, light absorption, fluorescence and single molecule tools are studied. Designed to be accessible to students with biochemistry, chemistry, or physics backgrounds. C—PHY 626

610. Extragalactic Astronomy and Cosmology. (3) Topics covered include galactic structure, models for galaxies and galaxy formation, the large-scale structure of the universe, the Big Bang model of the universe, physical processes such as nucleosynthesis in the early universe, and observational cosmology.

620. Physics of Biological Macromolecules. (3) Physics of biologically important molecules, especially proteins and nucleic acids. Topics covered include the physical basis of biomolecular structure, the energetics and statistical mechanics of biomolecular dynamics, and the electrostatics and solvation of biomolecules. Course requirements may include a field trip to a relevant conference, such as the Carolina Biophysics Symposium, and a discussion section with an appropriate physics colloquium speaker. Designed to be accessible to students with biochemistry, chemistry, or physics backgrounds provided they have some exposure to thermodynamics and macromolecular structure. C—PHY 623

623. Computational Molecular Biophysics Laboratory. (1) Application of techniques in molecular modeling, including energy minimization, molecular dynamics simulation, and conformational analysis, to biological macromolecules. P—PHY 630 or POI

625. Biophysical Methods Laboratory. (1) Lab involves experiments using various biophysical techniques such as DNA and protein gel electrophoresis, protein crystallography and X-ray diffraction, electron paramagnetic resonance, atomic force microscopy, fluorescence microscopy, light scattering, stopped-flow absorption spectroscopy and ultracentrifugation. C—PHY 607

637. Analytical Mechanics. (1.5) The Lagrangian and Hamiltonian formulations of mechanics with applications. Taught in the first half of the fall semester.

639, 640. Electricity and Magnetism. (1.5, 3) Electrostatics, magnetostatics, dielectric and magnetic materials, Maxwell's equations and applications to radiation, relativistic formulation. The first half course is taught in the second half of the fall semester, following PHY 637. The other course is taught in the spring semester. These should be taken in sequence. P—PHY 601

641. Thermodynamics and Statistical Mechanics. (3) Introduction to classical and statistical thermodynamics and distribution functions.

643, 644. Quantum Physics. (3,3) Application of the elementary principles of quantum mechanics to atomic, molecular, solid state, and nuclear physics.

645. Advanced Physics Laboratory. (1) The lab associated with PHY 643, 644

652. Physical Optics and Optical Design. (4) Interaction of light with materials; diffraction and coherent optics; ray trace methods of optical design. Lab—three hours.

654. Introduction to Solid State Physics. (3) Survey of the structure, composition, physical properties, and technological applications of condensed matter. P—PHY 643

661. Biophysics Seminar. (1) Seminal and current publications in biophysics are studied. Each week a member of the class makes an oral presentation on a chosen publication and leads the ensuing discussion. Students may also be required to make a second oral presentation relevant to their own research. Does not fulfill course requirements for Master's or PhD degrees. May be repeated for credit.

663. Condensed Matter Seminar. (1) Seminal and current publications in condensed matter physics are studied. Each week a member of the class makes an oral presentation on a chosen publication and leads the ensuing discussion. Does not fulfill course requirements for Master's or PhD degrees. May be repeated for credit.

681, 682. Research. (1-3, 1-3) Library, conference, and lab work performed on an individual basis. May be repeated for credit.

685. Bioinformatics. (3) Introduces bioinformatics and computing techniques essential to current biomedical research. Topics include genome and protein sequence and protein structure databases, algorithms for bioinformatics research, and computer architecture and environmental considerations. Also listed as CSC 685. P—Introductory courses in biology, chemistry, and molecular biology or biochemistry or POI.

691, 692. Special Topics in Physics. (1-4) Courses in selected topics in physics. May be repeated if content differs.

711. Classical Mechanics and Mathematical Methods. (3) A study of variational principles and Lagrange's equations, the rigid body equations of motion, the Hamilton equations of motion and canonical transformations, Hamilton-Jacobi theory, and applications to continuous systems and fields.

712. Electromagnetism. (3) A study of electric and magnetic fields in vacuum and within media and their sources. Analytical and numerical methods for solving Maxwell's equations are also an important part of the course.


741, 742. Quantum Mechanics. (3, 3) Study of the foundations of modern quantum theory, with an emphasis on the meaning of the wave equation, operators, eigen-functions, eigenvalues, commutators, matrix mechanics, spin, and scattering.

743. Advanced Quantum Mechanics. (3) Advanced topics in quantum mechanics, including an introduction to relativistic quantum theory; quantum electrodynamics, and many particle treatments.

744. Introduction to Quantum Field Theory. (3) Introduction to relativistic quantum field theory, including canonical quantization, path integral techniques, perturbation theory, and renormalization.

745. Group Theory. (3) Group theory and its applications to the quantum mechanics of atoms, molecules, and solids.

752. Solid State Physics. (3) Introductory course including the structure of perfect crystalline solids, their thermal electronic properties, the free electron and band theory of metals, imperfect crystals, transport properties, and semiconductors.

754. Surface Science. (3) Experimental and theoretical methods for the study of surfaces and interfaces. Lab—1.5 hours.
756. Seminar on Defects in the Solid State. (2) The generation and interactions of point and line defects such as color centers, vacancies, and dislocations treated.

765. Gravitational and Particle Theory Seminar. (1) Topics in general relativity, particle physics, and astrophysics are studied. Each week a faculty member or member of the class makes an oral presentation on a chosen topic and leads the ensuing discussion. Does not fulfill course requirements for Master's or PhD degrees.

770. Statistical Mechanics. (3) Introduction to probability theory and to the physics of systems containing large numbers of particles from the classical as well as the quantum point of view.


785. Topics in Theoretical Physics. (1-3) Selected topics of current interest in theoretical physics not included in other courses.

787. Advanced Topics in Physics. (1-3) Lectures on advanced topics in physics that depend on the sub specialty of the instructor. Topics range from medical physics to special topics in biophysics, condensed matter physics, or quantum optics. May be repeated for credit.

789. Survival Skills for Scientists. (1) Students will learn skills that are essential to a successful career in the sciences. The following topics will be covered: Mentoring; How to Read, Write, and Review a Research Paper; Grant & Fellowship Basics; Choosing a Career Path & Creating a Winning Job Application; and Networking & Giving Effective Talks. Does not fulfill course requirements for the degree, all graduate students must write a major research paper, and conduct and defend a thesis.

620. Physiological Psychology. (3) Neurophysiological and neuroanatomical explanations of behavior.

622. Psychopharmacology. (4) Survey of the influences of a wide range of psychoactive drugs, both legal and illegal, on human physiology, cognition, and behavior.

623. Animal Behavior. (3) Survey of lab and field research on animal behavior.

626. Learning Theory and Research. (3) Theory and current research in learning with emphasis on applications of learning principles for behavior modification and comparisons across species.

629. Perception. (3) Survey of theory and research findings on various sensory systems (vision, hearing, touch, taste).

631. Research in Cognitive Psychology. (3) In-depth examination of research in a selected area of cognitive psychology such as memory, attention, or executive function. Research projects required.


638. Emotion. (3) Survey of theory, methods, and research in the area of emotion. Developmental, cultural, social-psychological, physiological, personality, and clinical perspectives on emotions are given.


646. Stereotyping and Prejudice. (3) Research and theory on social and cognitive processes that underlie prejudice and discrimination.

648. Clinical Neuropsychology. (3) Surveys connections between abnormal neurological processes and clinical abnormalities. This implies already having an understanding of normal brain function and anatomy.

651. Personality Research. (3) The application of a variety of research procedures to the study of personality.
human personality. Research projects required.

655. Research in Social Psychology. (3) Methodological issues and selected research in the study of the human as a social animal. Field research projects required.

657. Cross-Cultural Psychology. (3) Examination of differences in psychological processes (e.g., attitudes, perception, mental health, organizational behavior) associated with cultural variation.

659. Psychology of Gender. (3) Exploration of the psychological similarities and differences between human males and females, including consideration of social, cognitive, motivational, biological, and developmental determinants of behavior.

662. Psychological Testing. (3) Theory and application of psychological assessment procedures in the areas of intelligence, aptitude, vocational interest, and personality.

663. Survey of Clinical Psychology. (3) Overview of the field of clinical and other selected areas of applied psychology.

664. Stereotyping and Prejudice. (3) Theoretical and empirical examination of the processes underlying prejudice, discrimination, and racism.

667. Parent-Child Relationships. (3) Surveys characteristics of parent-child relationships and issues of parenting as related to a variety of factors, including developmental changes of parent and child, family structure, and sociocultural context.

674. Judgment and Decision Making. (3) Theoretical and empirical examination of how people make decisions and judgments about their lives and the world, and how these processes can be improved.

692. Contemporary Issues in Psychology. (3) Seminar treatment of current theory and research in specific areas within psychology. The course is one-half semester.

701, 702. Current Topics in Psychology. (1.5, 1.5) Seminar courses in selected topics in psychology. P—POI

715, 716. Research Design and Analysis in Psychology. (3, 3) Intensive study of the design of experiments and the analysis of research data in psychology. Covers conventional methods, including univariate and multivariate analysis of variance, multiple regression, and factor analysis. Requires previous or concurrent coursework in basic statistics. Written POI required.

720. Biological Psychology. (3) Study of the biological basis of behavior and mental processes, with emphasis on current developments in neuroscience, and human applications of this information. Laboratory work in neuroanatomy and psychophysiology.

728. Human Cognition. (3) Current theory and research on functional characteristics and neural correlates of cognitive processes in such areas as memory, attention, and language.

738. Learning and Motivation. (3) Basic learning principles and concepts and related motivational concepts.

742. Seminar in Developmental Psychology. (3) Critical examination of the major findings, principles, and theories of development, with attention to both human and lower-animal research.

752. Seminar in Social Psychology. (3) Content and methodology of social psychology examined through a critical and comparative analysis of contemporary theory and literature.

757. Seminar in Personality Psychology. (3) Evaluation of contemporary solutions to important problems in personality psychology, with special attention to historical context and anticipated future directions.

770, 771, 772, 773. Psychology Practicum. (1-3) Work experience in an applied psychology setting (such as clinical or industrial) under a qualified supervisor.

872. Readings and Research in Psychology. (1, 2, or 3) This listing allows the graduate student, working under the supervision of a faculty member, to pursue and receive credit for 1) a special reading project in an area not covered by regular courses or 2) a special research project not related to the master's thesis. Supervising faculty member and hours credit for which enrolled determined by graduate committee prior to registration.

785, 786. Directed Thesis Research. (3, 3) First-year students undertake a substantial research project under the direction of their adviser.

791, 792. Thesis Research. (1-9, 1-9) May be repeated for credit. Satisfactory/Unsatisfactory

### Religious Studies (REL)

**Reynolda Campus**

<table>
<thead>
<tr>
<th>Program Director</th>
<th>Chair</th>
<th>Associate Chair</th>
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<tr>
<td>Jarrod Whitaker</td>
<td>Jay Ford</td>
<td>Lynn Neal</td>
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<tr>
<th>Associate Professors</th>
<th>Associate Teaching Professor</th>
<th>Assistant Professors</th>
<th>Emeritus Professor</th>
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<tr>
<td>Stephen Boyd, Jay Ford, Mary Foskett, Kenneth Hoglund, Simeon Ilesanmi, Nelly van Doorn-Harder, Ulrike Wiethaus</td>
<td>Lucas Johnston, Lynn Neal, Jarrod Whitaker</td>
<td>Shawn Arthur, Annalise Glaub-Todrank, Ron Neal</td>
<td>Fred Horton</td>
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**Overview**

Associated Faculty: Michaelle Browers (politics), Stewart Carter (music), Steve Folmar (anthropology), Robert Hellyer (history), Kevin Jung (School of Divinity), Christian Miller (philosophy), Patrick Toner (philosophy), Neal Walls (School of Divinity), David Yamane (sociology)

The Master of Arts in Religious Studies offered by Wake Forest University’s Department for the Study of Religions provides students an opportunity to forge a unique, creative, and rigorous program of study. The degree can serve either as a terminal degree or as preparation for a doctoral program. It emphasizes the comparative and theoretical study of religion in its various traditions and forms. Reflecting the teaching and research interests of the current graduate faculty in the department, the program fosters interdisciplinary approaches, offering training in traditional and contemporary theories and methods in conjunction with substantive investigations of diverse religious traditions and topics. Students are encouraged to make imaginative use of all available resources in the creation of their own distinctive programs of study. Typically, this would involve 1) a focus on a particular religious culture/region or historical period, and 2) an approach or approaches to the study of the subject area.

The general MA in religion program began in 1967. Departmental graduate committee: Whitaker (chair), Hoglund, Ilesanmi, Ramachandran.

**Degree Requirements:** please see “Requirements for Degrees” beginning on page 25.

**Program Structure**

Students can graduate with an M.A. in Religious Studies via two options:

- Course Intensive Option
- Thesis Option

**Course Intensive Option.** The M.A. in Religious Studies "Course Intensive Option" is the default way in which students can graduate from the program. It requires a total of 36 hours of coursework. At least 12 of the 36 hours in coursework must be in courses numbered 700 or above, and one of these courses must be "REL 700: Theory and Method in the Study of Religion." The remaining 24 hours may be in courses at either the 600-level or 700-level. Students must also submit to a committee of 1 professor of their choice and the graduate director a final portfolio no less than a month before the end of their final semester, comprising a resume, personal statement, a selection of 3 papers (at least 1 theoretical) from any graduate level courses they have taken during their M.A.,...
and a 12-15 page reflection paper that discusses the trajectory, methods, and personal growth across the 3 papers and the way in which the student's views of "religion," broadly defined, have developed.

In addition, students will present and discuss their portfolio with their committee in a meeting lasting no longer than one hour. The portfolio will be graded pass/fail (with an option to resubmit) and the committee will consider its overall presentation, clarity of expression and purpose, and attention will be given to the reflection paper and the student's ability to articulate its views during this oral examination.

**Thesis Option.** The Thesis Option is available for students who wish to undertake substantial independent research and who are already thinking and writing in a succinct, analytical, and sophisticated manner. In order to write a thesis, the student must have submitted a proposal and been approved by the graduate director and primary thesis adviser. The student must also form a committee of 3 faculty (2 must come from the Department for the Study of Religions). If no faculty member in the Department of the Study of Religions agrees to serve as Primary Adviser, then the student cannot finish the program via the Thesis Option. The M.A. in Religious Studies Thesis Option requires a total of 36 hours course work. At least 12 hours of coursework (not counting thesis research hours) must be in courses numbered 700 or above, and one of these courses must be "REL 700: Theory and Method in the Study of Religion." A further 18 hours may be in courses at the 600-level or 700-level (not counting thesis research hours). The final 6 hours are to be taken as thesis research (REL 791 and 792), typically in the final semester of study.

**Thesis Proposal.** In order to write a thesis, the student must have a primary thesis adviser from the Department for the Study of Religions faculty; and a committee comprising two additional faculty in relevant areas of research (one of whom must also be a member of the Department for the Study of Religions). In addition, the student must submit a thesis proposal in her or his third semester of study (typically in the Fall, by October 15th) to the graduate program director and the primary thesis adviser. The proposal must be 6-10 pages, with a clear synopsis of the thesis argument, proposed chapters, a timeline for chapter submission, and an annotated bibliography. If the student cannot demonstrate her or his ability to pursue the thesis independently and in a sophisticated and analytical manner, the advisory committee will recommend that the student continue with the Course Intensive Track to finish the program. This decision is made between the Graduate Program Director and the primary thesis adviser by November 1st.

**Thesis Length and Quality.** The length of the thesis is to be decided between the student and the primary faculty adviser, but the department recommends no more than 100 pages. At minimum, the department expects that the thesis should be a publishable, article-length paper (35-50 pages) accompanied by substantial sources. It should be original work and can be a heavy reworking of a previous term paper or other research effort. The thesis process culminates in an oral examination by a committee of at least three faculty members who must assess the thesis according to the normal guidelines (see Graduate Handbook).

**Language Requirements.** The Department of Religion requires proficiency in a foreign research language relating to the student's area of study, whether ancient or modern. Proficiency is normally a minimum of two years work in a specific language at the university level or equivalent and may include, but not limited to, the following: Hebrew, Greek, Sanskrit, Arabic, Spanish, French, German, Chinese, or Japanese. A second research language is not required, but may be advised depending on the student's area of study and their plans after graduation (i.e., whether or not they plan on pursuing a Ph.D.). For example, students working on the Hebrew Bible, New Testament, or Sanskrit literature may be advised to learn German (the German Department offers a reading course for graduate students most summers: 001 German for Science and Humanities).

**M.A. in Religious Studies with a Concentration in Religion and Public Engagement**

Religion and Public Engagement (RPE) Concentration is unique to Wake Forest University—the only program like it in the country. Encouraging theoretical and practical exploration at the intersection of religion and public life, the Concentration is open to graduate students enrolled in the M.A. in Religion Program, who want to relate their area of study to issues of public life. Students will be expected to apply their academic study to specific problems by engaging in public work through research projects, service-learning opportunities, and internships for academic credit. Internships or research projects may focus on local, state, regional, or international issues. The program has existing relationships with non-profits, governmental and non-governmental agencies in such places as Winston-Salem, Raleigh, The San Carlos Apache Reservation, Washington, DC, Chile, the Ukraine, Chile, Israel/Palestine, and South Africa. By working with professors in various specialties, students develop competence in public engagement in reciprocal collaboration with diverse communities regionally, nationally, and globally. Embracing the spirit of Pro-Humanitate, the RPE Concentration allows students to pursue their deepest interests and directs them towards community development consistent with internationally accepted standards of human rights and the highest academic standards of teaching, research and collaboration.

Graduate Students are to meet all requirements of and are subject to the policies of the M.A. in Religion (see http://college.wfu.edu/religion/graduate-program/overview-of-the-program/).

REL 700: Theory and Method in the Study of Religion is required for all M.A. students, including students completing the RPE Graduate Concentration.

As with all graduate students enrolled in the M.A. in Religion, students seeking to finish with a Concentration in RPE are initially enrolled on the Course Intensive Option, but can submit a thesis proposal to finish on the Thesis Option (the thesis can be on a topic independent/unrelated to RPE Concentration or it can focus on RPE; if so, then it is advised that the Primary Thesis Advisor should be a faculty member in the Department of Religion who has worked closely with the student on RPE topics).

**Graduate Concentration requires 12 hours of course work, and must include:**

1. REL 632: Religion and Public Engagement (Core Course) (3h)
2. Internship: REL 709: Field Program in Religion and Public Engagement (3h)
   a) If the student has already completed a significant internship or held a job that intersected with issues of public life, he or she can substitute an extra elective course for the internship requirement with the approval of the Director of RPE and Graduate Program Director.
3. One Graduate Course (3h) focused on theory and its application, taken from the "Theory" group listed below (the following are given as examples and other courses may be approved by the Director of RPE and Graduate Program Director):
4. One Elective Graduate Course (3h) from any of the following choices (other courses can be approved by the Director of RPE and Graduate Program Director). Since these are taken toward the RPE Graduate Concentration, they will also count toward the M.A. in Religion degree, even if they do not have a REL designator.
   a) REL 619: Feminist and Contemporary Interpretations of the Bible; REL 669: Radical Christian Movements; REL 679: Feminist and Liberation Theologies; REL 690: South Asian Women: Religion Culture and Politics; REL 648: Race, Memory and Reconciliation; REL 690: Socially and Politically Engaged Buddhism; MIN 790: Faith, Food Justice, and Local Communities; TTHS 621: Christianity and Public Policy; TTHS 624: Church and State in America; TTHS 625: Sexuality, Religion and the Law; TTHS 721: Freedom of Religion Under the Constitution; LAW 582: Non-Profit Management; LAW 601: Non-Profit Organization Law

**Courses of Instruction**

In the list of courses offered with graduate credit, not every course is scheduled every year, but usually 1-2 courses at the 700-level are offered each year, including REL 700: Theory and Method in the Study of Religion. In addition, we encourage students to approach individual professors to teach 700-level directed reading courses on specific topics. Substantive efforts are made to offer courses that are needed by students in either graduate course of study, and student input is welcome in determining the course schedule from semester to semester.

600. **Approaches to the Study of Religion.** (3) A phenomenological study of different ways of defining religion, including views of representative philosophers, psychologists, sociologists, anthropologists, theologians, and historians of religion.

605. Ethnography of Religion. (3) Study of theory and method in ethnography of religion where students closely read ethnographies from a variety of cultures and discuss the practical, methodological, and ethical issues related to ethnography. Culminates with students researching and writing their own ethnographies.

606. Ritual Studies. (3) An introduction to the various methods and theories employed in the field of ritual studies, while examining comparative rituals and ritualized practices from around the world.

607. Magic, Science, and Religion. (3) Explores concepts of magic, science, and religion that emerged in Western thought and culture from late antiquity through the European Enlightenment and analyzes connections between religious traditions and Western, Modern Science.

608. Sacred Scripture in the Traditions of Abraham. Comparative study of sacred texts in Judaism, Christianity, and Islam with particular attention to the issues authority, function, and interpretation.

610. The Prophetic Literature. (3) Examination of the development and theological contents of the literary products of Israel's prophetic movement.

612. The Critical Study of the Pentateuch. (3) Study of the five traditional books of Moses (the Torah) and various lines of analysis that modern Biblical critics have used to interpret their composition and role in the development of Israelite theological thought.


615, 616. Field Research in Biblical Archeology. (3, 3) Study of the religion and culture of the ancient Near East through the excavation and interpretation of an ancient site.

617. Wisdom Literature. (3) Examination of the development, literary characteristics, and theological contents of the works of ancient Israel's sages.

618. Feminist and Contemporary Interpretations of the Bible. (3) Study of feminist and contemporary approaches to the Bible in light of the history of interpretation and a range of contemporary concerns and interpretive contexts.

620. The Search For Jesus. (3) Introduction to the issues, assumptions, evidence, and debate that shapes the continuing quest for the historical Jesus.

623. Jesus Traditions. (3) Examines ancient Christian and other religious representations of Jesus in historical, social, cultural and theological context.


630. Pope, Jefferson & Imam: A Study in Comparative Ethics. (3) Comparative study of the moral values and socio-ethical positions in the major religious traditions of the world, with particular focus on their various methods of reasoning and sources of authority.

631. Religion and Law. (3) A study of religion and law as distinct yet interdependent spheres that influence cultural negotiations about authority, power, identity, and the regulation of society. Geographic and tradition-specific focus may vary with instructor.

632. Religion and Public Engagement. (3) This seminar introduces students to dynamics at work at the interface between religious communities and the public sphere. It will explore, through a wide range of readings, guest lectures, and films, the potential for social change-constructive and destructive-within and between communities in locally, regionally, nationally and globally.

635. Religious Ethics and the Problem of War. (3) Examination of the causes and characteristics of war, various Christian response to it, and approaches to peacemaking, with attention to selected contemporary issues.

636. Religious Traditions and Human Rights. (3) Study of the relationships and tensions between religious traditions and human rights, with illustrations from historical and contemporary issues and movements.

638. Religion, Ethics, and Politics. (3) Examination of ethical issues in religion and politics using materials from a variety of sources and historical periods.

639. Religion, Power and Society in Modern Africa. (3) Interdisciplinary study of the growth transformations of Africa's major religious traditions (Christianity, Islam, and the indigenous religions), and of their relations with secular social changes.

641. Religion and Ecology. (3) Cross-cultural examination of the relationships among human beings, their diverse cultures, habitats, and religions, including social and political understandings of the environment.

642. Religious Intolerance in the U.S. (3) Study of the various manifestations of religious intolerance in the U.S. from the colonial period until the present.

643. Religion, Culture, and the Body. (3) A cross-cultural, multi-disciplinary exploration of the body as a malleable locus of contested ideals that informs personal, social, and religious identity formation.

644. Religion, Poverty, and Social Entrepreneurship. (3) Interdisciplinary study of major themes in religion, poverty reduction, and social entrepreneurship. Focus and community emphasis may vary with instructor.


648. Race, Memory and Identity. (3) Explores the collective memory and identity of American-Indian and African-American communities and their response to historical trauma in their cultural imagination, spirituality, and political and social activism.

649. Asian Meditation Practices. (3) Introduces and examines theoretical and practical aspects of various forms of Eastern meditation (concentration, mindfulness, Zen, visualization, and moving energy work) from both practitioner and modern scientific perspectives.

651. Sociology of Religion. (3) Introduces the sociological analysis of religion, including religious beliefs and experiences, the cultural context of religion, varieties of religious organization, religious change and social change.

655. Jewish Identities: Religion, Race, and Rights. (3) Examines how evolving definitions of race, religion, and Jewishness have correlated and conflicted in varied and sometimes surprising ways and how these shifts have been tied to legal rights and social privileges.

656. Modern Jewish Movements. (3) Examines modern Jewish movements from Isaac Luria's system of Kabbalah in 16th century Palestine through Jewish Renewal in the Contemporary United States.

657. Jews in the United States. (3) Focusing on the 19th-21st centuries, this course examines Jewish American histories, experiences, and identities, as well as their impact on American society as a whole.

659. Hinduism in America. (3) Study of the meanings, values, and practices associated with the religions of Hinduism in dialogue with the dominant culture of America.

661. Topics in Buddhism. (3) Variable topics in Buddhist history, thought, and/or practice. May be repeated for credit if topic varies.
662. Topics in Islam. (3) Examination of the origins and development of Islam, the world’s second largest religious tradition. Attention is given to the formation of Islamic faith and practice as well as contemporary manifestations of Islam in Asia, Africa, and North America. May be repeated for credit if topic varies.

663. The Religions of Japan. (3) Study of the central religious traditions of Japan from pre-history to the present, including Shinto, Buddhism, Zen Buddhism, Christianity, and Confucianism.

665. History of Religions in America. (3) Study of American religions from Colonial times until the present.

667. Contemplative Traditions in Christianity. (3) Historical and interdisciplinary study of contemplative practices (meditation, spirit possession, visions, and dreams) with special attention to gender and culture.

668. Protestant and Catholic Reformations. (3) Study of the origin and development of Reformation theology and ecclesiology.

669. Radical Christian Movements. (3) Study of selected radical movements in the Christian tradition and their relation to contemporary issues.

672. History of Christian Thought. (3) Study of recurring patterns in Christian thought across time and cultures and some of the implications of those patterns in representative ancient and modern figures.

673. Special topics in African-American Religious Traditions. (3) Variable topics in African-American religious traditions. May be repeated for credit if topics varies.

674. Black Messiahs and Uncle Toms. (3) Examines the cultural and religious history of black leadership in the United States.

675. Race, Myth, and the American Imagination. (3) A study of myth and mythology in relation to the racial imaginary in America.

676. Race, Religion, and Film. (3) Examines past and contemporary filmmakers who couple religious themes with racial concerns.

681. Zen Buddhism. (3) An examination of the origins and development of Zen Buddhism from China (Chán) to Japan and contemporary America. Particular attention is given to Zen doctrine and practice in the context of the broader Buddhist tradition.

682. Religion and Culture in China. (3) A thematic study of Chinese religious traditions and culture focusing on history, ritual, scripture, and popular practice. Topics include cosmology, ancestor veneration, shamanism, divination, and the role of women.

683. The Quran and the Prophet. (3) Examines the history, content, and main approaches to the sacred book of Islam. Explores the influence and interaction between the holy word and its transmitter the Prophet Muhammad.

684. Islam and Law: Ways of Interpretation and Expression. (3) Explores main tenets of the Islamic law (Šari‘ah) and how this law has been applied in past and present Islamic societies. Looks at legal issues through the lens of gender, ethics, non-Muslim minorities, rights, and duties.

685. Topics in South Asian Religions. (3) Variable topics in the religions of South Asia. May be repeated for credit if topic varies.

686. Indian Epics. (3) Examines one or both Indian epics, the Mahabharata and Ramayana, while paying attention to either epic’s religious, social, and political contexts, performance, and development in Indian history.

687. Priests, Warriors, and Aspects in Ancient India. (3) Introduces students to the history, culture and religious traditions of ancient India by examining the overlapping practices, beliefs, ideologies, and gender representations of priests, warriors, kings, and ascetics.

688. South Asian Women: Religion Culture & Politics. (3) This course examines the intersection of religion, race, and gender of South Asian women from a feminist and postcolonial perspective.

689. Islam in the West: Changes and Challenges. (3) Explores issues of identity, ethnicity and religion within various Muslim communities living in western countries. A central goal is to understand how these communities negotiate the new environment and the challenges they face.

690. Special Topics in Religion. (1.5-3) Religion topics of special interest. May be repeated for credit.

691. Topics in East Asian Religions. (3) Variable topics in the religions of China, Korea, and Japan. May be repeated for credit if topic varies.

692. Topics in First Peoples’ Traditions. (3) Variable topics in the religions of American Indian and Canadian First Nations. May be repeated for credit if topic varies.

693. Topics in Religions of Africa. (3) Variable topics in the religions of Africa or African diaspora. May be repeated for credit.

696. Interreligious Encounters and Engagements. (3) Surveys the history of dialogue activities among various religious communities and introduces the methods and theories of interreligious dialogues. Part of this class is interaction with local interfaith projects.

Seminars

700. Theory and Method in the Study of Religion. (3) Explores the history of and methodological resources for the study of religion. Focus may vary according to the instructor, but the emphasis is on the ways religion has been defined, studied, and interpreted over the last several centuries.

701, 702. Directed Reading. (1-3, 1-3) May be repeated for credit if topic varies.


704. Conceptions of the Ultimate. (3) A comparative study of religious conceptions of the ultimate (divine, sacred) within Eastern and Western traditions through a range of methodological lenses including phenomenological, philosophical, theological, and sociological.

705. Research in Religion. (3) Tools and methodologies applicable to research in religion. Fulfills the three hours in research methods that the religion department requires of first-year MA students.

708. Religious Language and Symbol. (3) Examination of the distinct use of language in religious discourse, with attention to theoretical understandings of human language, the variety of philosophical efforts to define the validity of religious language, and the role of metaphor and analogy in religious communication.

709. Field Program in Religion and Public Engagement. (1-3) Integrated study of major themes in religion and public engagement carried out in partnership with one or more communities off campus. Focus varies with instructor. On request.


726. Seminar in Early Christianity Studies. (3) An intensive study of selected topics and texts in early Christianity studies.

737. Figures and Traditions in Religious Ethics. (3) Seminar course that examines the basic ethical
works and theories of central figures in Western and non-Western traditions. Students engage in close readings of important texts in religious thought and morality and produce essays reflecting on the themes addressed by the authors.


740. Seminar in the Sociology of Religion. (3) Examination of selected classical and contemporary texts illustrative of the theories, methods, and purposes of the sociological study of religion.

751. Theory and Practice of Pastoral Counseling. (3) Study of counseling methodologies, psychotherapeutic techniques, personal development, and human behavior in terms of the implications for pastoral counseling.

755, 756. Clinical Pastoral Education. (3, 3) Clinical experience in pastoral care, including work in crisis situations, seminars, interdisciplinary clinical group sessions, formal pastoral counseling, urban ministry assignments, and participation in group therapy. (Both semesters must be completed.)

761. Seminar in Eastern Religion. (3) Directed study in selected areas of the religious traditions of the East.

762. The Literature of Ancient Judaism. (3) Examination of the rabbinic writings (Mishnah, Tosefta, Talmud, Midrashim, Targumim, and the Liturgy), the Dead Sea Scrolls, the Old Testament Apocrypha and Pseudepigrapha, and the literature of Hellenistic Judaism (e.g., Philo and Josephus).

763. Hellenistic Religions. (3) Consideration of available source materials, questions of method, and bibliography related to such Hellenistic religions as the Mysteries, Hellenistic Judaism, and Gnosticism.

766. Seminar in Christian History. (3) Directed study of selected areas in the history of Christianity, including Baptist history.

768. The Protestant and Catholic Reformation. (3) Study of the origin and development of Reformation theology and ecclesiology.

771. Religions in America. (3) A study of religious traditions, events, and individuals shaping religious life in America. Attention is given to native religious, colonization, denominations, awakenings, religious liberty, the western movement, and the rise of the “American Self.” The development of pluralism and the impact of immigration, civil rights, and “new religions” are also studied.

775. Seminar in the History of Christian Thought. (3) Intensive study of a selected period or movement in Christian theological history, with special reference to seminal persons and writings.

780. Seminar in Theology and Literature. (3) Intensive study of a single theologian in relation to a literary figure with a similar religious outlook, the aim being to investigate how literature and theology mutually invigorate and call each other into question. Representative pairings: Niebuhr/Auden, Barth/O'Connor, Tillich/Updike, Newman/Eliot, Kierkegaard/Percy. May be repeated for credit. POI on request.

781. Special Topics in Religion. (3) An intensive, in-depth study of a selected issue in the study of religion. Focus varies with instructor. May be repeated if topic varies.

791, 792. Thesis Research. (1-9) May be repeated for credit. Satisfactory/Unsatisfactory

NEAR EASTERN LANGUAGES AND LITERATURE (NLL)

111, 112. Elementary Hebrew. (3, 3) A course for beginners in the classical Hebrew of the Bible, with emphasis on the basic principles of Hebrew grammar and the reading of Biblical texts. (Both semesters must be completed.)

113. Standard Literary Arabic. (3) Introduction to the principles of Arabic grammar and a reading of selections from the Quran.


601. Introduction to Semitic Linguistics. (3) Study of the history and structure of four languages from the Hamito-Semitic family of languages.

602. Akkadian I. (3) Analysis of the phonology, morphology, and syntax of the East Semitic languages of the ancient Near East as they relate to the larger family of Semitic languages.

603. Akkadian II. (3) A continuation of NLL 602 with further emphasis on building expertise in vocabulary and syntax through the reading of texts from the Middle Babylonian period.

610. Readings from the Rabbis. (1) Analysis of selected classical Hebrew texts designed to expand the student's facility with Hebrew. May be repeated for credit. POI on request.

611. Aramaic. (3) The principles of Aramaic morphology, grammar and syntax based on readings from the Bible and other ancient Near Eastern texts. P—NLL 611 or POI on request.

614. Readings from the Rabbis. (3) Texts in Hebrew and Aramaic from the Talmud and Midrash. P—NLL 611 or POI on request.

615. Syriac. (3) A study of the grammar, syntax, and scripts of Syriac based on the reading of selected texts. P—NLL 611 or POI on request.

621, 622. Introduction to Middle Egyptian I & II. (3, 3) The phonology, morphology, and grammar of Middle Egyptian. POI on request.

625. Coptic. (3) The phonology, morphology, and grammar of Sahidic Coptic with special emphasis on the texts from Nag Hammadi. Some knowledge of Greek is helpful. POI on request.

Sustainability (SUS)

Reynolda Campus

Program Director
Dan Fogel

Reynolds Professor
Miles Silman

Professors
Richard Williams

Associate Professors
Abdou Lachgar

Assistant Professors
Ananda Mitra

Research Professors
Keith Bonin

Associate Faculty
Dedee DeLongpre Johnston

Overview
The Center for Energy, Environment and Sustainability (CEES) offer the Master of Arts in Sustainability, an innovative and distinctive one-year program that combines the social sciences, humanities, natural sciences, management and law. Courses taught will include guest lecturers and off-site facility visits. As a result, students will have unparalleled opportunities to engage with professionals beyond the Wake Forest campus. In addition to completing the four core courses, students will engage with organizations outside of the classroom through the completion of a two-credit practicum in Applied Sustainability as well as through course electives. In the summer following the second semester, students will complete a research thesis or internship.

The MA in Sustainability mission is to educate the next generation of leaders in sustainability and place them where they can be most effective. We provide students with a high caliber education.
and prepare them to enter the workforce or create new ventures to address the social, economic and environmental demands in their respective fields. We educate students to be change agents and develop a vision for ways to invest in and contribute to creating a sustainable future. The program expands Wake Forest's commitment to sustainability and creates opportunities for faculty members to direct their teaching and scholarship toward sustainability-related topics. The multidisciplinary program strengthens collaboration among the different schools at Wake Forest University and the greater communities of business, government agencies, and non-government organizations.

Candidates for the MA in Sustainability do not share a typical background nor are they required to have completed specific prerequisites prior to matriculation. The profile of a candidate will typically take the form of an accomplished mid-career professional seeking to re-orient or supplement their career with deep expertise in the field of sustainability, or a recent undergraduate from a highly ranked institution of higher education from across the nation or from across the globe. The integrated curriculum of our programs prepare students to join the vanguard of the sustainability movement, which is generating extensive and diverse opportunities for graduates in private business, as well as in NGOs, and government bodies. Candidates of the MA in Sustainability will utilize our program as a mechanism for adding value to their professional endeavors while simultaneously satisfying the urgent societal need for highly knowledgeable leaders in the field of sustainability.

Degree Requirements: please see "Requirements for Degrees" beginning on page 25.

Courses of Instruction

POL 269A. Environmental Political Thought. (3) Why should we preserve the wilderness, create national parks, concern ourselves with pollution? Answers to these questions depend on how we conceive the human relationship with the natural world. Does the natural world have value in itself (ecocentrism)? Or is it valuable only because it is useful for human beings (anthropocentrism)? Having considered these questions, we will turn to particular issues, such as the creation of national parks, preservation of wilderness, sustainable development, and the culture of consumerism, asking how we should respond through government and individual action.

600. Communications Workshop. (1) Designed to build skills in writing and presentations. At the end of this workshop students will have advanced skills in writing memos to various constituents, making presentations in front of varied groups, an ability to write white papers, and criteria for evaluating other communication. Students will design and deliver various communication products that will be critiqued by trained professionals.

601. Professional & Leadership Skills. (1) This workshop covers effective and ineffective presentations of data-driven arguments, science-based discussion of policy implications, how confounding plays a role in all survey and observational data (and how this contrasts with controlled experiments), and strengthening the level of understanding in the science of climate change.

602. Scientific Literacy. (1) This workshop builds on basic skills in statistics and quantitative and qualitative research. The main learning outcome of this workshop is how to evaluate data to make decisions. This critical thinking includes modeling data and evaluating research documents on various sustainability topics from peer reviewed and popular press sources.

603. Natural Capital Valuation and Ecosystem Services. (1) This workshop includes tools and concepts on how to value nature and take this valuation into account in various decisions. Students will apply the basic principles underlying ecosystem service analyses and valuation and be able to identify and select tools and data to complete an analysis.

604. Global Human Systems. (3) This course will draw on anthropology, sociology, and health sciences to focus on the global social outcomes of decision making and resource management, with an emphasis on sustainability in cultural contexts. Topics that will be covered include sustainable community development, agricultural policy, the effects of sustainability policy choices on public and community health, and public policy regulating the built environment. Students will look at these topics through the lens of environmental ethics and learn to think critically about the interdependence of economic and environmental policy and community well-being. After studying sustainability initiatives in developing nations, they should be able to realistically assess the feasibility of development strategies in various societies.

691. Special Topics. (1-3) Examination of topics not covered in the regular curriculum.

694. Internship. (1–4) Internships are available for a student who has completed one year of graduate study and desires experience working in the private sector or a nonprofit or government agency. Internships typically take place during the summer months and last for three months, although the timing and duration may be adjusted to satisfy each student's needs and the type of internship available. Credit hours are adjusted based on the length of the Internship. The student receives a written evaluation from the host mentor and is required to submit a written report of his/her work. May be repeated for up to 4 credits.

695. Individual Study. (1-3) Opportunity to pursue a topic covered in a regular course in greater depth or topics relevant to the student's field of concentration. Usually involves extensive reading and tutorial sessions with a faculty supervisor. Written papers may be required. May be repeated for up to 6 credits.

702. Sustainable Organizational Management. (3) Drawing on business management, finance, and accounting, this course will examine strategies for sustainability in corporations, governments, and NGOs. Topics covered will include corporate management and social responsibility, organizational change, systems thinking, organizational strategy, innovation, sustainable supply chains, and measurement and accounting methods. Students will also examine emerging trends in global industry standards, inclusion of environmental mandates in free trade agreements, and voluntary codes of conduct; they will be expected to critique the effectiveness of these methods in terms of environmental impact and stakeholder outcomes. They will also learn methods by which to value an ecosystem through social, economic, and environmental criteria. Students will develop leadership abilities to apply to their fields as they identify levers to encourage systemic change in various contexts.

703. Natural Science for Sustainability. (3) This course provides participants with an in-depth scientific understanding of the most important non-renewable and renewable energy sources including fossil fuels, solar, hydropower, biofuel/biomass, nuclear, wind, tidal, and geothermal. Students in this course will study the world's present and future energy needs, focus on energy production and consumption, and environmental impact, and explore ways in which these principles relate to sustainability. Students will be introduced to energy systems such as fossil fuels, solar, wind, geothermal, biofuels and biomass. The sustainability and environmental trade-off of different energy systems will be studied.

704. Environmental Law & Policy. (3) To understand how we can move toward sustainability domestically and abroad, we must understand how and why law and policy are developed, challenged, and changed. This course will look at the historical development of environmentalism and the movements that provided the impetus for modern environmental legal regimes, as well as recent studies illustrating contemporary environmental issues. We will cover common law and statutory remedies for private citizens, principles of federalism and separation of powers, agency rulemaking, the role of the judiciary in environmental law and policy, and international environmental law. Each case study in this course will emphasize one of the major U.S. environmental statutes, so that upon completion of the course you will not only have a foundation in law and policy processes but also a familiarity with the most significant U.S. statutory schemes.

705. Applied Sustainability 1. (2) Contextualizing the material covered in the four classroom courses, this course will provide opportunities for students to experience sustainability in action. On a biweekly basis, students may travel off campus for mini-practicum opportunities that will include visits to a permaculture farm, a scientific research site dedicated to monitoring coal byproduct runoff, local small businesses assisting corporations as they develop sustainability strategies, a nonprofit dedicated toremoving food shortages in poor and minority communities, and a solar farm. A longer student tour mid semester will take students to see the effects of mountain top removal and fracking and meet with organizations and legislators lobbying for and against these methods of energy production. Weeks when students remain on campus, this course will bring outside speakers.
and presentations to address issues of global development, environmental riders to trade treaties, biofuel production, genetically modified foods, LEED certification and sustainable building design, sustainable urban planning and transportation, and sustainable strategies for public health.

706. Applied Sustainability 2. (2) Contextualizing the material covered in the four classroom courses, this course will provide opportunities for students to experience sustainability in action. On a biweekly basis, students may travel off campus for mini-practicum experiences that will include visits to a perma-culture farm, a scientific research site devoted to monitoring coal byproduct runoff, local small businesses assisting corporations as they develop sustainability strategies, a nonprofit dedicated to remediating food shortages in poor and minority communities, and a solar farm. A longer study tour mid semester will take students to see the effects of mountain top removal and fracking and meet with organizations and legislators lobbying for and against these methods of energy production. Weeks when students remain on campus, this course will bring outside speakers and presentations to address issues of global development, environmental riders to trade treaties, biofuel production, genetically modified foods, LEED certification and sustainable building design, sustainable urban planning and transportation, and sustainable strategies for public health.

710. Sustainable Urban Planning and the Built Environment. (3) This course will explore the tenets of sustainable construction and high performance building practices and prepare students for the U.S. Green Building Council's LEED Green Associate Exam. LEED, or Leadership in Energy & Environmental Design, is a certification program that recognizes best-in-class building strategies and practices. Sustainable architecture and construction seeks to minimize the negative environmental impact of buildings by efficiency and moderation in the use of materials, energy, and development space. This course widens the conversation to include how buildings and other community planning impacts urban environments. The focus of this planning is to satisfy construction and design goals with sustainable outcomes.

715. Environmental Sustainability in a Global Context. (2) Students will develop practical problem-solving skills that address the challenges of climate change in an international context. This experiential learning course employs a variety of interdisciplinary approaches to explore concepts related to climate change adaptation. Students will interact with practitioners and stakeholders in various economic and political sectors to develop a group client-based project that supports real policy and management decisions on sustainable practices. Students will have the opportunity to travel internationally to visit affected areas and meet with government officials, researchers, conservationists, and economic planners. This course offers students a firsthand opportunity to conduct field research, hone interviewing practices, draft policy reports, and engage clients.

720. Sustainability Practices & Policy in a National Context. (1) This seminar is designed specifically for graduate students in sustainability, students who are early and mid-career professionals looking to transition into careers in sustainability or environmental protection through business, government, NGOs, policy institutes or non-profits. Students will hear from and meet with a range of experts in climate change and sustainability, learn about the work they do and get a clear understanding of the challenges they face (practically and politically) and the impact they can have. This seminar will model possible career paths and provide networking opportunities.

791. Thesis Research. (1-4) Research directed toward fulfilling the capstone requirement. May be repeated for a total of 4 credits.

Courses in General Studies

As a mechanism for enrichment of graduate studies at Wake Forest University, additional courses in liberal arts are offered for graduate credit. These courses are designed to provide special opportunities for students in the humanities and social sciences, but are open to students on either campus. The courses may be taken after consultation with the student's departmental advisory committee.

Anthropology

605. Museum Anthropology. (3) Examines, through hands-on use of the Museum's collections, the historical, social, and ideological forces shaping the development of museums, including the formation of anthropological collections and representation, and the intellectual and social challenges facing museums today.

607. Collections Management Practicum. (1.5) The principles of collections management including artifact registration, cataloging, storage, and handling; conservation issues and practices; disaster planning and preparedness; and ethical issues are covered through lectures, readings, workshops, and hands-on use of the Museum's collections.

613. Traditions, Continuity, and Struggle: Mexico and Central America. (3) Acquaints students with the lives and struggles of indigenous and non-indigenous people of Mexico and neighboring countries, with special focus on the Maya. Includes study of contemporary and prehispanic traditions, including Mayan cosmology; language, art and architecture, issues of contact during Spanish colonization, and current political, economic, health, and social issues affecting these areas today.

615. Artifact Analysis and Laboratory Methods in Archeology. (3) Introduction to methods for determining the composition, age, manufacture, and use of different prehistoric and historic artifact types. Techniques for reconstruction of past natural environments from geological or ecofact samples. Exploration of data display tools including computer-based illustration, GIS, and archeological photography.

630. Seeing World Cultures. (3) Focuses on selected cultures throughout the world to better understand these societies through the use of ethnographic literature and assesses the effectiveness of visual communication in conveying ideas about these cultures through the use of ethnographic videos and films.

632. Anthropology of Gender. (3) Focuses on the difference between sex, a biological category, and gender, its cultural counterpart. An anthropological perspective is used to understand both the human life cycle and the status of contemporary women and men worldwide. In section one, topics covered include evolution and biological development, sexuality and reproduction, parenting and life cycle changes. The second section takes students to diverse locations, including Africa, South Dakota, China, India, and the Amazon for a cross-cultural comparison examining roles, responsibilities and expectations, and how these interact with related issues of class and race.

641. Peoples and Cultures of South Asia. (3) Survey of the peoples and cultures of the Indian subcontinent in the countries of Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. Reviews major topics of interest to anthropologists, including prehistory, history and politics, religion, social organization, caste, gender, development and population.


637. Economic Anthropology. (3) Examines the relationship between culture and the economy and its implications for applied anthropology. The variable nature and meaning of economic behavior will be examined in societies ranging from non-industrial to post-industrial. Discusses the impact of economic development programs, foreign aid and investment, technology transfer, and a variety of other economic aid programs.

639. Culture and Nature. (3) Exploration of humanity's "place" in the cosmos, focusing on different worldviews of nature and culture. Case studies from anthropology, archeology, and environmental science examine conceptions of technology, resources, environment, and ownership in the context of environmental change, "natural" disasters, and resource scarcity.

640. Anthropological Theory. (3) Study and evaluation of the major anthropological theories of humans and society. The relevance and significance of these theories to modern anthropology are discussed.

642. Development Wars: Applying Anthropology. (3) Explores the application of anthropological
concepts and methods in the understanding of contemporary problems stemming from cultural diversity, including competing social and economic development models and ideologies of terror. Emphasizes conflict and change in developing areas but also considers the urban experience.

653, 654. Field Research. (3, 3) Issues-based field program providing students with a critical understanding of the historical, social, political-economic and environmental conditions that have shaped the lives of the people of the Greater Southwest, with special attention to the Native American and Latino/a experience. The program moves from the Mexican border region through New Mexico and Arizona, focusing on border issues, archaeology and prehispanic history, and contemporary Native American culture. Students camp, hike, and learn to use digital technology in the field. Specific sites may vary from year to year.

655. Language and Culture. (3) Covers theoretical and methodological approaches to the study of language and culture, including: semiotics, structuralism, ethnoscientific, the ethnohistory of communication, and sociolinguistics. Topics include: linguistic relativity; grammar and worldview; lexicon and thought; language use and social inequality; language and gender; and other areas.


662. Medical Anthropology. (3) The impact of Western medical practices and theory on Western and non-Western cultures and anthropological contributions to the solution of world health problems.

663. Primate Behavior and Ecology. (3) Examines the evolution and adaptations of the order Primates. Considers the different ways that ecology and evolution shape social behavior. A special emphasis on the lifeways of monkeys and apes.

664. Primate Evolutionary Biology. (3) Examines the anatomy, evolution, and paleobiology of members of the order Primates. Emphasis is on the fossil evidence for primate evolution. Topics covered include: primate origins, prosimian and anthropoid adaptations, patterns in primate evolution, and the place of humans within the order Primates.

665. Evolutionary Medicine. (3) Explicitly evolutionary approach to complex relationships between human evolutionary adaptations and health problems related to modern behavior and culture.

666. Human Evolution. (3) The paleontological evidence for early human evolution, with an emphasis on the first five million years of biocultural evolution.

668. Human Osteology. (3) Survey and analysis of human skeletal anatomy, emphasizing archeological, anthropological, and forensic applications and practice.

670. Old World Prehistory. (3) Survey of Old World prehistory, with particular attention to geological and climatological events affecting culture change.

674. Prehistory of North America. (3) The development of culture in North America as outlined by archeological research, with emphasis on paleoecology and sociocultural processes.

676. Archeology of the Southeastern United States. (1.5) Study of human adaptation in the Southeast from Pleistocene to the present, emphasizing the role of ecological factors in determining the formal aspects of culture.

677. Ancestors, Indians, Immigrants: A Southwest Cultural Tapestry. (3) Exploration of factors that shaped the lives of people in the Southwest, with attention to Native American and Hispanic experience. From kivas to casinos, coyotes to cartels, it links archeological and prehispanic history to contemporary lifeways in the canyons, deserts, and cities of the U.S./North Mexico.

678. Conservation Archeology. (1.5) Study of the laws, regulations, policies, programs, and political processes used to conserve prehistoric and historic cultural resources.


681, 682. Archeological Research. (3, 3) Integrated training in archaeological field methods and analytical techniques for researching human prehistory. Students learn archeological survey, mapping, excavation, recording techniques and artifact and ecofact recovery and analysis.

683, 684. Field Research in Cultural Anthropology. (3, 3) Comparative study of culture and training in ethnographic and cultural analysis carried out in the field.

685, 686. Special Problems Seminar. (3, 3) Intensive investigation of current scientific research within the discipline, concentrating on problems of contemporary interest.

687. Ethnographic Research Methods. (3) Designed to familiarize students with ethnographic research methods and their application. Considers the epistemological, ethical, political, and psychological aspects of research. Field experience and data analysis.

698. Individual Study. (3) Reading or research course designed to meet the needs and interests of selected students, to be carried out under the supervision of a departmental faculty member. May be repeated for a maximum of 6 hours.

785. Directed Research and Reading. (3) Research and reading course, including field component, designed to meet the needs of individual students and resulting in a professional-quality paper and/or presentation. May be repeated for a maximum of 6 hours. P—POI

Art

614. Video Art: Site Specific (3) A historical, aesthetic, and technical exploration of contemporary video art production. Students will produce multi-channel video projects that interact with physical space. P—Video Art/Film-making experience required.

624. Video Art: Cyberspace. (3) A historical, aesthetic, and technical exploration of contemporary video art productions. Students will produce multi-channel video projects that interact with cyberspace. P—Video Art/Film-making experience required.

628. Video Art: Theatre Works. (3) A historical, aesthetic, and technical exploration of contemporary video art productions. Students will produce single-channel video projects for theatre viewing P—Video Art/Film-making experience required.

685. Global Contemporary Art. (3) A global perspective on contemporary artistic trends since 1980, including discussions about art criticism, exhibitions and the changing art world.

696. Art History Seminar. (3) Offered by members of the faculty or visiting faculty on topics of their choice.

- a. Ancient Art
- b. Medieval Art
- c. Renaissance Art
- d. Baroque Art
- e. Modern Art
- f. Contemporary Art
- g. American Art
- h. Modern Architecture
- i. American Architecture
- j. Art and Popular Culture
- k. Film
- l. Architecture and Urbanism
- m. Museums
- n. Special Topics

697. Advanced Topics in Studio Art. (3) Focus on selected studio projects, critical readings, and discussions on topics selected by members of department faculty. May be repeated for a maximum of 6 hours.

- a. Drawing
- b. Painting
- c. Printmaking
- d. Sculpture
- e. Photography
- f. Digital Art
- g. Special Topics

697 H. Video Art. (3) Continues the historical, aesthetic, and technical exploration of contemporary video art production.
Classical Languages

689, 690. The Teaching of Latin. (3, 3) A reading course and workshop in the problems of Latin pedagogy and the secondary Latin curriculum, designed to meet the needs and interest of selected students. P—POI

History

605. Medieval and Early Modern Iberia. (3) The cultures that flourished on the Iberian peninsula between 700 and 1700 were diverse and contradictory. This course examines the formation of religious, cultural and political identities and the economics of empire in the medieval and early modern period.

607. Italian Renaissance. (3) Examination of the economic, political, intellectual, artistic, and social developments in the Italian world from 1350-1550.

608. The World of Alexander the Great. (3) Examination of Alexander the Great's conquests and the fusion of Greek culture with those of the Near East, Central Asia, and India. Special emphasis on the creation of new political institutions and social customs, modes of addressing philosophical and religious issues, as well as the achievements and limitations of Hellenistic Civilization.

609. European International Relations Since World War I. (3) This course surveys European international relations in the 20th century beyond treaties and alliances to examine the economic, social, and demographic factors that shaped formal arrangements between states. Additionally, it will cover the impact on European diplomacy and international relations of new forms of international cooperation, pooled sovereignty, and nongovernmental organizations.

610. Twentieth Century Eastern Europe. (3) Examination of the history of twentieth century Eastern Europe, including the creation of nation-states, World War II, and the nature of Communist regimes established in the postwar period. The course concludes with a discussion of the collapse of the Eastern Bloc and the challenges of European integration.

612. Jews, Greeks, and Romans. (3) Largely from a Jewish context, the course explores the political, religious, social, and philosophical values shaped by the collision between Jews, Greeks, and Romans, from the Hellenistic Period to the Middle Ages.

613. The History of European Jewry from the Middle Ages to the Present. (3) Examines the Jewish historical experience in Europe from the medieval period to the Holocaust and its aftermath. Includes a consideration of social, cultural, economic and political history, and places the particular experience of Jews within the context of changes occurring in Europe from the medieval to the modern period.

614. European Economic and Social History, 1700-1990. (3) Changes in Europe's economic structures and how they affected Europeans' lives, emphasizing how economic forces interacted with social and institutional factors.

615. Greek History. (3) The development of ancient Greek civilization from the Bronze Age to the end of the Classical Period stressing social institutions, individual character, and freedom of social choice within the framework of cultural, political, and intellectual history.

616. Rome: Republic and Empire. (3) Survey of Roman history and civilization from its beginning to about 500 C.E., with emphasis on the conquest of the Mediterranean world, the evolution of the Republican state, the growth of autocracy, the administration of the empire, and the interaction between Romans and non-Romans.

617. The French Revolution and Napoleonic Empire. (3) The revolution and wars that constitute one of the pivotal points in modern history.

618. Weimar Germany. (3) Art, literature, music, and film of Weimar Germany, 1919-1933, in historical context. German or history credit determined at registration.

619. Poland and the Baltic Region. (3) Introduction to the history of Poland and the eastern Baltic littoral since 1760, covering territory that later became Estonia, Latvia, Lithuania, and Poland; emergence of independence after World War I; the Soviet experience; and re-establishment of independence during the breakup of the Soviet Union.

624 Fashion in the Eighteenth Century. (3) Examines the relationship between consumer culture and democratic politics in the eighteenth-century, focusing on Britain, North America, France, and Haiti. Considers laws regulating dress; the relationship between democracy, political resistance, and costume; the construction of political allegiance through clothes and symbols; and the ways fashion mediated ideas about empire, race, and gender.

625. English Kings, Queens, and Spectacle (3) Examines how English royal authority was created, legitimized, performed, and challenged between the reigns of Henry VIII and George III through ritual, Image, and text. Topics include: gender and power; court culture; the press and political revolution; popular politics and propaganda; graphic satire; and the commercialization of politics.

627. Profit and Power in Britain. (3) Examines economic ideas and British society between 1688 and 1914. Topics include connections between consumption and Identity; the relationship of morals to markets; the role of gender and the household; knowledge, technology, and the industrial revolution; and the place of free trade in the political imagination.

628. History of the English Common Law. (3) Study of the origins and development of the English common law and its legacy to modern legal processes and principles.


630. Race, Religion, and Sex in Early Modern Europe. (3) Explores issues of race, ethnicity, and gender in Europe between 1400 and 1800. Topics include contact and conflict among Jews, Muslims, and Christians; marriage, the family, and sexuality; migration and immigration; and slavery and conquest in early European colonies and empires.

631. The United States in Age of Empire, 1877-1919. (3) Explores the late 19th and early 20th centuries when the United States joined in the global scramble for empire. Examines the domestic and international causes of American imperial expansion; the modes of rule that the U.S. exercised in its formal expansion and as a informal world possesspower. ons; and the political and intellectual debates at home and abroad about America's expansion as a world power.

632. The United States and the Global Cold War. (3) Considers United States efforts to secure its perceived interests through "nation building" and economic development in Africa, Latin America, the Middle East, and much of Asia during the Cold War and after, Emphasizes the ideological and cultural dimensions of American intervention.

633. European Diplomacy, 1848-1914. (3) The diplomacy of the great powers, with some attention given to the role of publicity in international affairs. Topics include the unification of Italy and Germany, the Bismarckian system, and the coming of World War I.

634. Mystics, Monarchs, and Masses in South Asian Islam. (3) An introduction to Islam through South Asian social, political, cultural, and intellectual history.

635. Hindus and Muslims in India, Pakistan, and Beyond. (3) Examining the shared yet different, intertwined yet separate histories of the Hindus and Muslims of modern India, Pakistan, Bangladesh, and Sri Lanka primarily over the last two centuries. This course explores the checkered existence of the two communities in order to understand diversity and questions of coexistence and conflict.

636. Gender in African History. (3) Examines the centrality of gender to the African past. Major topics include definitions of gender in African settings; the operation of gender in precolonial African societies; gender and slavery; gendered transformations during colonial rule; gender, nationalism and independence; and the evolution of relationships between men and men, men and women, and women and women in various regions of the continent.

637. Women and Gender in Early America. (3) History of women and gender roles from 1600 through the Civil War, including the social constructions of femininity and masculinity and their political, economic, and cultural significance. (CD)

638. Sexuality, Race and Class in the U.S. since 1850. (3) History of gender relations from the
id-nineteenth century to the present. Analyzes the varying definitions of femininity and masculinity, the changing notions of sexuality, and the continuity and diversity of gender roles with special attention to race, class, and ethnicity.

639. Sickness and Health in American Society. (3) Analysis of major trends in health, sickness, and disease within the broad context of social, political, and economic developments. Examines indigenous healing; colonial medicine; emergence of hospitals and asylums; public health; medical ethics; race, class, and gender issues; and natural versus high-tech approaches to health care in the 20th century.

640. Social and Cultural Change in Urban Africa. (3) While popular imagination suggests that the African past is largely a rural one, many of the continent's most explosive social and cultural transformations have taken place in its cities. This course examines how urban residents have worked to creatively shape some of sub-Saharan Africa's major transformations. Major topics include the social and cultural fabric of precolonial African cities, the impact of colonialism on African towns, cities as sites of revolution and independence, and the contemporary conditions and challenges facing urban residents. (CD)

641. Africans in the Atlantic World, 1750-1815. (3) Explores Africans' experience in the Atlantic world (Africa, Europe, and the Americas) during the era of slave trade by examining their encounters with Indians and Europeans and their adjustment to slave traders in West Africa. Also listed as AES 341. (CD)

644. Early Modernity in China. (3) This course explores historic transformations in Chinese economy, society, thought, and culture from 1500 to 1800. These developments are placed within their local, global and comparative context. Students read a wide variety of Chinese primary sources in English translation, including philosophical treatises, literary works, letters, diaries, and memoirs, some of which were written by Jesuit missionaries from Catholic Europe. (CD)

647. Japan since World War II. (3) Survey of Japanese history since the outbreak of the Pacific War, with emphasis on social and cultural developments. Topics may include occupation and recovery of independence, the "1955 System," high-growth economics, and the problems of prosperity in recent years.

648. Samurai and Geisha: Fact, Film, and Fiction (3) Focuses on two well-known groups in Japanese history, the samurai (warriors) and geisha (entertainers). By analyzing historical studies and primary sources, as well as works of fiction and film about samurai and geisha, the course considers how Japanese and Western historians, novelists, and filmmakers have portrayed the two groups and by implication Japan and its history in the modern period.

650. World Economic History: Globalization, Wealth, and Poverty, 1500-Present. (3) Explores the growth of globalization and its role in the creation of wealth and poverty in both developed and underdeveloped nations. Focuses on trade, industrialization, and agriculture and technological advances in global contexts.

651. Global Environmental History. (3) Analysis of environmental aspects of world history from the beginning of agriculture to the present. Focus on how humans have used the environment to different ends. Topics include forests, agriculture, water, urbanism, science, warfare, conservation, energy, and perceptions of nature.


653. War and Society in Early America. (3) Examines the evolution of warfare among the indigenous and colonial societies of North America between 1500 and 1800 and considers the roles of economics, class, gender, race, religion, and ideology in cultures of violence.

654. The Early American Republic. (3) A history of the formative generation of the United States. Considers the dramatic transformations of the constitutional, economic, and racial orders, as well as new performances in politics, national identity, gender and culture.

655. History of Nature Conservation in Latin America. (3) Explores the human dimensions of nature conservation in Latin America in a global perspective. Topics include the methods used by different cultures and societies to conserve natural resources (including forests, fields, waterways, and wildlife), the social consequences of environmental protection, and how conservation changed over time. Taught only in Latin America.


658. Race and the Courts. (3) Examines the impact of state and federal court cases upon the evolution of race relations in the U.S. Beginning with Dred Scott, the historical context of each case is placed in juxtaposition to the social and political realities for the given time periods. Case law, scholarly articles, as well as the Supreme Court Digest provide a foundation for analyzing government intervention, inaction, and creative interpretation.

659. Prostitutes, Machos, and Travestis: Sex and Gender in Latin-American History. (3) Explores gender and sexuality across 20th century Latin America and the Caribbean. Applies new theoretical developments in gender, masculinity, and LGBT studies to the region's history of race, revolution, labor, dictatorship, and social movements. Cases include the Mexican, Cuban, and Nicaraguan Revolutions and the Dominican and Argentine dictatorships. (CD)

660. Jewish Migrations to the Americas (3) Compares Jewish migrations to the U.S., Latin America, and the Caribbean from the colonial period to the present, focusing on the peak mobility of the 1880s–1920s. Topics include changing conceptions of identity (national, racial, ethnic, religious), class, gender, assimilation, institutions, and relations both among Jews and between Jews and other groups. (CD)

661. Economic History of the U.S. (3) The economic development of the U.S. from colonial beginnings to the present.

662. American Constitutional History. (3) Origins of the Constitution, the controversies involving the nature of the Union, and constitutional readjustments to meet the new American industrialism.

665. Modern Native American History: (3) Considers broad historical issues and debates about Native American identity, experiences with and memories of colonialism, cultural preservation and dynamism, and political sovereignty from 1830 to the present. Focuses on individual accounts, tribal case studies, and popular representations of Native people.

666. Historic Preservation and Conservation. (3) Explores the history of the preservation and conservation movements organized to save historic buildings and landscapes in the U.S. and other nations. Examines the Jaws, international charters, national, statewide, and local agencies, practices, collaborations, and emerging challenges of historic preservation and conservation.

667. Public History. (3) Introduces students to the major issues involved in the practice, interpretation, and display of history for nonacademic audiences in public settings. Central themes include controversial historical interpretations, the role of history in popular culture, issues and aims in exhibiting history, and the politics of historical memory. Explores some of the many ways people create, convey, and contest history, major themes in community and local history, and the problems and possibilities of working as historians in public settings.

669. Modern Military History. (3) Making war in the modern era, with special attention to the social context of military activity.

670. Topics in North Carolina History. (3) General chronological survey of North Carolina with emphasis on selected topics. May be repeated for credit if topic varies.

671. Transgender History, Identity, and Politics in the U.S. (3) This course explores the experiences of and responses to transgender, gender non-conforming, and intersex (TGI) people in nineteenth- and twentieth-century America. We will examine how scientific/medical authorities, legal authorities, and everyday people have understood and responded to various kinds of gender non-conformity. (CD)

672. Queer Public Histories. (3) Explores how public history projects (oral histories, museums,
674. Protest and Rebellion in Latin America. (3) Study of the history of protest movements and rebellions in Latin America from primitive and agrarian revolts to mass working class and socialist organizations. (CD)

675. Black Lives. (3) Explores both the lived experience and the historical reality of African Americans. Black lives are profoundly shaped by their group experience, influenced in no small part by the role of racism. The biographical approach individuates historical figures struggling to fashion identity. Topics include character development, intimacy, gender roles, public and private personas, self-deceptions or defenses, and personal perceptions and biases. The craft of writing biography is taught throughout the semester. (CD)

676. Civil Rights and Black Consciousness Movements. (3) A social and religious history of the African-American struggle for citizenship rights and freedom from World War II to the present. (CD)

677. American Diplomatic History. (3) Introduction to the history of American diplomacy since 1776, emphasizing the effects of public opinion on fundamental policies.

678. Race, Memory and Identity. (3) Explores the collective memory and identity of American-Indian and African-American communities a d their response x to historical trauma in their cultural imagination, spirituality, and political and social activism. Also n listed as REL 348.(CD)

680. America at Work. (3) Examines the people who built America from 1750 to 1945. Themes include free labor versus slave labor, the impact of industrialization, the racial and gendered realities of work, and the growth of organized labor and its political repercussions.

681. Religious Utopias and the American Experience. (3) Religious groups of many different origins have found in North America an open space for creating settlements that would embody their ideals. This course surveys a range of such 18th- and 19th-century communities, including Moravians, Rappites, Shakers, and the Oneida and Amana colonies.

682. Religion in the Development of Higher Education. (3) Examines the role of religious groups in the founding of American colleges and universities, and explores how their role has changed across history up through contemporary trends and issues. Major themes include the heritage of religion in European higher education; institutions of higher education founded by specific American religious groups; religion in the liberal arts curriculum; religious activities in student life; the relationship of colleges and universities with religious sponsors and constituents, focusing on controversies such as science and religion; the impact of universities on liberal arts colleges; and the trends toward growth and “secularization” in the last 50 years.

683. Revolution and Culture in Latin America. (3) Explores the links between revolutionary movements and cultural expression in Latin America and the Caribbean. Includes a Language Across the Curriculum component that allows students to earn credits in Spanish by reading and discussing at least half of the texts in Spanish.

684. Global Outlaws in History Since 1500. (3) Examines the motivations, ideologies, goals, and behavior of those who have been deemed “outlaws” to international society since 1500, including pirates, terrorists, smugglers, war criminals, and violators of copyright. Analyzes the role of power in creating the global regimes that define and target such activities.

685. History of Film: Bollywood and the Making of Modern India. (3) This course juxtaposes historical films made by the world's largest film industry based out of Bombay/Mumbai with textual primary sources and secondary historical works and seeks to understand films as both interpretations and sources of history. It also explores specific themes such as nation, gender, caste, and community characteristics that are critical to understanding modern India.

686. History of Islamic Law. (3) Introduces students to the development of Islamic law in its historical context. Focuses on sources of law and methods of law-finding, emergence of schools of law, legal institutions, and administration of justice, changes that Islamic law underwent since the end of the 19th century, and its role in the modern nation states. (CD)

687. The Last Great Muslim Empires. (3) Examines, in a comparative way, central themes in the history of the Ottoman, Mughal, and Safavid Empires in the early modern period (1400-1800). Considers the ways in which Muslim rulers fostered political legitimacy, ruled over non-Muslims and heterodox subject populations, and recruited persons of diverse religious and ethnic background into state service. (CD)

688. Nation, Faith, and Gender in the Middle East. (3) Traces the development of nationalism and its interaction with religious, transnational, and gender identities in the Middle East in the 19th and 20th centuries. Topics include Zionism, Arabism, Turkish nationalism, and Islamic revitalism.

689. The British Empire in the Middle East. (3) Covering the period from the late eighteenth to late twentieth centuries, this course considers British involvement in the Middle East, exploring the political, economic, social and cultural facets of imperial power, decolonization and postcolonial international relations. (CD)

690. Research Seminar. (3) Offered by members of the faculty on topics of their choice. A paper is required.

691. Making History. (3) Seminar explores how historians make history through analysis, synthesis, and interpretation. Open to all students. Honors students must take HST 391.

692. Individual Research. (3) Writing of a major research paper. May be repeated for credit. P—POI

693. American Foundations I. (3) Interdisciplinary study of American art, history, literature, and music. Using its collection of American art as the basis for study, Reynolda House Museum of American Art, in cooperation with Wake Forest University, accepts a limited number of students to study with professors from various disciplines through lectures, discussions, and concerts. Includes a study tour to New York City. (Taught in summer; students enroll for both courses. Students may enroll in either 693 or 676)

697. Historical Writing Tutorial. (1.5) Individual supervision of historical writing to improve a project. P—POI

698. Individual Study. (3) A project in an area of study not otherwise available in the department; permitted upon departmental approval of petition presented by a qualified student. May be repeated for credit.

699. Directed Reading. (1-3) Concentrated reading in an area of study not otherwise available. May be repeated for credit if topic varies. P—POI

763. American Foundations I. (3) Interdisciplinary study of American art, history, literature, and music. Using its collection of American art as the basis for study, Reynolda House Museum of American Art, in cooperation with Wake Forest University, accepts a limited number of students to study with professors from various disciplines through lectures, discussions, and concerts. Includes a study tour to New York City. (Taught in summer; students enroll for both courses. Students may enroll in either 676 or 693).

765. Management of Cultural Organizations. (3) The structure and management of not-for-profit institutions, with emphasis on museums, historical societies and preservation organizations, libraries, archives, and research institutions.

771. Internship. (1, 2, 3) A project involving supervised work in a historical organization or scholarly effort; permitted only upon approval by the graduate committee of a petition presented by a qualified student.

798. Individual Study. (3) A project in an area of study not otherwise available in the department; permitted upon approval by the graduate committee of a petition presented by a qualified student. May be repeated for credit.

Humanities

620. Perspectives on the Middle Ages. (3) A team-taught interdisciplinary course using a variety of literary, historical, and theoretical materials to examine one of the following: a) medieval women; b) medieval constructs of gender, race, and class; c) love and war in the middle ages; d) the medieval
environment: landscape and culture. May be repeated for credit with different sub-topics.


685. Legends of Troy. (3) Interdisciplinary investigation of translations and transformations of the Trojan Legend from the Greeks through the Middle Ages and the Renaissance to the present. Texts, studied in English translation, are by such authors as Homer, Virgil, Ovid, Chaucer, Racine, and Giraudoux.

Linguistics

640. Special Topics. (3) Inter-cultural Communication. In-depth examination of the role of intercultural communication in the shaping of the world order today. Through a historical and theoretical survey, as well as self-awareness tools, students will acquire insights and experience in the analysis and design of intercultural communication strategies with a global mindset at personal, corporate, national and international mass-media levels.

680. Language Use and Technology. (3) Introduction to the fundamental concepts of creating and accessing large linguistic corpora (electronic collections of “real world” text) for linguistic inquiry. Course surveys a variety of cross-discipline efforts that employ corpus data for research and explores current applications.

683. Language Engineering: Localization and Terminology. (3) Introduction to the process of making a product linguistically and culturally appropriate to the target locale, and to computer-assisted terminology management. Surveys applications in translation technology. Taught in English. P—POI

Philosophy

631. Plato. (3) Analysis of selected dialogues, covering Plato's most important contributions to moral and political philosophy, theory of knowledge, metaphysics, and theology. P—POI

632. Aristotle. (3) Study of the major texts, with emphasis on metaphysics, ethics, and theory of knowledge. P—POI

641. Kant. (3) Study of selected works covering Kant's most important contributions to theory of knowledge, metaphysics, ethics, religion, and aesthetics. P—POI

642. Studies in Modern Philosophy. (3) Treatment of selected figures and/or themes in seventeenth and eighteenth century European philosophy. P—POI

652. Hegel, Kierkegaard, and Nietzsche. (3) Examination of selected sources embodying the basic concepts of Hegel, Kierkegaard, and Nietzsche, especially as they relate to each other in terms of influence, development, and opposition. P—POI

654. Wittgenstein. (3) The work of Ludwig Wittgenstein on several central philosophical problems studied and compared with that of Frege, James, and Russell. Topics include the picture theory of meaning, truth, skepticism, private languages, thinking, feeling, the mystical, and the ethical. P—POI

660. Ethics. (3) Systematic explanation of central ethical theories in the Western philosophical tradition. Such theories include Kantian deontology, utilitarianism, Aristotelian virtue ethics, and divine command theory.

661. Topics in Ethics. (3) P—POI

662. Social and Political Philosophy. (3) Systematic examination of selected social and political philosophers of different traditions, with concentration on Plato, Marx, Rawls, and Nozick. Topics include rights, justice, equality, private property, the state, the common good, and the relation of individuals to society. P—POI

and others.

650. Afghanistan, Pakistan, Iraq and U.S. Policy since 2001. (3) Broadly addresses the phenomena of U.S. involvement in two ongoing conflicts—the Afghanistan war and the Iraq war. Focuses on the respective domestic and international politics and policies of the four main actors relevant to the conflicts: U.S., Afghanistan, Pakistan, and Iraq.

653. International Political Economy. (3) Analyzes major issues in the global political economy including theoretical approaches to understanding the tension between politics and economics, monetary and trade policy, North-South relations, environmentalism, human rights, and democratization.

654. U.S. Foreign Policy. (3) Analyzes the historical and theoretical perspectives shaping U.S. engagement with the world past and present. Applies this understanding to current problems in U.S. foreign Policy.

659. Palestine and the Arab-Israeli Conflict. (3) Explores the nature and scope of the conflict with particular emphasis on the time period post-1967 and the respective policies of the three most significant actors in the conflict: the U.S., Israel and Palestine.

663. U.S. Foreign Policy in the Middle East. (3) Critical analysis of U.S. foreign policy with respect to the Middle East since the second World War. Utilizes a case study method of instruction.

672. Democratic Theory. (3) Examines the historical and theoretical underpinnings of democracy and some of the critiques of those foundations. Focuses on understanding some of the major and competing traditions of democracy theory and how key democratic concepts are recontextualized within these various traditions.

673. Marx, Marxism and the Aftermath of Marxism. (3) Examination of Marx’s indebtedness to Hegel, his early humanistic writings, and the vicissitudes of 20th century vulgar Marxism and neo-Marxism in the works of Lenin, Lukacs, Korsch, Horkeimer, Marcuse, and Sartre.

677. Feminist Political Thought. (3) Examines major themes, concepts and theories in feminist political thought. Themes explored include schools of feminist thinking, feminism’s diverse expressions over time, theories of the interlocking systems of oppressions, and the connection between theory and practice.

678. Politics and Identity. (3) Investigates the ways in which concepts of identity have informed political norms, structure, and practices; the myriad forms identity takes (particularly gender, sexual orientation, class, race, religion, and ethnicity) drawing on examples from across the globe and theoretical approaches proposed for engaging differences.

687. Individual Study. (2 or 3) Intensive research leading to the completion of an analytical paper conducted under the direction of a faculty member. Students are responsible for initiating the project and securing the permission of an appropriate instructor. May be repeated for credit. P—POI

688. Directed Reading. (2 or 3) Concentrated reading in an area of study not otherwise available. Students are responsible for initiating the project and securing the permission of an appropriate instructor. May be repeated for credit if topic varies. P—POI

689. Internship in Politics. (2 or 3) Field work in a public or private setting with related readings and an analytical paper under the direction of a faculty member. Students are responsible for initiating the project and securing the permission of an appropriate instructor. Normally one course in an appropriate subfield is taken prior to the internship. P—POI

Romance Languages

French

623. Advanced Grammar and Stylistics. (3) Review and application of grammatical structures for the refinement of writing techniques. Emphasis is on the use of French in a variety of discourse types. Attention given to accuracy and fluency of usage in the written language.

629. Introduction to Business French. (3) Introduction to the use of French in business. Emphasizes oral and written practices, reading, and French business culture, as well as a comprehensive analysis of different business topics and areas.

660. Cinema and Society. (3) Study of French and Francophone cultures through cinema. Readings and films may include film as artifact, film theory, and film history.

661. Special Topics in French and Francophone Film Studies. (3) In-depth study of particular aspects of French and/or francophone cinema. Topics may include film adaptations of literary works, cinematographic expressions of social or political issues, selected filmmakers, theories, genres, historical periods, or cinematographic trends. May be repeated for credit for a maximum of 6 hours when topics vary.

663. Trends in French and Francophone Poetry. (3) Study of the development of the poetic genre with analysis and interpretation of works from each period.

664. French and Francophone Prose Fiction. (3) Survey of French prose fiction, with critical study of several masterpieces in the field.

665. French and Francophone Drama. (3) Study of the chief trends in French dramatic art, with reading and discussion of representative plays from selected periods: Baroque, Classicism, and Romanticism, among others.

670. Seminar in French and Francophone Studies. (3) In-depth study of particular aspects of selected literary and cultural works from different genres and/or periods. Topics vary from semester to semester. May be repeated for credit for a maximum of 6 hours when topics vary.

674. Topics in French and Francophone Culture. (3) Study of selected topics in French and/or francophone culture. Works will be drawn from different fields (sociology, politics, art, history, music, cinema) and may include journalistic texts, films, historical and other cultural documents. May be repeated for credit for a maximum of 6 hours when topics vary.

675. Special Topics in French and Francophone Literature. (3) Selected themes and approaches to French literature transcending boundaries of time and genre. May be repeated for credit for a maximum of 6 hours when topics vary.

681. French Independent Study. (1.5, 3) May be repeated for credit. P—Permission of the department.

Spanish

619. Advanced Grammar and Composition. (3) Advanced-level review of Spanish morphology and syntax applied to the refinement of writing techniques.

621. The Rise of Spanish. (3) The development of Spanish from an early Romance dialect to a world language. Study of ongoing changes in the language’s sounds, grammar, and vocabulary system, with a focus on the effects of cultural history and relationships with other languages.

622. Spanish Pronunciation and Dialect Variation. (3) Description of, and practice with, the sounds, rhythm, and intonation of Spanish and the differences from English, with special attention to social and regional diversity. Strongly recommended for improving pronunciation. This course meets a N.C. requirement for teacher certification.

623. Advanced Grammar and Composition. (3) Advanced-level review of Spanish morphology and syntax applied to the refinement of writing techniques.

629. Special Topics in Hispanic Linguistics. (3) Investigation of key areas in Spanish languages research, such as dialectology, history, language acquisition, and usage.

631. Medieval Spain: A Cultural and Literary Perspective. (3) Examination of the literary, social and cultural themes, such as: Quests and Discoveries, Pilgrimage and the Act of Reading, Images of Islam, The Judaic Tradition in Spanish Literature, and Spiritual Life and Ideal.

632. The Golden Age of Spain. (3) Close analysis of literary texts, such as Lazarillo de Tormes, and study of the history of art, politics, and economics of the 16th and 17th centuries, with emphasis on themes such as the writer and society, humanism, the picaresque, Catholic mysticism, and power.
633. 18th- and 19th-Century Spanish Literature and Culture. (3) Study of the major intellectual movements of the period: Enlightenment, Romanticism, Realism, and Naturalism in Spain through literary texts, essays, paintings, and music.

634. Voices of Modern Spain. (3) Study of the multifaceted cultural identity of contemporary Spain through different literary genres, art, and film.

635. Modern Spanish Novel. (3) Study of representative Spanish novels from the Generation of 1898 through the contemporary period.

636. Lorca, Dalí, Buñuel: An Artistic Exploration. (3) Study of the relationship of these three Spanish artists through their writings, paintings, and films, respectively, and of their impact on the 20th century.

637. Lorca in the 20th Century. (3) Study of the life and works of poet, playwright, painter, and lecturer Federico García Lorca, within the social, cultural, literary, and artistic realities of the 20th century, including Modernism and Surrealism. Emphasis is on Lorca's treatment of minority cultures, including the Gypsy, the Arab, and homosexuals.


640. Film Adaptations of Literary Works. (3) Study of the cinematic and literary discourses through major Spanish literary works from different historical periods and their film adaptation.

641. Golden Age Drama and Society. (3) Study of the theatre and social milieu of 17th-century Madrid, where the works of playwrights such as Lope de Vega, Tirso de Molina, and Calderón de la Barca were performed. Includes analysis of texts and of modern stagings of the plays.

643. Cervantes: The Birth of the Novel. (3) Study of Don Quijote, the first modern novel, and several exemplary novels, and contemporary theoretical approaches to them. Considers related art, music, and film. Includes discussion of themes such as the development of prose fiction, the novel as a self-conscious genre, women and society, religion and humanism, nationalism, and imperialism.

644. The Debate about Woman in Late Medieval Spain. (3) Explores romantic love in the Iberian Peninsula in the 14th and 15th centuries focusing on the debate about woman as an index of social changes happening at the moment.

645. Medieval Pilgrimages. (3) Study of pilgrimage as transformative experience. Examines the dual experience of the physical journey, in particular to Santiago de Compostela, and the practice of reading as pilgrimage.

649. Special Topics. (1.5-3) Selected special topics in Spanish literature. May be repeated for credit.

651. Transatlantic Renaissance. (3) Study of the Spanish Golden Age period by reading and analyzing relevant peninsular and Colonial texts within the broader political, social and cultural contexts of the Spanish presence in the New World. Exposure to recent critical perspectives in early modern cultural studies.

652. Contemporary Theatre in Spain and Spanish America. (3) Study of contemporary Peninsular and Spanish-American theatre within its political, social, cultural, and aesthetic context.

653. Contemporary Women Novelists and their Female Characters. (3) Study of representative novels by women writers from Spain and Latin America, with emphasis on the representation of the female protagonist within her cultural context.

654. Transatlantic Enlightenment. (3) Study of the Enlightenment in Spain and Spanish America through analysis of texts within broader cultural and political contexts. Readings include primary sources from the 17th through 19th centuries and secondary sources from the late 18th century through current critical reexaminations of the concept of Enlightenment.

655. European-American Encounters, 1492 to the Present. Study of the 500-year tradition of representations of encounter between Spain and the Americas, with special attention to the ways the topic is used to define and redefine individual and collective identities. Primary texts include narratives, plays, engravings, murals, films, and advertisements.

659. Special Topics. (3) Special topics in Transatlantic literature and culture. May be repeated for credit.

660. Colonial Spanish America. (3) Explores the early Spanish-American colonial period alongside contemporary intellectuals' attempt to return to and recover this historical past. Readings include 15th- and 16th-century codices, post-conquest indigenous writings, Iberian chronicles and letters, as well as 20th-century documents.

661. Cultural and Literary Identity in Latin American: From Colonial to Postcolonial Voices. (3) Study of a variety of texts from the 18th and 19th centuries dealing with political emancipation, nation-building, and continental identity.


666. Latin-American Cinema and Ideology. (3) Examination of major Latin-American films as cinematographic expressions of social and political issues.

667. The Social Canvases of Gabriel García Márquez and Pablo Neruda. (3) Exploration of the techniques used by two Nobel Prize winning writers to create a literary vision of Latin America. Special attention to humor, surrealism, and the grotesque, and both writers' assimilation of personal anxieties to their portrayal of a social world.

668. Spanish-American Short Story. (3) Intensive study of the 20th-century Spanish-American short story with emphasis on major trends and representative authors, such as Quiroga, Rulfo, Borges, Cortázar, Donoso, García Márquez.


671. Contrasting Spanish/English Grammar and Stylistics. (3) Advanced study of structure and style in a variety of Spanish texts, with an indepth approach to idiomatic expressions and some back/cross translation exercises.

672. Spanish-American Theatre: From Page to Stage. (3) Study of the transition of a dramatic work from text to performance and the role of Spanish-American theatre as a vehicle for cultural values and sociopolitical issues. Includes rehearsals for the public staging of selected one-act plays. Proficiency in Spanish and willingness to act on stage are required.

673. Literatures of the Mexican Revolution. (3) Explores 20th-century Mexican cultural production as it relates to the Mexican Revolution (1910-1920). Readings include novels, short stories, popular poetry, and historiographic texts. Attention to Mexican muralism and cinema, and special emphasis on relationships between literature, history, and contemporary politics.

679. Special Topics. (1.5, 3) Selected special topics in Spanish-American culture and literature.

681. Spanish Translation. (3) Introduces translation strategies through practice, with emphasis
Students’ research skills will improve through the examination of available resources and the creation of content to determine the most appropriate process to achieve the highest quality translation. Finally, students will gain familiarity with textual conventions that govern source and target texts within these domains and deepen their understanding of both Spanish and English as language for special purposes. Apart from translation proper, students will also be able to analyze texts for register, style, tone and content to determine the most appropriate process to achieve the highest quality translation. Finally, students’ research skills will improve through the examination of available resources and the creation of domain-specific resources.

Interships for Spanish Translation/Localization and Spanish Interpreting. (1.5-3) Under faculty supervision, a student undertakes a translation/interpreting project at a translation bureau or translation department of a company/public organization. A community service-oriented internship is preferred for interpreting.

Spanish for Medical Professions. (3) Study of terminology and sociocultural issues relevant to interlinguistic medical communication. Oral and written practice in medical context.

Spanish for Business. (3) Introduction to Spanish vocabulary and discourse in business. Emphasizes oral and written practices, reading, and Hispanic business culture as well as a comprehensive analysis of different business topics and areas. Two mid-term essays and final essays are required.

Sociology

Sociology of Education. (3h) An evaluation of the major theories and significant empirical literature, both historical and statistical, on the structure and effects of educational institutions.

Sociology of Health and Illness. (3) Analysis of the social variables associated with health and illness.

Aging in Modern Society. (3) Basic social problems and processes of aging. Social and psychological issues discussed. Course requirements include field placement in a nursing home or similar institution. P—POI

Sociology of Law. (3) Consideration is given to a variety of special issues: conditions under which laws develop and change, relationships between the legal and political system, the impact of social class and stratification upon the legal order.

Social Inequality. (3) Study of structured social inequality with particular emphasis on economic class, social status, and political power.

Work, Conflict, and Change. (3) Examination of the changing trends in the U.S. labor force, the individual's view of work, and the effect of large organizations on white- and blue-collar workers. Use of some cross-cultural data.

Global Capitalism. (3) Analysis of industrial organization, including discussion of market relations and the behavior of firms, the structure of industrial development, and labor relations and the growth of trade unions.

Individual Study (1-3) Reading, research, or internship courses designed to meet the needs and interests of selected students, to be carried out under the supervision of a departmental faculty member. May be repeated for credit when topic varies.

Visual Storytelling Consortium

VSC 700. Fundamentals of Sports Storytelling. (4) The focus is on theory and practice of sports storytelling, including conceptualizing, writing, directing, editing and producing visual stories.

Course assignments include production of three visual sports stories. Fundamentals of Sports Storytelling is one of two courses required for completion of a five-hour Summer Program in Sports Storytelling. The second course, Ethics and Problems in Sports Storytelling, must be taken concurrently. The course is open to undergraduates.

VSC 701. Ethics and Problems in Sports Storytelling. (2) The course provides a nuanced perspective on sport and society that includes an appreciation of the benefits and the origins of sports’ popularity as well as an understanding of the emergent societal issues to be found in sports. More specifically, the student will learn how to write an effective editorial/blog entry on ethical issues in sports. Ethics and Problems in Sports Storytelling is one of two courses required for completion of a five-hour Summer Program in Sports Storytelling. The second course, Fundamentals of Sports Storytelling, must be taken concurrently. The course is open to undergraduates.

Women's and Gender Studies Program

Undergraduate students are given preference in enrollment for courses in the Women’s and Gender Studies Program.

620AG. Research Seminar: Feminist Theory and Practice. (3) Examines the major themes and terminology in feminist thought, with focus on its diverse and multicultural expressions through time. Themes to be explored include schools of feminism, interlocking systems of oppression and the connection between theory and practice.

621. Interdisciplinary Seminar. (3) Research-centered study of questions raised by women’s and gender studies on an interdisciplinary topic, such as women’s health issues, international women’s issues, perspectives on women and aging, lesbian and gay culture and theory, and women in the arts.

622AG. Introduction to Women's, Gender, and Sexuality Studies. (3) An interdisciplinary course that integrates materials from the humanities and the sciences, taught by WGS faculty representing at least two fields. Topics include critical methods and practical solutions, history and theory of women’s, gender, and sexuality studies, women in culture and society, and cross-cultural issues of gender, ethnicity, social class, disability, and sexual orientation.

658. Mothers and Daughters: Literature and Theory. (3) Examines literature and feminist theories on motherhood and the mother-daughter relationship. Writers to be studied include Morrison, Rich, Allison, Danticat, and Walker. A cross-cultural perspective is taken.

677. Special Topics: Gender and Islam. (3) Considers the complicated relationship between gender, Islam, and identity, paying special attention to how gender roles are enacted, resisted, or transformed in relation to Islam. For example, the class will investigate how veiling informs women’s identities in both Islamic and secular nations. Drawing on ethnographic accounts, students explore the intersection of gender and Islam in daily life and its theological implications.

680AG. Sexuality, Law and Power. (3) This course will explore a wide variety of issues related to sexual identity and orientation, particularly as those issues continue to push the law to address the wide variations of patterns in which human beings relate. The course will look at the law as it both constrains societal development at times, and acts as a catalyst for radical social change at other times. We will look at the ways in which religion and popular morality shape the law and, in some instances, are shaped by it.

696. Independent Study. (1-3) Independent projects in women’s studies, which either continue study begun in regular courses or develop new areas of interest. By prearrangement. May be repeated for credit.
Joint Degree Programs Offered
Joint degree programs are offered in conjunction with other university professional schools (School of Medicine, Schools of Business, School of Law and Divinity School)

BS/A & MA Dual Degrees in Bioethics
(5 year program available to WFU undergraduate students)

Program Co-Directors
Nancy King and Ana Iltis

Overview
Sponsored by Wake Forest College and the WFU Graduate School of Arts & Sciences, the Bachelor of Sciences/Arts & Master of Arts in Bioethics can be completed in as little as 5 years (10 semesters + 1 summer). By allowing students who are admitted to the dual program to begin graduate bioethics coursework while enrolled through the College, students are able to earn two degrees in less time than it would take to earn the two degrees separately.

Undergraduate students must complete all requirements for the undergraduate program, including major, minor, and general requirements (generally, 120 credit hours). Students who are in a position to complete the 120 credit hours required for the undergraduate degree in fewer than the typical four years and are accepted into the dual degree program may take up to nine credit hours of graduate level bioethics courses while they are enrolled in the College. The Graduate School will accept those credit hours toward the Master in Arts in Bioethics degree if they are above and beyond the minimum 120 hours required to receive a BA/BS. The graduate credit hours earned toward the MA degree during the undergraduate years may not be part of the 120 credit hours required for the undergraduate degree.

It is anticipated that students accepted to the program will spend their first four years full-time in the College, followed by a year or more in the bioethics program (The year typically will consist of two semesters plus a summer for students who complete at least six hours of transferable graduate work during their undergraduate years). Because students must complete all of the requirements for the undergraduate degree independently of their Bioethics coursework, students will receive their BA/BS degrees when they complete their BA/BS graduation requirements. The MA will be awarded separately after completion of the MA requirements. The dual degree program will require undergraduates to enroll in 700-level bioethics courses. As part of their acceptance into the program, all accepted students will meet criteria for enrollment of undergraduate students in graduate courses. Students must complete all requirements for the Master of Arts in Bioethics degree.

Typically, students interested in the BA/BS & MA in Bioethics must apply no later than the spring semester of their junior year. Students should alert the Associate Director of the Master of Arts in Bioethics program of their intent to apply and follow the usual procedures for making an application for admission to a graduate program at the Graduate School of Arts & Sciences. In order to be considered eligible for admission, the candidate must take the Graduate Record Examination (GRE). Candidates may request, however, to submit verifiable test scores from another graduate or professional entrance examination in a relevant field (e.g. LSAT, MCAT, etc.). Additionally, select candidates may request a waiver of the GRE requirement, if certain criteria are met. Only students in good academic standing according to the standards of Wake Forest College should apply.

To remain in the program, students must remain in good academic standing with both Wake Forest College and the Graduate School of Arts & Sciences.

JD/MA in Bioethics
Program Co-Directors
Nancy King and Mark Hall

Overview
Under the joint auspices of the Wake Forest University School of Law and the Graduate School of Arts and Sciences, the JD/MA in Bioethics facilitates an interdisciplinary and comparative study of law and bioethics and encourages students whose academic or career interests require gaining competence in both disciplines. By allowing some law courses to count as electives toward the MA degree, as well as by allowing some graduate bioethics courses to count among the elective credits permitted within the JD curriculum, students are able to earn the joint degree in less time than it would take to earn the two degrees separately. The student in the JD/MA divides his/her time between the School of Law and the Bioethics Program and benefits not only from an array of course offerings from both curricula, but also from the social and general intellectual life of both academic programs.

Students may receive the joint degree in as little as seven semesters, usually registering with the School of Law for six semesters and with the Graduate School for at least one semester. The joint degree grants 12 hours of law credit for bioethics coursework and 6 hours of bioethics credit for law coursework. Typically, students spend their first year full-time in the law school, complete 12 bioethics hours during their 2nd and 3rd years of law school, and enroll for one semester full-time in the Bioethics program to complete an additional 6 hours of bioethics coursework and the thesis.

Admission to the joint JD/MA program is a two-tiered process. Students interested in the program must first apply separately to the School of Law and the Graduate School of Arts and Sciences and be accepted for admission by both schools. These applications do not need to be simultaneous, but they should indicate their intent to be considered for the joint degree program on...
their respective applications to the School of Law and the Graduate School. Alternatively, students may submit a separate application to enroll in the joint degree program if already admitted to either School. In order to be considered eligible for admission, the JD/MA candidate must take the Law School Admission Test (LSAT). The Graduate Record Examination (GRE) test is optional, however, and is waived on request. Final decision about admission to the program is made by a joint committee of the JD/MA program. Students should consult the prospectuses of both schools for information about tuition and financial assistance.

To continue in the program, students must remain in good academic standing in both the School of Law and the Graduate School of Arts & Sciences.

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**JD/MA in Religious Studies**

**Program Director**  
Jarrod Whitaker

**Overview**

The JD/MA in Religious Studies program facilitates an interdisciplinary and comparative study of law and religion and encourages students whose academic or career interests require gaining competence in both disciplines.

Interested students can combine the three-year law curriculum and the two-year MA curriculum into a four-year program. Students will first complete a year of work in the Department for the Study of Religions. Years 2 and 3 will be completed in the School of Law. For the 4th year, students will enroll in each school for one semester, completing any remaining degree requirements and elective courses that are joint-degree appropriate.

**Law School Requirements**

When undertaken as part of the joint JD/MA in Religious Studies program, the JD degree requires completion of 75 hours of law course work including the degree requirements prescribed by the law school for graduation.

**Academic Advising**

Students will be provided a faculty advisor from each school to help guide them through the program and its curriculum. To make the most of the degree program, students will meet with both advisors at least once during each semester.

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**JD/MA in Sustainability**

**Program Director**  
Dan Fogel

**Overview**

The Sustainability Graduate Programs and Wake Forest University School of Law have designed a new dual degree program to provide students a pathway for succeeding in professional roles where legal scholarship and practice intersect with sustainability.

Students with the JD and MA in Sustainability will expand their potential work force networks, deepen their knowledge base, and cultivate leadership skills. Attorneys seeking to work in a sustainability related practice area will benefit greatly from foundational knowledge gained through coursework focusing on energy, environmental and sustainability related studies.

**Plan of Study**

This dual degree will require 78 hours of School of Law coursework, including requirements specific to the JD, and 22 hours of Graduate School of Arts and Sciences coursework and is designed to be completed in six semesters and one full summer session.

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**MD/MA in Bioethics**

**Program Co-Directors**  
Nancy King and Mark Hall

**Overview**

The Graduate School of Arts and Sciences and the Wake Forest University School of Medicine jointly offer a five-year degree program, Doctor of Medicine (MD) and Master of Arts (MA) in Bioethics. The program’s objective is to facilitate an interdisciplinary and comparative study of bioethics and medicine, and to encourage students whose academic or career interests require gaining competence in both disciplines. Students are able to earn two advanced degrees in less time than it would take to earn the two degrees separately.

A joint degree program in bioethics and medicine signals the commitment of both the School of Medicine and the Graduate School of Arts and Sciences to interdisciplinary collaboration and learning. By dividing their time between the Medical School and the Bioethics Program, students will benefit not only from an array of course offerings from both curricula, but also from the social and general intellectual life of both academic programs.

The joint degree program will save students a semester or a summer of enrollment because students will complete a research thesis relating to bioethics coursework (which counts as 6 hours of bioethics credit toward the MA degree) during the third and fourth years of medical school. Students accepted to the program will spend four full years in medical school and two full semesters in the Bioethics Program. The bioethics semesters come after the second year of medical school. Students will complete two semesters in the Bioethics Program from August-May, and then return to the School of Medicine to finish their third and fourth years.

Admission to the joint MD/MA program is a two-tiered process. Students interested in the program must first apply separately to the School of Medicine and the Graduate School of Arts and Sciences and be accepted for admission by both schools. Application to the Graduate School of Arts and Sciences should be made during a student’s first year in the School of Medicine. In order to be considered eligible for admission, the MD/MA candidate must take the Medical College Admission Test (MCAT). The Graduate Record Examination (GRE) test is optional and will be waived on request. Final decision about admission to the program will be made by a joint committee of the MD/MA program. Students should consult the prospectus of both schools for information about tuition and financial assistance.

To continue in the program, students must remain in good academic standing under the minimum standards of both the School of Medicine and the Graduate School of Arts & Sciences.
MD/MS in CPTS

Program Co-Directors

Janet Tooze, Capri Foy

Overview

Those interested in the MD/MS degree may choose to complete an extra year of training after the second year of medical school. Medical students may apply for admittance to the MS graduate program in the fall of their second year.

Accepted applicants are admitted to the MS program for their third year of study and complete required coursework for the MS degree in that year. Students rejoin medical studies in years 4 and 5, while they simultaneously complete a master's thesis project as the final requirement for the MS degree.

The MD/MS in Clinical and Population Translational Science is designed to develop competencies in clinical researchers interested in conducting translational research.

In addition to the master of science degree, an abbreviated CPTS Certificate is also available for medical students who will not have time to complete a thesis. The purpose and entrance requirements are identical to the master's program. Although a thesis is not required, students will need to complete at least 15 hours of CPTS coursework during their third year of medical school study, complete ethics training requirements and demonstrate competency in basic biostatistics.

MD/PhD

Program Director

Christopher Whitlow

Overview

An MD/PhD degree offers graduates outstanding opportunities in the new era of biomedical research of the 21st century. The invaluable perspective of an MD/PhD graduate positions the physician scientist as a crucial link in translating scientific research into improving human health and reducing disease. During the past decade, 62 percent of Nobel prizes in medicine and physiology were awarded to MD or MD/PhD researchers.

With the increasing sophistication of research tools, MDs without extensive formal research training rarely have the depth of knowledge needed to progress rapidly as a research scientist. The increasing pace of research, the need for knowledge in specific techniques, and the competition in funding have made it more difficult for MD clinicians to succeed in a research-intensive career. Optimal training is provided by combining an MD with a PhD academic program.

The MD/PhD program, a combined effort between the School of Medicine and the Graduate School of Arts and Sciences, is an integrated program where neither the MD nor the PhD degree is compromised. The student gains the full perspective for identification and analysis of problems related to human health while receiving rigorous training in a basic or translational research discipline—training which provides the depth of knowledge of scientific logic and techniques for an effective, exciting, and successful career in medical research.

The program seeks outstanding students who have already shown aptitude and enthusiasm for research.

Structure of the Program

The duration of the program typically is seven years. During the summer before entry into medical school, beginning in early June, students attend an orientation program to introduce faculty and available research opportunities. An eight-week research rotation is conducted with a selected member of the participating graduate faculty. This research rotation (and subsequent ones, if needed) familiarize students with faculty and their fields of expertise; usually one of these faculty are chosen as the student's graduate (PhD) advisor.

MD/PhD in CPTS

Program Directors

Christopher Whitlow, Janet Tooze, Capri Foy

Overview

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Years One and Two. The first two academic years are spent as a medical student. Phase I (seven months) introduces core biochemical knowledge, including development and structure of the human body (gross, microscopic, embryological, and radiological anatomy) and basic cellular functions (biochemistry, molecular biology and genetics, immunology, introduction to pathology).

Phase II (months 8-20) includes courses in systems pathophysiology (physiology, pharmacology, microbiology and pathology), and a two-month period for a second rotation in a lab of the selected graduate program in the summer after the first year.

Medicine as a profession, clinical decision making, and epidemiology studies are included in both Phases I and II.

During these years, the student usually attends a graduate seminar course. The seminar meets once a week and provides a continuing in-depth introduction to the chosen graduate discipline in addition to social and intellectual contact with other graduate students and faculty.

If possible, the student chooses a graduate adviser by the end of Phase II of the medical curriculum. Otherwise, the summer after Phase II may be used for another laboratory rotation, prior to choosing an adviser.

At the beginning of year three students will remain with their medical school class for a three month clinical experience. These three months are spent learning basic clinical skills on internal medicine rotations and introduce the students to the practice of medicine providing basic skills in completing the history and physical exam experience during the graduate school years in an out-patient clinic. These three months of training will also increase the flexibility for returning to medical school upon completion of the graduate degree. After completion of the three clinical months the students will then join the graduate school with the new cohort of graduate students.

Years Three through Five: During the graduate school years, the student participates in a monthly outpatient clinical experience. Students rotate at a clinic for the underserved, working with faculty and private practice physicians. Participation in this clinic not only helps to maintain clinical skills but gives the student experience with balancing research and clinical responsibilities.

The third year is spent taking advanced basic science courses and conducting research. Didactic coursework is intended to supplement the biomedical knowledge base built in the medical school curriculum. Program or departmental courses also provide a more discipline-specific focus and, therefore, depend on the chosen graduate program.

The duration of the dissertation research may vary but typically is completed in years three-to-five and, if needed, a portion of year six. The PhD dissertation is completed and defended prior to returning to clinical studies.

Years Six and Seven. The student completes eighteen months of required clinical rotations (Phase III of the clinical curriculum) which include internal medicine, surgery, pediatrics, obstetrics, women's health, neurology, psychiatry, radiology, anesthesiology, family and community medicine, and emergency medicine. Four months of elective time are spent in other clinical experiences or may be used for completion of graduate studies prior to returning to the medical curriculum. This part of the schedule is tailored to the individual student with the approval of the graduate advisor, MD/PhD program director, and the Associate Deans for medical education and student services.

Confering of Degrees. The PhD degree is conferred in the semester in which all requirements for that degree are met. The MD degree shall be awarded upon completion of the program.

Participating Graduate Programs

Track 3 - Biology

Biochemistry and Molecular Biology
Cancer Biology
Microbiology and Immunology
Molecular Medicine and Translational Science
Molecular Genetics and Genomics
Mechanism of Application

Both the School of Medicine and the Graduate School evaluate the applicant's credentials. The MCAT is the required standardized test for all applicants.

Initial application is through the American Medical College Application Service (AMCAS). When the School of Medicine receives AMCAS applications, students are sent supplemental forms for application to the School of Medicine. The applicant should indicate interest in the combined MD/PhD program on the supplemental application. The School of Medicine supplemental packet requests an evaluation by the applicant's premedical advisory committee. For the MD/PhD program, the applicant should also include letters of evaluation specifically addressing his or her research experience and abilities.

This is a highly competitive, limited program. Students who matriculate receive tuition scholarships throughout the program. In addition to outstanding grades and MCAT scores, the applicant should provide evidence of enthusiasm and aptitude for research, with prior research experience beyond that of college courses. This is an important factor in evaluation of the application.

After the supplemental application packet, MCAT scores, and letter(s) of evaluation are received, the completed application is reviewed by the committees on admissions of the MD/PhD program. A small percentage of applicants are then asked to visit the University for interviews from October through March.

MDiv/MA in Counseling

Program Co-Directors Nancy King, and Mark Hall

Overview

Sponsored by the Wake Forest University School of Divinity and the Graduate School of Arts & Sciences, the MDiv/MA in Bioethics facilitates an interdisciplinary conversation between theology and bioethics and provides resources for students whose vocational aims require knowledge and/or competencies necessary for achieving excellence in careers where religious leadership and education and community engagement; and 2) provides students pathways for developing skills and acquiring competencies necessary for achieving excellence in careers where religious leadership and education intersect. This degree provides distinctive vocational perspectives and opportunities not available separately in the education or divinity degree programs.

Admissions

The Process. Up to three students per year will be admitted to the MDiv/MA-Counseling dual degree program. Applicants must be accepted for admission by both the Department of Counseling and by the Divinity School. Applicants are required to submit a separate application to each school by January 15. Applications for the Counseling Program are submitted directly to the Divinity School at http://www.wfu.edu/divinity. Applications for the Divinity School are submitted through the Graduate School of Arts and Sciences at http://graduate.wfu.edu. Applications for the Divinity School are submitted separately in the education or divinity degree programs.

Upon successful completion of the counseling program, students will receive both the Masters of Divinity and the Masters of Arts in Counseling degrees.

MDiv/MAED in Education

Program Director Leah McCoy

Overview

The School of Divinity (WFUSD) and the Department of Education offer a dual graduate degree that 1) promotes interdisciplinary conversation between theological education, public education, and community engagement; and 2) provides students pathways for developing skills and acquiring competencies necessary for achieving excellence in careers where religious leadership and education intersect. This degree provides distinctive vocational perspectives and opportunities not available separately in the education or divinity degree programs.

The dual degree curriculum includes foundational requirements from both divinity and education. It is estimated that the time required to complete the dual degree is seven semesters and two summer sessions. Students complete 56 credits of core requirements in MDiv courses enrolled. To continue in the program, a student must remain in good academic standing with both the School of Divinity and the Graduate School of Arts and Sciences.
and 39 credits of core requirements in MAEd courses. The total number of required credits is 95. Integrative components include an education internship in a context approved by the Master of Arts in Education program in conversation with WFUSD’s Art of Ministry (internship) director and a capstone requirement that either through research or an advanced internship encourages students to consider connections between the two fields of study. Advisers from both degree programs work with students to determine an elective course strategy that most effectively prepares each student to succeed as a religious leader who is also a public educator.

Candidates for the dual degree must apply both to the Graduate School of Arts and Sciences and the School of Divinity, following the admissions’ requirements of the respective programs, and be accepted to each program in order to pursue the dual degree. A joint committee consisting of faculty/staff representatives both from divinity and education will make final determinations about an applicant’s suitability for the dual degree.

Typical Program Outline:

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<th>Year</th>
<th>Divinity</th>
<th>Education</th>
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<tr>
<td>Year One</td>
<td>Divinity</td>
<td>Education (12 hrs)</td>
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<td>Year Two</td>
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Note: Year Two and Year Three are interchangeable.

MDiv/MA in Sustainability

Program Director Dan Fogel

Overview

The MDiv/MA in Sustainability joint degree acknowledges the growing demand for professionals in religious leadership venues who have the knowledge and the skills to lead communities to respond to critical ecological and other social issues. Congregations and other religiously affiliated organizations are increasingly interested in sustainability concerns and seek leaders who can guide their efforts to respond to these concerns. Knowledge from the biological, physical, chemical, and earth sciences are critical to any working professional who designs and implements sustainability practices. The humanities and social sciences incorporate information about spirituality, religious beliefs, and an understanding and appreciation of our relationship to the natural world.

This degree is a collaborative project shared by the Wake Forest University Center of Environment, Energy, and Sustainability and the School of Divinity.

Plan of Study

The MDiv/MA in Sustainability joint degree is designed to be 96 credit hours completed in seven semesters plus one full summer session (based on full-time enrollment).

- 48 hours of required course work specific to the Master of Divinity degree
- 18 hours of required course work specific to the Master of Arts in Sustainability
- 17 hours of required course work specific to the Masters of Arts in Sustainability

- 8 hours of elective credit hours to be chosen by the student in either program.

Admission

Candidates for the joint degree must apply both to the Graduate School of Arts and Sciences and the School of Divinity, following the admissions’ requirements of the respective programs, and be accepted to each program in order to pursue a joint degree. A joint committee consisting of faculty and staff both from the School of Divinity and CEES will make final determinations about an applicant’s suitability for the joint degree.

Current Wake Forest students already enrolled in the Master of Divinity degree program who decide to pursue the joint degree will complete an abbreviated application that includes a statement of interest and appropriate test scores.

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- 8 hours of elective credit hours to be chosen by the student in either program.

Admission

Candidates for the joint degree must apply both to the Graduate School of Arts and Sciences and the School of Divinity, following the admissions’ requirements of the respective programs, and be accepted to each program in order to pursue a joint degree. A joint committee consisting of faculty and staff both from the School of Divinity and CEES will make final determinations about an applicant’s suitability for the joint degree.

Current Wake Forest students already enrolled in the Master of Divinity degree program who decide to pursue the joint degree will complete an abbreviated application that includes a statement of interest and appropriate test scores.
MMS/PhD (PA & MMTS)

Program Co-Directors K. Bridget Brosnihan and Gail Curtis

Overview
The MMS/PhD is a 5- to 7-year program that combines a Master of Medical Science in Physician Assistant Studies with a PhD in Molecular Medicine and Translational Science (MMTS) and is offered in conjunction with the Wake Forest University Graduate School of Arts & Sciences. The program targets students interested in clinical research, community research, and the translation of knowledge into improved human health. Graduates with the MMS-PhD will be basic scientists trained to function successfully in clinical environments and will have considerable professional flexibility. They can work as clinician scientists on teams conducting clinical trials, for example, or they can teach and do research within academic health centers.

Applicants for the MMS-PhD dual degree program must be accepted first into the PhD program through a separate admissions process to the Graduate School. The student can apply for admission to the PA program during the first, second, or third year of study in the PhD program and will begin the preclinical year in the PA program after completing the dissertation defense.

Potential applicants should note the following:

• Students with the MMTS PhD who were involved with translational research and attached to a physician mentor are considered to have met the PA program admission requirement of 1,000 patient/clinical contact hours.

• Because students with the MMTS PhD have completed a doctoral thesis, they are also considered to have met the PA program requirement to complete a Graduate Project.

PhD/MBA Program

Program Director Dwayne Godwin

Overview
In addition to intensive doctoral training, the PhD/MBA program incorporates core knowledge of business and managerial skills to provide the student with a marketable, competitive advantage, whether the student finds employment in industry or academia. Graduates choosing to pursue a traditional tenure-track faculty position will have the managerial and business training to initiate and operate their own research laboratories and to collaborate more effectively with the private sector. Graduates choosing a non-traditional career path will be prepared to exercise their research training in management positions in the pharmaceutical industry, private foundations, government agencies, or university research and technology transfer offices.

Structure of the Program
The program is a synthesis of curricula from the Graduate School and the Evening MBA Program of the Babcock School, with specialized course-work and opportunities for industrial and business internships. The joint program is open to all PhD-granting departments or programs across all Wake Forest campuses. It has taken students approximately 5 years to complete the joint program, depending on the nature of the graduate research undertaken in the home program. The first year of the curriculum provides students with a core base of knowledge in biomedical sciences and includes training in the core competencies of the home graduate program. At the same time students begin to be exposed to issues related to research and design, career development, and journal clubs. Laboratory rotations usually occur in this first year in accord with Track requirements. The students typically begin their dissertation research during the second year. At the end of the second year and before beginning MBA course-work, the student is required to take and pass a qualifying exam that will admit him or her to candidacy for the PhD.

Certificates Offered

Bioethics (BIE)
(General, Biomedical Research Ethics, or Clinical Bioethics)

Program Co-Directors Nancy King and Mark Hall

Overview
The Graduate Certificate in Bioethics provides students with basic knowledge and skills that enable them to better address bioethics issues that arise in biomedical research, clinical practice, and health policy. The Graduate Certificate is a freestanding program of graduate study in which students attend the same classes as students in the Master of Arts (MA) in Bioethics graduate program.

In their first semester of study, all degree-seeking and Graduate Certificate students typically must enroll in at least one required course prior to or concurrently with taking any elective course or BIE 706/707: Bioethics Seminar.

Requirements
The Graduate Certificate requires 12 credit hours of course work with an average grade of B or above. At least 9 credit hours must come from required courses in the MA in Bioethics program. There is no thesis requirement. All work must be completed within four years of the date of initial enrollment in the graduate program. Up to 3 hours of transfer credit may be considered in place of elective course work. Transfer credit acceptance is based on review and approval of grades, course syllabi, and other relevant information.

Admitted students may enroll in the general Graduate Certificate program or may specialize by enrolling in the Graduate Certificate in Clinical Bioethics or the Graduate Certificate in Biomedical Research Ethics. The specialized certificate options require particular courses within the general requirements described above. The Graduate Certificate in Clinical Bioethics requires students...
to enroll in BIE 705: Clinical Ethics for 3 of the 9 credit hours of required courses. The Graduate Certificate in Biomedical Research Ethics requires students to enroll in BIE 702: Biomedical Research Ethics for 3 of the 9 credit hours of required courses. Students in the specialized certificate programs may utilize elective courses designed to provide supervised observational and experiential opportunities in relevant settings.

Clinical and Population Translational Science (CPTS)

Program Co-Directors: Janet Tooze, Capri Foy

Overview

The objective of this certificate program is to provide training in epidemiology, biostatistics, and applied clinical and population research methods to health professionals, research professionals, and health sciences students, residents, and fellows. Students trained in the program will develop skills: 1) to develop meaningful and feasible research questions, 2) to design and implement studies to answer clinical and population research questions, 3) to communicate through grant applications, protocols, manuscripts, abstracts, and presentations, and 4) to collaborate productively in multidisciplinary scientific teams. Courses are primarily taught by faculty within the Division of Public Health Sciences and are held on Tuesdays and Thursdays.

Certificate Requirements

Students are required to complete 15 credit hours of instruction of CPTS coursework, complete ethics training requirements and demonstrate competency in basic biostatistics.

Interpreting and Translation Studies (ITS)

Program Co-Directors: Sally Barbour and Olgierda Furmanek

Overview

For students who are not able or ready to commit to earning a Master of Arts degree in interpreting and translation studies, but who would like to focus on an area of interest, the program offers four Graduate Certificates and one Post-Graduate Certificate in specialized areas. Pairing various certificates provides a comprehensive package for students to reach their career goals in a more flexible, customized manner. Credits from a certificate program can often be transferred to a graduate degree program. A student who chooses to complete three certificates can meet the requirements for an MA in Interpreting and Translation Studies.

Certificate Requirements

Students are required to complete 15 credit hours of instruction within four consecutive semesters. Credits from a certificate program can often be transferred to a graduate degree program. A student who chooses to complete three certificates can meet the requirements for an MA in Interpreting and Translation Studies. The minimum GPA average required for graduation is 3.0.

Foreign Language or Special Skills Requirements for Certificates

The Graduate Certificate in Interpreting Studies, the Graduate Certificate in Translation Studies and the Graduate Certificate in Audiovisual Translation and Interpreting are language-specific.

Certificates Offered:

- Graduate Certificate in Interpreting Studies (language-specific)
- Graduate Certificate in Translation Studies (language-specific)
- Graduate Certificate in Audiovisual Translation and Interpreting (language-specific)

Graduate Certificate in Intercultural Services in Healthcare

Post-Graduate Certificate in Teaching of Interpreting (students holding an MA, MS, or MBA)

Medieval and Early Modern Studies (MDV)

(Departments of English, Romance Languages, Religion, History, Political Science and International Affairs, Philosophy, Music, Classics, Art History, Divinity School, German, Humanities, Art History)

Program Director: Herman Rapaport

Professors: Stewart Carter, Roberta Morosini, Gillian Overing, Mary Pendergraft, Gale Sigal, Harry Titus, Ulrike Wiethaus

Associate Professors: Bernadine Barnes, Michaele Bowers, Jefferson Holdridge, Judy Kem, Sol Miguel-Prendes, Monique O'Connell, Olga Valbuena-Hanson, Neal Walls

Assistant Professor: Patrick Toner, Charles Wilkins

Adjunct Associate Professor: Darlene Rae May

Overview

The Interdisciplinary Graduate Certificate Program in Medieval Studies (GCPMS) is designed to allow MA students in English and Religion to both broaden their knowledge of and focus their studies on the medieval period. The GCPMS combines programmatic interdisciplinary coursework, training in the technical skills of medieval studies, and linguistic preparation. The program offers prospective and first-year MA students a competitive advantage in admission to doctoral programs. Students may be admitted to the program by permission of the directors when they are admitted to the graduate program in the department to which they apply or at any time during their first year.

Students must complete all graduate requirements for the MA in English or religion (separately listed in this bulletin under each department) and may take undergraduate courses in any participating department towards the certificate. (A listing of courses that satisfy the medieval studies minor can be found in the Wake Forest University Undergraduate Bulletin.) Courses satisfying the certificate may overlap with department graduate requirements, but acquiring the certificate requires coursework beyond that of the disciplinary MA.

Students are required to take a minimum of four additional courses (12 hours) with a medieval focus; these courses should represent two different disciplinary fields in addition to that of the candidate’s home department. In consultation with the program director, one or more of these additional courses may be taken as directed reading or as medieval language courses. The graduate thesis must have a medieval focus, and the thesis committee should have at least two participating departments represented.

The GCPMS generally does not require more time to complete than the host MA program in English or religion. While students working towards the GCPMS are required to take four courses in medieval studies beyond the standard requirements of the departmental MA, some of those additional courses may be taken as an overload during the academic years or during the summer. Students are strongly encouraged to apply for extramural fellowships to study one or more summers at the international sites where a medieval studies curriculum is available (e.g., St Peter's College at Oxford [see the medieval studies minor in the Wake Forest University Undergraduate Bulletin for details]). A final mechanism is to request approval from the relevant departmental graduate committee to apply two of the courses taken toward completion for the MA degree toward the certificate program with the addition of relevant course-related materials.

Students in the GCPMS may avail themselves of many activities and opportunities including the medieval studies lecture series; the paper competition that rewards the winners with funding to the International Congress on Medieval Studies at Western Michigan University; the Gordon A. Nelson Graduate Student Award in Medieval Studies, specifically awarded to an outstanding graduate student to attend the International Congress on Medieval Studies at Western Michigan University; the medieval studies summer program at St. Peter’s College, Oxford; the annual Wake Forest Medieval Studies Student Society Conference, a student-organized interdisciplinary conference.
inviting participation from graduates and undergraduates from surrounding universities; the medieval section of the department's library in the Archie Ammons English Department Faculty Lounge; the establishment of internships and fellowships for La corónica: A Journal of Medieval Spanish Language, Literature and Cultural Studies (see the website at http://college.holycross.edu/lacoronica), edited by Professor Sol Miguel-Prendes, a medievalist in the Romance Language department.

Structural and Computational Biophysics (SCB)

(Programs of Biology, Chemistry, Computer Science, Mathematics, Molecular and Cellular Biosciences and Physics)

Program Director: Freddie R. Salsbury Jr
Assistant Professors: Adam Hall, Derek Parsonage

Overview

The Interdisciplinary Graduate Certificate Program in Structural and Computational Biophysics (SCB) is designed to meet the need for scientists and educators with broad, interdisciplinary training in the quantitative biological, biochemical, and biomedical sciences. Students who successfully complete the SCB Certificate Program and degree requirements will receive a certificate in Structural and Computational Biophysics, as well as the degree in the program in which they matriculate. The Certificate Program is implemented by collaboration among the programs of Biology, Chemistry, Computer Science, Mathematics, Molecular and Cellular Biosciences and Physics at Wake Forest University.

Following matriculation and at least one semester of coursework in a participating program (currently, Biology, Chemistry, Computer Science, Mathematics, Molecular and Cellular Biosciences and Physics), students can apply for admission to the SCB Graduate Certificate Program. Admission to the Certificate Program is initiated by meeting with the SCB program representative. The student will then submit a letter of intent and a Wake Forest University graduate transcript to the SCB program representative. The letter of intent should express the student's interest in the SCB program, a proposed plan of study, and how the SCB program meets the student's career and academic goals. Following favorable evaluation, applicants may be recommended for admission by the SCB advisory committee, with final approval determined by the Graduate School. Prior to admission, it is recommended that applicants complete coursework in introductory chemistry, introductory biology, introductory biochemistry, molecular and cellular biology, calculus-based physics, and programming in a high-level language; however, all applicants should meet the prerequisites for the individual graduate degree program to which they are applying (physics, chemistry, biology, mathematics, molecular and cellular biosciences or computer science).

Students in the Interdisciplinary Graduate SCB Certificate Program must complete all graduate degree requirements in the individual department to which they were admitted. (The official degree requirements for the PhD in Physics, Biology, Chemistry, or programs under the Molecular and Cellular Biosciences Track or the MS in Computer Science or Mathematics are described under the department listing.) In addition, at least 15 hours of the student's graduate coursework should consist of courses approved as part of the SCB Certificate Program (listed in this bulletin), including a general, introductory SCB course and two hours of journal club credit. At least one course must be at the 700 level. Students must take at least two graduate hours in each of the curriculum areas:

- chemistry/biochemistry, computer science/mathematics, and biophysics. All students in the SCB Program must complete and defend a PhD dissertation (or MS thesis for computer science or mathematics) that involves original, interdisciplinary research in the area of structural and computational biophysics or computational biology; broadly defined. The dissertation committee will consist of members from at least three participating SCB departments. All students must successfully complete a course in scientific ethics. Each semester, several seminars from the participating departments will be designated as SCB discussion group seminars. Students in the Certificate Program are required to attend these seminars.

Students in the SCB Certificate Program have access to state-of-the-art equipment and facilities in multiple departments, including the Wake Forest Structural Biology Facility (scb.wfu.edu), the DEAC Linux cluster (deac.wfu.edu), and well-equipped research laboratories in biophysics, biochemistry, and biomedical engineering.

The Interdisciplinary Graduate Certificate Program in Structural and Computational Biophysics began in 2005. Information on the program and links to faculty research interests can be accessed at scb.wfu.edu.

Courses of Instructions

Courses listed in this bulletin are examples and are those already approved for the Interdisciplinary Graduate Certificate Program in Structural and Computational Biophysics. Other courses may be approved by the SCB Certificate Program director. Course descriptions can be found under the department which administers the course.

SCB-Specific Courses

SCB 701. Structural and Computational Biophysics Journal Club. (1) Seminal and current publications in structural and computational biophysics are read and discussed. P—Admission to the SCB graduate certificate program or POI.

SCB 710. Research Topics in Structural and Computational Biophysics. (1) Lectures and discussions on research topics in the field of structural and computational biophysics and biology. Topics depend on the specialty of the instructors in a given semester. P—Admission to the SCB graduate certificate program or POI.

Curriculum Area 1. Chemistry/Biochemistry

General prerequisites: Two semesters of undergraduate chemistry and one semester of undergraduate biochemistry or molecular biology; one semester of organic chemistry is considered ideal, but is not required for most courses. (If additional prerequisites are required, they are listed individually by course.)

CHM/PHY 641. Fundamentals of Physical Chemistry. (3 or 4)
BICM 716. Special Topics in Biochemistry: Macromolecular X-ray Crystallography. (2)
BIO 672. Molecular Biology. (3 or 4)
BIO/CHM 670. Biochemistry: Macromolecules and Metabolism. (3)
BIO/CHM 670L. Biochemistry Laboratory: Macromolecules and Metabolism. (1)
CHM 672. Biochemistry Laboratory: Macromolecules and Metabolism. (1)
CHM 751. Biochemistry of Nucleic Acids. (3)
CHM 752. Protein Chemistry: Structures, Methods and Molecu- lar Mechanisms. (3)
CHM 756. Biomolecular NMR. (1.5) P—POI.
CHM 757. Macromolecular Crystallography. (1.5) P—CHM 356A/656 highly recommended.
MCB 700. Analytical Skills. (1) Taught every August.
MCB 701 Molecular and Cellular Bioscience A (1-6) Taught every fall.
MCB 711 Biological Systems and Structures (2)
Curriculum Area 2. Physics
General prerequisites: Two semesters of undergraduate physics. (If additional prerequisites are required, they are listed individually by course.)

PHY 607. Biophysics. (3)


PHY 685. Bioinformatics. (3) P—Introductory courses in biology, chemistry, and molecular biology or biochemistry or permission of instructor; also listed as CSC 685, though requirements and prerequisites are different.

PHY 620. Physics of Biological Macromolecules. (3) P—PHY 651 or CHM 641, or POI.

Curriculum Area 3. Computer Science/Mathematics
General computer science prerequisites: Programming in a high level language. (If additional prerequisites are required, they are listed individually by course.)

CSC 621. Database Management Systems. (3)
CSC 631. Object-oriented Software Engineering. (3)
CSC 646. Parallel Computation. (3)
CSC 652. Numerical Linear Algebra. (3)
CSC 655. Introduction to Numerical Methods. (3)
CSC 671. Artificial Intelligence. (3)
CSC 685. Bioinformatics. (3)
CSC 721. Theory of Algorithms. (3)

MTH 653. Mathematical Models. (3)
MTH 656. Statistical Methods. (3)
MTH 750. Dynamical Systems. (3) P—MTH 611.
MTH 761. Stochastic Processes. (3)

Sustainability (SUS)
Program Director
Dan Fogel

Professors
Miles Silman, Abdou Lachgar, Keith Bonin, Dilip Kondepudi, Alan Palmeter, Robert Whaples, Dick Schneider, Sid Shapiro, John Knox

Associate Professors
David Phillips, Saylor Breckenridge, Justin Catanoso

Assistant Professors
Ron Von Burg, Judith Madera, Steven Folmer, Michael Gross, Rob Erhardt

Research Professors
Bailey Green

Associate Faculty
Dedee DeLongpre Johnston, Amy Wallis, Vanessa Zboreak, Mark Curtis, Rebecca Dickson

Overview
The Graduate Certificate in Sustainability Program is a twelve credit hour certification that consists of the four core courses of the Master of Arts in Sustainability and can be obtained on a stand-alone basis or in conjunction with another master's program. This track provides students with exposure to sustainability issues in the natural sciences, social sciences, humanities, business management, law, and policy. Candidates of the Graduate Certificate in Sustainability Program will utilize our program as a mechanism for adding value to their professional endeavors while simultaneously satisfying the urgent societal need for highly knowledgeable leaders in the field of sustainability.

Students wishing to change from the certificate program to the master's program will be expected to qualify for and apply to move into the full master track. Successful completion of the Graduate Certificate Program in Sustainability does not guarantee admission to the Master of Arts in Sustainability program.
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The Graduate Faculty
Please visit the Graduate School’s website (http://graduate.wfu.edu/faculty/directory.html) for a current list of all graduate faculty with their year of appointment and department affiliations.
The Administration

Year following name indicate year of appointment to current position.

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